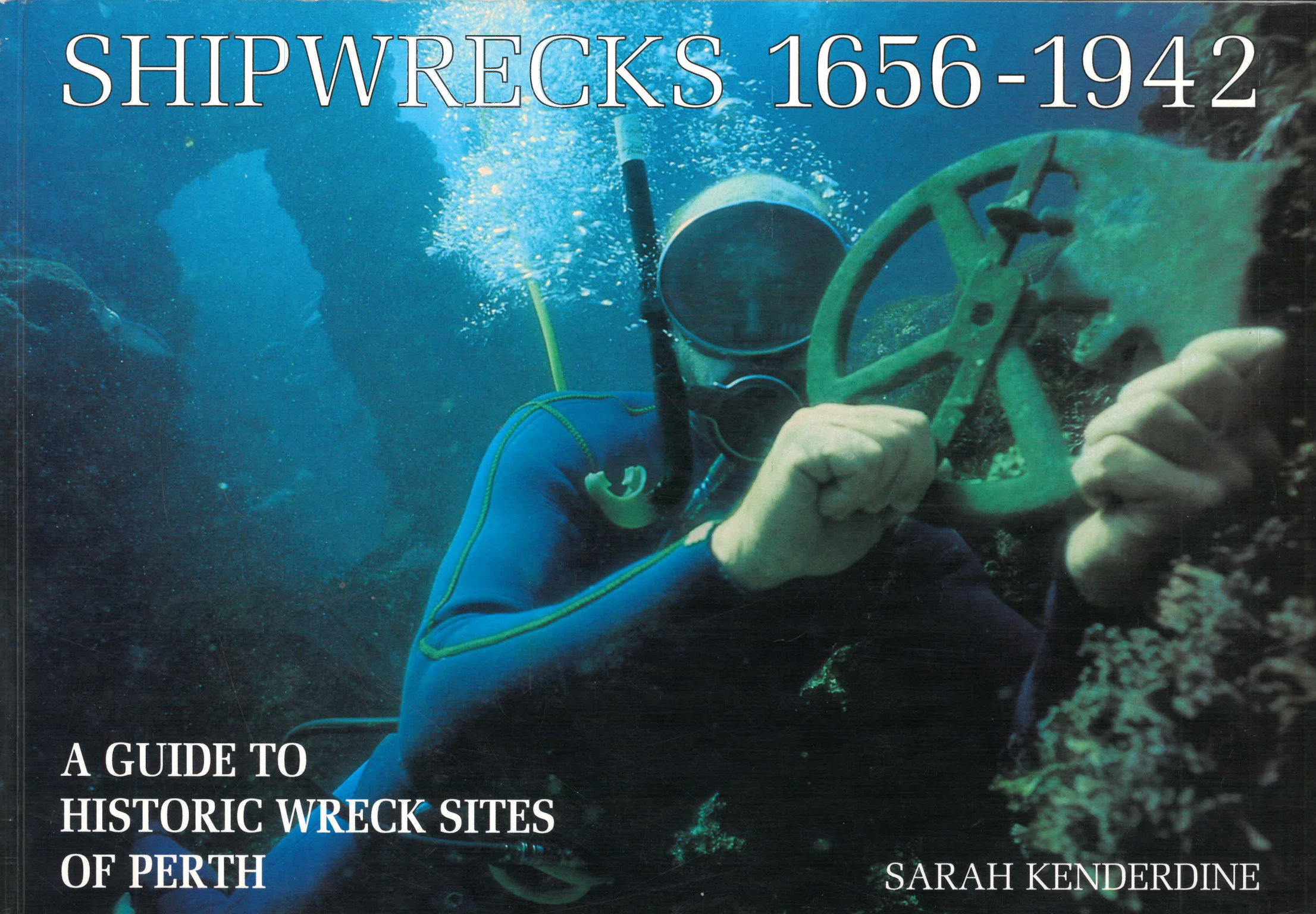
SHIPWRECKS 1656-1942



A GUIDE TO HISTORIC WRECK SITES OF PERTH

SARAH KENDERDINE

SHIPWRECKS 1656–1942

Shipwrecks 1656–1942
A guide to historic wreck sites of Perth

Sarah Kenderdine

Department of Maritime Archaeology
Western Australian Maritime Museum
Fremantle, Western Australia

Report—Department of Maritime Archaeology, Western Australian Maritime Museum: No. 257.

First published in 1995 by
Western Australian Maritime Museum
Fremantle Western Australia 6160

Shipwrecks 1656–1942: A guide to historic wreck sites of Perth

ISBN: 0 7309 6974 6

Cover design: Sarah Kenderdine
Typeset: Sarah Kenderdine
Consultant editor: Judith Robinson
Funding: Western Australian Maritime Museum and Department of Communications and the Arts
Sponsorship: Fremantle City Council and Gingin Shire Council
Printed: Scott Four Colour Print

Front cover: A diver retrieving an astrolabe from the *Vergulde Draeck* (photograph by Brian Richards, GA/A/339)
Back cover: A diver's view of SS *Macedon* (photograph by Patrick Baker, MA 35)

National Library of Australia Cataloguing-in-Publication entry

Kenderdine, Sarah.
Shipwrecks 1656–1942: A guide to historic wreck sites of Perth

Bibliography.
Includes index.
ISBN 0 7309 6974 6

1. Shipwrecks - Western Australia - Perth Region - Guidebooks. 2. Historic ships - Western Australia - Perth Region - Guidebooks. 3. Historic sites - Western Australia - Perth Region - Guidebooks. I Western Australian Maritime Museum. Dept. of Maritime Archaeology. II. Title.

919.41

Foreword

The aim of *Shipwrecks 1656-1942: A guide to historic wreck sites of Perth* is to present to the public the wealth of history to be discovered under the sea in the Perth region between Ledge Point and north Mandurah, in the form of historic shipwrecks. Not all the wreck sites located in these waters are included here, but the thirty-eight wreck sites described are examples of the maritime archaeological remains of historic shipping in Western Australia between 1656 and 1942, and all of these are currently protected under historic shipwreck legislation. The management and protection of this priceless historic resource is entrusted to both Commonwealth and State-appointed agencies. This book is offered to the public as a guide to the significance and locality of the wreck sites within the region, providing historical and geographical information on each of the sites. In addition, it is a plea for their protection.

This publication is the result of nine months of marine fieldwork, but also draws its material from over two decades of painstaking work undertaken by the Western Australian Maritime Museum. For many years the Museum has been responsible for the identification, documentation, research, protection and interpretation of the wreck sites, and the book highlights some aspects of this previous work. The sites are interpreted to show the significance of historic shipping in the development of Fremantle and Western Australia. In an effort to be concise, only a précis of all the available material has been presented here.

Over the years each site has been investigated and recorded at various levels. Site plans, for example, display different styles and details, ranging from very simple to more complex. Some wreck sites have little recorded information, so plans have not been included here. There are practical tips for site relocation, historical summaries and references for those interested in further research. The guide seeks to encompass all aspects of the Museum's programme for resource management, from wreck inspection, excavation and analysis to protection and interpretation, developing a series of significance statements for each historic wreck site.

Finally, *Shipwrecks 1656–1942* is published in the hope that it will find a local readership which values its own cultural heritage and which is willing to strive to protect this rich cultural resource for the benefit and enjoyment of present and future generations. The author commends the book to the public as part of the dynamic process involving the ongoing study of shipwrecks. The reader is invited to contribute information that can further our understanding of these sites, and thereby assist the Museum in assembling a body of information on the vessels which represents many aspects of the Western Australian, Australian and indeed world-wide maritime heritage.

Sarah Kenderdine
September 1995

Contents

PART 3. Appendix

List of illustrations

Figures

Tables

Maps

List of shipwrecks
Chronological

Alphabetical

Wreck sites on each location map

Map 1

Map 2

Map 3

Map 4

Map 5

Preface

In an attempt to make the use of this book as easy and as practical as possible, it has been divided into three distinct PARTS, so that the reader can readily find the information of immediate personal interest without first having to search through other material of a less directly relevant nature.

PART 1 is an introduction to the history of the shipwrecks and to the shipping within the survey region between Ledge Point and north Mandurah. It presents an historical perspective from the accidental discovery of the Western Australian coast, through its early exploration and on to the activities associated with the shipping, trade and expansion of the Swan River colony.

PART 2 presents a coverage of the thirty-eight wreck sites in the region. There is an overall location map, and then the sites have been grouped into five sub-regions for easy reference. Each of the sub-regions is identified by a location map. The convenient blue colourband along the right edge of the page will assist readers in finding each sub-region more quickly. Wherever possible, the information on each site is recorded in the following format:

- site plan
- transit photographs
- summary of vessel's specifications
- historical details about the vessel
- the wreck event
- salvage and inquiry
- excavation
- wreck site location guide
- wreck site description
- statement of significance of site
- site specific references.

The summary of the vessel's specifications can be used as a quick reference guide to: the dimensions of each ship; its location; the finders of the wreck site; its unique number in the Australian Shipwrecks Database (ASD); the Department of Maritime Archaeology file number; and, the relevant volume (Volume 1, 2 or 3) of *Unfinished Voyages* (Henderson, 1980; Henderson & Henderson, 1988; Cairns & Henderson, 1995) in which further historical information has been documented. Relevant site significance criteria have also been stated.

Three transit photographs have been provided for those members of the public, government and private sectors who want to relocate a wreck site. Where possible a site plan has also been prepared for each site. An historical précis of each site is given defining the wreck event and subsequent salvage. A description of the archaeological investigations on each site follows. In some instances the wreck site significance is further described. Site specific references used to compile information for this book are also cited.

PART 3 has been collated as an Appendix, and contains a wide range of more detailed information. The cultural resource management programme operating through the Department of Maritime Archaeology (DMA) at the Western Australian Maritime Museum (WAMM, the Museum) is explained. There is an overview of the physical oceanography and environmental influences that operate along the coast in the survey region, and their direct impact on the shipwreck remains is explored. A later section analyses the extent of this historic resource in terms of site types, what they reveal about the nature of the maritime and shipping trade in Western Australia, and the evolution of ship technology and design. The distribution of the wreck sites within the survey region is examined, and a correlation between the casual factors and the likelihood of a wreck event is sought. A study of the site environments and observed patterns of remains on the sea-bed enables predictions to be made about wreck deterioration. Finally, a summary of recommendations for continued wreck-site preservation and study is offered, and a list of relevant references and a concise index conclude this book.

Acknowledgements

The success of this project has been largely dependent on the work of people that I never met in person. In particular I would like to thank past staff of the Department of Maritime Archaeology, including the former coordinator of the wreck inspection programme, Scott Sledge. The numerous others, volunteers and those whose names appear on the files have been invaluable in the documentation of the historic wreck resource.

I am grateful to the past and present members of the Maritime Archaeology Association of Western Australia who actively participated in fieldwork and also provided some of the excellent site plans contained in this book.

To all the staff of the Materials Conservation Department at the Western Australian Museum I offer many thanks. I recognise your active cooperation in conducting conservation assessments as part of a successful wreck inspection programme. To Ian MacLeod, Vicki Richards and Jon Carpenter—'til we dive again.

I hold all my colleagues in the Department of Maritime Archaeology in great regard. I wish to celebrate Sue Cox for her perennial calm, Dena Garratt for her joy and Sally May for her energy. Lynne Cairns offered access to much of her meticulous historical research, for which I am very appreciative.

'Boating with the boys' meant a most divine summer of fieldwork. To Bob Richards for his good humour and seamanship, to Geoff Kimpton for his talent at spatial concepts and drafting, and to Patrick Baker without whom I would not have had a lens to see through, I offer my thanks. Thanks also to Colin Powell.

I warmly acknowledge the help of Mike McCarthy who helped to navigate me through the wreck inspection system, and to Myra Stanbury whose attention to detail and breadth of knowledge supplemented the production of this document. I greatly appreciate the vitality of Jeremy Green, and especially for networking my brain to the computer highways. He gave freely of his time to one on a desk-top publishing learning curve that, without his help, would have seemed vertical.

I would also like to thank Graeme Henderson, Director of the Western Australian Maritime Museum, for the research that he instigated with regard to the shipwrecks of Western Australia and the compilation of the *Unfinished Voyages* volumes.

Many thanks to John Clarke for his assistance, to Henry Thompson, Geoff Glazier, and the CALM officers from the Marmion Marine Park.

Much appreciation is extended to my editor Judith Robinson and to Jemma Green who helped with the index.

This survey was made possible with funding provided from the Western Australian Maritime Museum and the Federal Department of Communication and the Arts. Generous contributions for the publication of the book were also provided by the Fremantle City Council and Gingin Shire Council.

Disclaimer

While this book is aimed at facilitating better access to the wreck sites, the difficulties of accurately describing the navigational approaches to the hazardous reefs of the Western Australian coastline prevented in-depth descriptions of site locations. Boat owners will need to adhere to safe boating practice and be equipped with accurate charts of the area they wish to visit. Latitude and longitude (for users of GPS) have been provided. The inherent discrepancies of using non-differential GPS means that some of the locations provided may vary from those obtained by public users. Transit photographs (a picture speaks a thousand words) have been included in the book where possible to assist in site relocation. Where further sailing directions to the sites are required, this information can be obtained upon request from the Department of Maritime Archaeology.

Weather conditions on many of the reef located sites mean that they are particularly exposed to north-westerly winds, swell and surge that often makes them inaccessible. Divers will need to assess the conditions before making an attempt to dive on some wrecks. Also, moving sea-bed sands and weed may cover sites that have formerly been exposed, thereby making their relocation difficult.

Local diving guides and sailing directions are recommended in addition to the information contained in this book.

List of abbreviations

Organisations

ACDO	Australian Cultural Development Office
AIMA	Australian Institute for Maritime Archaeology
CALM	Conservation and Land Management, Department of
CSIRO	Centre for Scientific and Industrial Research Organisation
DCA	Department of Communication and the Arts
DMA	Department of Maritime Archaeology
DMH	Department of Marine and Harbours
DOLA	Department of Land and Administration
ICOMOS	International Committee on the Conservation of Monuments and Sites
MAAWA	Maritime Archaeological Association of Western Australia
PWD	Public Works Department
VOC	Dutch East India Company
WAM	Western Australian Museum
WAMM	Western Australian Maritime Museum

Technical

B	breadth
D	depth
GPS	Global Positioning System
gml-1	grams per litre
hp	horse power
km	kilometres
L	length
lbs	pounds
m	metres
ms-1	metres per second
SOI	Southern Oscillation Index
˚ C	degrees Celsius

Terminology

CRM	Cultural Resource Management
ASD	Australian Shipwrecks Database

1.1 The survey

of the Western Australian coast, including the surveyed Marmion Marine Park, and this agency has a policy of the preservation and conservation for shipwrecks in these protected areas.

For over two decades the Western Australian Maritime Museum has borne the responsibility for providing data on wreck sites. A precise outline of the survey brief and other issues concerning this survey can be found in PART 3, Appendix. Without the careful documentation of each wreck site there would be no basis and framework for cultural resource management (CRM), and without adequate management and protection the wreck sites are vulnerable to destruction.

The coastal environment

The coast of Western Australia was not considered by the Dutch to be suitable for settlement, despite the fact that it was used by mariners as a landfall in the safer parts. It was described as the 'last of lands' (cited in Appleyard & Manford, 1979:19). Their general lack of interest was due to a number of factors including the monotonous and inhospitable landscape, the lack of water and the dangerous reefs which had caused the loss of many passengers, crew and cargo.

The environmental conditions of the survey region (outlined in PART 3) are significant to this present study of shipwrecks as they contributed to the initial loss of many colonial ships. The processes involved in the disintegration of the vessels and in the ongoing preservation and deterioration of the wreck sites are also largely dependent upon the environment. Understanding the climate, physical oceanography and biota of

Introduction

The overall objective of this book is to describe the historic shipwreck resource that lies adjacent to the Perth metropolitan coastline. Stimulus for the selection of the Perth area for a regional study was varied. Firstly, as the largest population base in the State is centred within its environs interpretation and publication of material about the historic shipwrecks will have the greatest impact here, servicing the needs of the widest audience.

Another important factor in the choice of the survey area is that it acted as a major focus for colonial shipping in Western Australia. The Port of Fremantle was the main transportation node for the State. The concentration of the 38 historic wreck sites in the region reflects the level of shipping that was generated by the colonial development of Perth.

Nowadays, there is growing community and development interest directed to the coastal margins of Perth. Community members are increasingly involved in water-based activities and the number of sports divers continues to grow unabated. The region also attracts large numbers of visitors from interstate and overseas who enjoy the superior diving conditions here.

Furthermore, as Perth investors continue to develop along the metropolitan coastline, developers and environmental impact assessors need a summary of the historic shipwreck resource that may be encountered before they begin their activities. It is essential that these developers consider the location, description and significance assessments for the shipwrecks within their area of interest.

Figure 1
Lifebuoy from RMS Orizaba *(OR 40)*

Cultural resource management

Similarly, legislators and government authorities who manage our natural and cultural resources need to understand and consider the significance of the shipwrecks when making laws and critical decisions about the development of the coastal fringe. The Department of Conservation and Land Management (CALM) manages some sections

the survey region facilitates better management of the wreck site resource. The development of models based on the observation of remains helps to provide better protection strategies for the sites.

Analysis of the shipwreck resource

During the latter half of the nineteenth century sail and steam shipping was improved by a number of technological advances resulting in lighter and faster vessels. The major structural changes for the sailing vessel occurred from the 1840s and 1850s when the wooden clippers were replaced with ships of composite construction. New designs increased the available cargo space by using iron frames and wooden planking (and protective Muntz metal sheathing). The increasing use of iron and steel in the hull from the 1880s enabled larger, stronger vessels to be built that continued to enhance the carrying capacity per gross registered ton. The study of technological change and trading patterns of the vessels found in the survey region enables us to place the Western Australian shipwrecks in the world context.

The observed distribution or pattern of historic shipwrecks along the coastline is the result of both historical and environmental factors. These factors include trade routes, port locations, layout of and access to facilities, economics, commerce, technological change and development, the knowledge and development of navigation standards, and competency of masters and crew. Environmental factors include prevailing weather patterns, storms and currents, winds, shoals and reefs.

Site formation and classification models are becoming increasingly popular for shipwreck studies as tools to help understand the formation of sites and the processes that have affected the archaeological evidence that is contained on a site. The processes of wrecking involve certain regular features that are common in all instances. If they can be described then their implication for sea-bed analysis and shipwreck remains can be identified. Testing carried out on sites for which the archaeological and documentary evidence is extensive means models and conclusions can be applied where evidence is more fragmentary and confused. The environments of the wreck sites found within the survey region are examined for information that may help form models for the long term protection and conservation of sites. For a detailed examination and analysis of the various technological and scientific aspects, see PART 3, Appendix.

1.2 Historic Shipping in Western Australia

Introduction

The shipwreck resource of the survey region effectively documents shipping movements from the mid-seventeenth century Dutch trade routes, through to the settlement of Western Australia and the colony's dependence on imports from the United Kingdom. It also reflects the development of two other significant trade regions of Afro-Asia, and the Australian colonies and New Zealand.

The period of historic shipping represented by the wreck site resource occurred between 1656 and 1942. The survey region acts as a focus for discussions on the historical development of the Port of Fremantle. The following overview emphasises those issues that are reflected in the archaeological record and is not meant to describe all aspects of maritime history in Western Australia.

Historic shipping and the development of export economies, the establishment of ports, building of jetties, lighthouses and harbour facilities are associated with the land-based archaeological deposits and the names of places in the survey region. However, discussion of these aspects remain outside the scope of this book. The selective historical précis below provides a backdrop against which the significance of the shipwreck sites can be interpreted and explored.

Trading routes

Dutch routes to the East Indies

Before 1611 the route from Amsterdam to the East Indies was via the Cape of Good Hope up the east coast of Africa to India, Ceylon (Sri Lanka) and eventually east to Bantham in Java (although some vessels proceeded west of Madagascar and then to Bantham). After this date a new route that was discovered by Hendrick Brouwer, one of the Dutch East India Company's (VOC) mariners, began to be used. It was his observation that the prevailing winds at high latitudes might prove to be a quicker and therefore less costly route to the Indies. He sailed east from the Cape of Good Hope at latitude 40° until what he believed to be about the longitude of Sunda Strait whereupon he turned north on the favourable winds. The new route was only of six months duration compared to the twelve months or more for vessels using the old route. Vessels had to cross 7 000 kilometres eastwards before turning north for Java (Figure 2).

This alternative route was developed before an accurate way of measuring time at sea (eventually developed in the form of the chronometer) had been established, and this meant that there was no way to accurately establish longitude. Distance travelled eastwards could only be estimated by dead reckoning with the aid of a log line.

The use of the Brouwer's route was a major impetus in the discovery, exploration and settlement of Western Australia. Dirk Hartog in 1616 aboard *Eendracht*, was the first Dutch master to make landfall on an offshore island adjacent to the mainland.

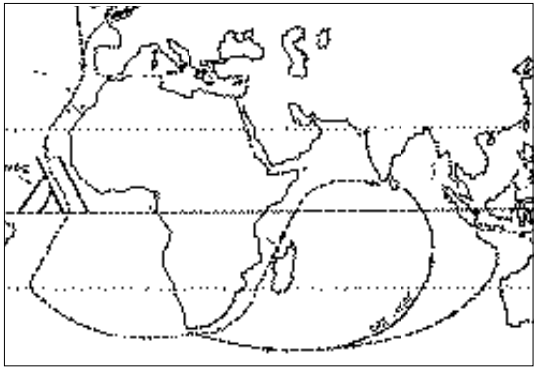


Figure 2 Brouwer's navigational route (after Jacobs, 1991:54)

In the century that followed Hartog's discovery, the Dutch East India vessels progressively revealed the shape of the Western Australian coastline. By 1628 Hessel Gerritsz, chief cartographer of the VOC, had drawn a detailed map that incorporated all the information from charts and journals handed to the Company at the completion of their voyages. The contact with the coast of Western Australia was a relief for the early mariners as it signified that the last leg of their voyage to Batavia was about to begin. The land they encountered, however, was barren and lacking in much needed water and possible food sources (Jacob & Vellios, 1987).

Not surprisingly, the lack of accurate navigational aids caused some vessels following the new trade routes to encounter the coast of Western Australia, its outlying islands and reefs, by venturing too far eastwards before turning north. The oldest shipwreck that lies in the survey region is *Vergulde Draeck* wrecked in 1656 and it occurred as a result of these early navigational difficulties. It has been established from historical records that the vessel struck reef at a time between watches on the deck, and due to the negligence of the lookout on the foretop. The vessel was wrecked south of Ledge Point (182 kilometres north of Fremantle) near latitude 32° south. In 1656 *Goode Hoop* and *Witte Valk* were dispatched to rescue any survivors from *Vergulde Draeck*, and to chart bights, bays and shallows in the area. Eleven crew members

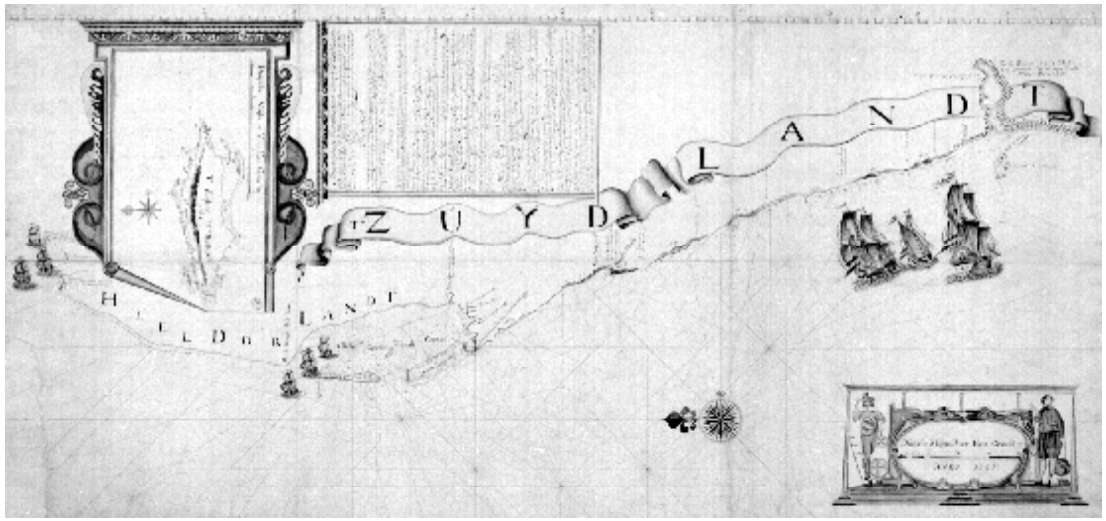


Figure 3
Vlamingh's voyage to Western Australia and the approaches to the Swan River Settlement (MA 1557)

were lost on this voyage. Although this expedition came into the area of the western coast between latitudes 32° and 33° south, no survivors were found. Further expeditions were to follow and in 1658 the vessels *Emeloort* and *Waeckende Boey* were instructed to rescue survivors and salvage wreckage. The captains' reports included references to the finding of wreckage belonging to the vessel, and confirmed land in the region of Rottnest Island. This land was described as inhospitable, and the reefs hazardous for vessels that came close inshore (Jacob & Vellios, 1987).

The search for habitable land prompted the subsequent visit of Captain de Vlamingh who, in *Geelvinck*, reached Rottnest Island in December 1696. Parties landed on the mainland a few miles north of the Swan River ('the River of Swans') and trekked eastwards. An early chart from this period shows his party and the accompanying vessels approaching Rottnest Island (Figure 3).

French and British interests

The French and British colonial empires became interested in the possibilities of Western Australia in the eighteenth century. In 1738 the French sent de Lozier Bouvet to explore the southern lands and take possession of all places he considered suitable for settlement. Kerguelen followed in 1772 although he failed to contact the mainland. St Allouaran in 1772 sailed from Kerguelen Island to Cape Leeuwin and then to Shark Bay. Several great French explorers and scientific parties including Lapérouse and D'Entrecasteaux reached Cape Leeuwin in 1792. Baudin was to follow (Jacob & Vellios, 1987).

The British sent William Dampier in 1699 and he explored the north-western coast of Australia. Vancouver in his exploration of the south-western region encountered King George Sound. Flinders in 1801 charted the coastline with great care. Both Britain and France were interested in protecting their trade as well as the possibility of settlement and laying a claim to the land.

A well-documented account of the region under study was made by a French expedition under Captain Nicolas Baudin. In the vessels *Naturaliste*, *Geographe,* and *Casuarina* the party sailed up the Western Australian coast and anchored off the mouth of the Swan River in June 1801, returning again in 1803 to anchor off the seaward side of Garden Island. To this island the name *Ile Bauche* was given, and to the smaller island to the north *Ile Berthollet* (later to become known as Carnac Island). His reports after four years in the region declared that the area was not suitable for settlement and that the Swan River had no resources to offer. The dangerous reefs were again mentioned as an issue (Fall, 1972).

The Frenchman Freycinet and his British counterpart King were also significant in contributing to the knowledge of the South-West. Perhaps the most important aspect of the latter's visit to Rottnest Island in 1822 was that he was accompanied by John Septimus Roe, who was later to play a major role in the establishment of the colony of Fremantle and Perth.

Settlement and development of Fremantle

It was not until 24 years after Baudin, on 5 March 1827, that Captain James Stirling of the Royal Navy arrived in HMS *Success* on an exploratory voyage

of the coast. His vessel lay just off the South Head in an area that became known as Gage Roads (after Rear Admiral Gage). Entrance to the adjacent Swan River was not possible because of a rock bar which prevented all but those vessels with a shallow draft from navigating it (Fall, 1972:1).

A more suitable anchorage was sought in the north of Cockburn Sound. It was considered a better proposition than to remain at sea 'with a lee shore in a gale' (Stirling quoted in Fall, 1972:3). Stirling noted that the westerly winds appeared to be the most violent he had encountered on the coast. He considered Cockburn Sound as

> the best anchorage…on this coast…there is a channel into it from the sea, with not less than five fathoms in it (Stirling cited in Fall, 1972:3).

Despite this affirmation, the difficulties associated with Fremantle and the fledgling Swan River Colony were demonstrated when HMS *Success* ran aground near Carnac Island during a subsequent trip made by the vessel in November 1829. The ship was careened at Garden Island and took fourteen months to repair (Figure 4).

In 1829, Captain Fremantle, in HMS *Challenger,* was dispatched from Cape Town to take formal possession of 'the whole of the west coast of New Holland'. The urgency in this directive was due to the fear that the French might lay claim to the land before the English. Using Captain Stirling's chart of the passage between Carnac and Garden Islands he records 'the Chart to be incorrect and the passage rocky, but possible to enter' (Fremantle quoted in Fall, 1972:4). Once within the safety of Cockburn

Sound about 2.5 kilometres from Garden Island soundings of between 4 and 8 fathoms (12 and 24 metres) were taken. He later anchored in Careening Cove, Garden Island in 12 fathoms, where many trading vessels were later to lie when they came to the Port of Rockingham for their cargoes of timber and to careen. It was also used for the anchorage of hulks.

On 2 May 1829, Captain Fremantle landed on the beach at Arthur Head, ran up the Union Jack and took formal possession of the west coast. The view from this point to the south would have included Cape Peron (named earlier by Baudin). In the stretch of water between this point and the southern end of Garden Island were many breaks of white water indicating the presence of rocks and reef. The passage that he charted (known as Challenger Passage) to Cockburn Sound from the seaward side avoided the difficult Success and Parmelia sandbanks which lay across the northern end of the Sound making the journey from Gage Roads and Swan River dangerous. The harbour master at Fremantle from an early date was charged to see to it that the Passage was well buoyed, and that the channel facilitated access to all vessels (especially those that were intended for the port at Rockingham and Mangles Bay).

Captain Stirling returned to Western Australia and formerly established the city of Perth on 12 August 1829, with himself as governor of the new colony.

Figure 4
Careening of HMS Success *at Garden Island, 1929 (MA 2360)*

> During the following weeks and months ship after ship arrived from England bringing colonists eager for a stake in the new land, and also livestock, stores and goods of every kind. Most of these anchored in Gage Roads, sending their passengers and freight ashore in boats to set up their temporary dwellings on the sandy, scrub covered country on which now stands the town of Fremantle (Fall, 1972:8).

The expectations of a thriving settlement at Fremantle had not eventuated by the 1830s. Stirling had maintained that the establishment of a settlement at Swan River was very little out of the track of ships bound for China, through the Eastern Passages, and that these vessels were lightly laden in their outward voyages because merchants were unable to find suitable cargoes for the China markets (Appleyard & Manford, 1979:187). He argued that shipowners would welcome the opportunity to fill their vessels with exports from the settlement colony, including seal-skins, ships' timbers, *trepang* and other local goods. Prior to 1813 all British trade with India and China was controlled by the East India Company was mainly interested in the tea that could be obtained there. However, to detour on a leisurely outward voyage, that such a monopoly was able to provide, was not considered practical. Stirling had also failed to take into account the season that these vessels would be making the passage and the considerable

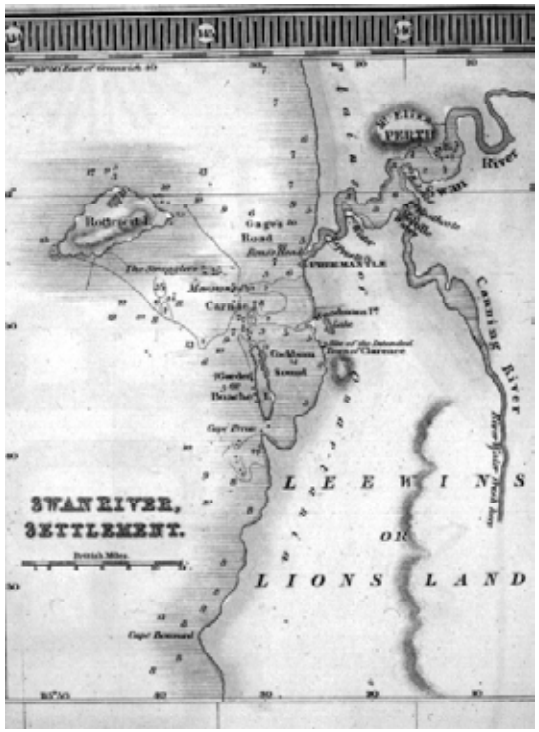


Figure 5
Chart showing the approaches to Fremantle and the Swan River Settlement (MA MAP 96)

Figure 6
Consulting the charts (Bourne Collection, MA 1786)

extra distances involved in a trade with Fremantle (Appleyard & Manford, 1979:188).

Western Australia was established as a free enterprise colony, and in its formative years there was a lack of available labour force to maintain the settlement. However, after an initial period of inertia considerable changes began to take place between 1851 and 1880. The years of convict transportation (as a response to the need for manual labour) began on 1 June 1850 with the arrival of 75 prisoners aboard the *Scindian*. The last 299 convicts arrived on the *Hougomount*, bringing the total number to 9 668 by 1868.

The early history of Western Australia and the development of Fremantle was concerned with establishing suitable sites for settlement and finding safe and sheltered waters for ships at anchor (Figure 5). As will be discussed below the difficulties involved in the navigational approaches to Fremantle and the exposed nature of the coastline were significant factors in the wrecking of a number of vessels found in the survey region. The 'north-wester' gales that blew into the exposed Gage Roads were notorious. The anchorage was considered very unsafe in the winter months. More sheltered anchorage was increasingly sought in Cockburn Sound, a full survey of which was eventually undertaken by the surveyor general, John Septimus Roe, in 1847.

Early colonial trade routes

Before the advent of the steamer, trade routes remained stable in terms of the number of days sail from Europe. In 1839 the voyage took an average 110 days and by 1890 this had only reduced to 97 days. Interestingly, this period was accompanied by major developments in the science of navigation and sailing ship technology, that enabled remarkable improvements in sailing performance. Navigational improvements included the publication of updated and more detailed charts (Figure 6), and the availability of the chronometer. Advances in sailing ship technology included a greater size of sailing ship, the development of heavier rigging and the capacity for a larger sail area through the use of iron shrouds, and the adoption of fine lined vessels of the goldrush period (Henderson, 1977:10). After 1870, an important technological development in shipping took place in the transition from sail to steam. However, the developments appeared to have little effect upon the passage times to Western Australia.

Lieutenant Maury of the United States Navy collated material drawn from ships' logs to produce charts of the ocean winds and currents and popularised the shorter Great Circle route for trading vessels (published in *Physical Geography of the Sea*, 1855), and significant reduction in the sailing time could be expected. This route, however, had disadvantages for passenger ships and smaller craft (Henderson, 1977:12). For vessels sailing south of the 40° south parallel stormy weather, sudden changes in winds, and uncharted islands could be expected. Composite tracks were recommended as a way of avoiding these problems. For example, a voyage picked off on an outline chart depicting the track of the ship *Hastings*, a regular wool trader from London to Fremantle in the 1860s indicates that the vessel went south of the 44° south parallel and then passed between

Amsterdam Island and St Paul Island *en route* (Henderson, 1977:12).

The Great Circle route was of less value to Western Australian shipping than to that of the eastern colonies because of the West's need to use the south-east trade winds and the shorter distance involved. The size of the trade issuing from the colony was so small that the competitive edge gained over distance and speed was not of great importance. By the time general trade became competitive on the route in the 1880s steam was providing fast and regular communication (Henderson, 1977:12). The homeward route to Britain via the Suez Canal had proved to be attractive. The need for fast sailing ships declined when high value cargoes for which quick transport was a premium could be carried by steam vessels.

In the analysis of vessels wrecked in the approaches to Fremantle, however, only two steam-powered ships (SS *Macedon* and SS *Orizaba*) are recorded as having been lost, despite the increasing number of steam vessels used worldwide. This perhaps indicates a lag in the diffusion of this changing technology to the peripheral colonial economies. Further details on the relationship between the archaeological record and the historical development of the trade, and the evolution of ship technology are further discussed in PART 3.

Vessels sailing from the eastern colonies of Australia after 1830 went via Cape Horn catching the prevailing westerlies to ensure a fast passage to Europe. Vessels from the ports west of Adelaide, however, normally went via the Cape of Good Hope. Vessels from Adelaide rounded Cape Leeuwin and then edged northwards until they encountered the south-east trades, running westwards to Mauritius and the Cape of Good Hope, south of Madagascar.

Intercolonial communication was also slow until steam was introduced. Within the coastal region of Western Australia the distances involved made the sea route the only practical means of heavy transportation. The volume of trade was relatively light, however, and required only the smaller vessels. Cape Leeuwin was a significant obstacle to the mails and these went via the quicker overland route between Fremantle and Albany where the Peninsula and Orient (P & O) ships called.

Development of trade prior to 1870

The shipping movements to and from Fremantle were modest and:

> …the umbilical cord with Britain remained the most important trade route, imports from Britain never falling below seventy per cent of the total imports (Henderson, 1988:xiii).

Food, beverages and clothing were the most important group of imports, as well as items of hardware and machinery essential in the establishment of agriculture and the exploitation of primary produce. Cargo manifests included many items that would have helped to make the colonial outpost more like the country and homeland that settlers had left behind.

Fremantle was by far the leading port in handling the colony's trade and passengers, although this was not a monopoly. Vessels often made intermediate voyages along the coast and would occasionally clear directly for overseas from the ports of Busselton, Bunbury, Geraldton and Shark Bay. Albany was the port of discharge for vessels from the eastern colonies in the 1830s and 1840s even though their cargoes were bound for the Swan River Colony. King George Sound was the port of call for the Royal Mail steamers from 1853 (Broeze, 1984:2).

In 1870 the census figures counted 24 785 inhabitants of the colony. In general the total shipping tonnage statistics reflected 'the demographic and economic development of the colony', as the following figures indicate (Broeze, 1984:2):

Date	Tonnage
1829–1830	17 426
1834	2 696
1839	3 635
1844	3 033
1849	4 914
1854	10 653
1859	8 027
1864	11 544
1869	18 162

Of the ships that visited from overseas, convict vessels were by far the largest in size, generally measuring between 700 and 1 200 tons. The migrant vessels of the 1850s and 1860s were smaller, between 500 and 750 tons. Cargo ships were less than 200 to 300 tons in the 1830s but by the 1860s had increased to between 450 and 940 tons (Broeze, 1984:3–4).

The freight required by the colony far exceeded

that needing to be exported in terms of produce and passengers to Europe. Outbound vessels had to seek cargo elsewhere. Fremantle was in relatively close proximity to the so-called Loading Ports of Mauritius, British India, Singapore and the Dutch East Indies, and China. These ports exported bulky raw materials to Britain and imported relatively small volumes of manufactured goods (Broeze, 1984:4). The availability of cargo space to Asia was a major stimulus to the export of colonial produce to that region (Broeze, 1984:5).

In 1837 the first freight of colonial wool and whale products left Fremantle for London. Every wool season saw the dispatch of at least one direct ship. A new pattern of shipping began to emerge where more and more tonnage arriving in the spring found employment as wool ships. Convict and migrant vessels were too large for this trade and continued on to the Loading Ports (Broeze, 1984:6).

Other exports began to include whale oil, whale bone, gum, bark, and various metal ores from the colony's mines (principally Geraldton). Guano came from Shark Bay, Browse and Lacepede Islands and other offshore islands.

Apart from the trade with Britain a second region with which Western Australia maintained maritime links was the Indian Ocean and China Sea regions. Departures from Fremantle to Asia never fell below 50 per cent and in 1864 their share was as high as 87 per cent. Mauritius, India, Singapore, Java and China were sources of sugar, tea, rice, coffee and spices for the colonists. Western Australia began to develop primary produce for markets in Asia: sandalwood for Singapore and China; horses and timber for India; sheep and cattle for Mauritius (Broeze, 1984:20).

The small size of the Western Australian market meant that arrivals from Britain were often those vessels used to fetch colonial exports. The need for vessels owned by Western Australians was most definitely felt (Broeze, 1984:19). Although surplus tonnage from Britain and the East facilitated Western Australian exports, it was unreliable. The dependency on the British and eastern colonial State-owned and controlled ships for regular supplies of goods meant heavy freight charges. In general the:

> …interlocking factors of ignorance of overseas customers and investors, lack of capital and inadequate shipping facilities hampered development (Broeze, 1984:21).

Western Australia was dependent on the Tasmanian and South Australian produced wheat and flour, and imported supplies of sheep and cattle from all the colonies. The Western Australian shipowners were able to maintain an interest in this trade. However, many freight seekers did not even call at Fremantle but obtained their timber at Vasse, and copper, lead ore ballast and horses in Geraldton. This was a period when improved communications (with the establishment of telegraphy and jetties) and increased production allowed Fremantle to be by-passed altogether for Busselton, Rockingham, Bunbury and Hamelin Bay.

Development of trade after 1870

Western Australia was overwhelmingly dependent on foreign shipping to maintain overseas communications. Both in quality and quantity Western Australian ships compared unfavourably with their British rivals (Broeze, 1984:23). As already noted the modest development of the Western Australian fleet was primarily due to a critical shortage of capital and vessels had to be bought overseas. Large vessels were required for the export of sandalwood, horses and railway sleepers. Local interest in shipping concentrated on the coastal and regional trades thereby reducing that capital available for other ventures. The Western Australian shipbuilding industry which produced small craft failed to build anything over 100 tons even though they had access to the superior 'Western Australian mahogany'. A shortage of sailors meant that the cost of labour was high, placing further economic stress on the possible development of a locally controlled trade.

Even though the Fremantle trade was very much in the domain of the British shipping industry, only a very small part of it called at Cockburn Sound. Western Australia was never visited by the fast and famous clipper ships that sailed to the gold ports of the eastern colonies, nor did it participate in the tea races of the 1860s. Broeze (1984) maintains that the unsafe conditions were, however, not a factor in deterring ships from calling at Cockburn Sound. Although insurance premiums at Swan River were slightly higher, shipowners offset this by higher freight rates. This premise contradicts contemporary statements made about the port facilities, which are outlined further below.

The economic growth of Western Australia during the nineteenth century depended on the development of suitable exports, financial

investment and an increasing population. Prior to the 1870s this had been artificially stimulated by forced immigration and substitute Commissariat spending (Henderson, 1977:47). During the 1870s and 1880s the colonists:

> …gradually adjusted to the hardships accompanying greater independence and then after the first gold discoveries, stormed ahead to what has been described as the watershed years of the nineties (Henderson, 1977:48).

Of the principal exports, wool, timber (including sandalwood) and pearling industry products accounted for 82 per cent of the exports in 1870 although by 1890 this had reduced to 77 per cent. Wheat was the most important food crop designed primarily for domestic consumption. Lead ore, horses, guano, skins and tin ore made up the remainder. Gold discoveries in the Kimberley in the 1890s made up nearly 13 per cent of the total value of the exports (Henderson, 1977:49).

Imports continued to far exceed exports and official records show that drapery, haberdashery and millinery made up between 15 per cent and 20 per cent of the total value. Food and beverages were the most important group, primarily tea, beer and tobacco. Those items related to the construction and maintenance of vessels grew rapidly in the late 1880s as the technology of steam was applied. Public projects involving railways, gas and water piping, and the increasing use of galvanised iron as roofing and wire for fencing, also drove demand (Henderson, 1984:53).

The balance of trade fluctuated. With the United

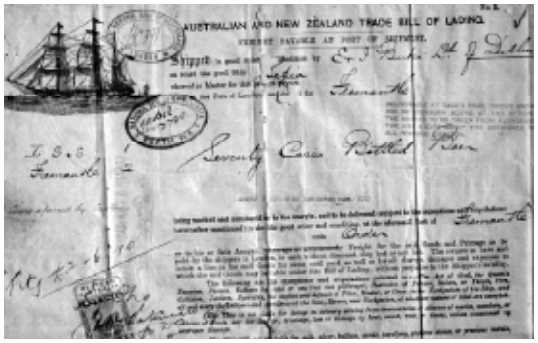

AUSTRALIAN AND NEW ZEALAND TRADE BILL OF LADING

Figure 7
Bill of lading
(MA IL 287)

Kingdom there was a moderate excess of imports in 1870 and 1890, but with a surplus of exports in the intervening years. Imports from the Australian colonies far exceeded exports while the Afro-Asian sector showed the opposite trend. Re-exports tend to complicate the analysis of the import and export figures, and the implication of these are outside the scope of this historical overview. Fremantle's shipping links with Asia changed less dramatically than those with Britain in the late nineteenth century. The volume of shipping moving between Fremantle and the eastern colonies increased at the fastest rate.

Within Western Australia, coasters gathered goods between the settlement outposts of a State with one of the largest coastlines in the world. Its reliance on maritime enterprise stems from being too large geographically for the effective use of developments made in land transportation. Once the best agricultural lands around the Swan River had been settled, farmers looked further south. Sailing coasters were unable to adequately service the passenger trade, being too small and designed for the transport of cargo, of irregular schedule, and in poor condition. The arrival of steam rapidly spelt the demise of the sailing coastal trader (Broeze & Henderson, 1986:24). In the 1870s the most significant development was the introduction of a regular steamer service to Adelaide. By 1870 the total tonnage of shipping between Fremantle and outports was 17 291 tons, with only 4 604 tons to Britain, and 10 216 tons to the eastern colonies (Broeze & Henderson, 1986:24).

The exposed nature of Fremantle meant that the mail and passenger steamers that serviced Melbourne and Sydney preferred to call at Albany from 1852. King George Sound provided ample sheltered waters for coaling. Colonists continued to travel to and from Albany to Britain until 1884 when two overseas steamer routes were opened to Fremantle. It was not until 1897 when the harbour facilities at Fremantle were completed, that all passenger and mail steamers were switched from Albany to this new development (Broeze & Henderson, 1986:21).

Ownership

Overseas ownership of the vessels engaged with the trade to Britain started with Frederick and Charles Mangles from the mid-1830s. Duncan Dunbar, a London shipowner, was involved in the convict transportation to Western Australia. By the mid-1870s, Wilson and Company of London owned the majority of the vessels. Robert Hagwood also owned regularly visiting vessels.

Around 1877 British shipowners formed themselves into the Association of Australian Shipowners and Brokers to maintain a regulated outbound loading schedule. William Felgate

and Company managed the London end, and in Fremantle George Shenton and Charles Manning loaded vessels with Western Australian exports.

Organisation of the coastal trade after the introduction of steam was largely outside of Western Australia. The Adelaide Steamship Company ran its Melbourne to Fremantle service and coastal Western Australia was part of this overall network. Coastal shipping as a separate entity all but disappeared as it integrated with intercolonial and overseas steam-based trade. The British shipowners Trinder Anderson and Bethell Gwyn operated between Singapore and Fremantle, together with the local interest of the Western Australian Steam Navigation Company. In 1890, Alfred Holt's Blue Funnel Line entered the north coast and Singapore run. Increasingly however, residents in the north grew dissatisfied with the level of service that was needed to reduce their effective isolation.

Western Australian merchants Walter Padbury and John Bateman owned one vessel each. This did little to enhance the control of trade by local interests:

> …the establishment of a substantially locally owned company for the London trade was the subject of perennial discussion in the Colony, but few of the projects got off the ground and none ever attained the magnitude to carry out the envisaged task adequately (Henderson, 1988:xiv).

The State was only able to gain access to the coastal trade on an organised basis with the creation of the State Shipping Service in 1912 (Broeze & Henderson, 1986:12).

Associated maritime enterprise

Shipbuilding

With the shortage of available shipping for the fledgling colony early settlers had to build their own boats for delivering goods up and down the coast. Shipbuilding became one of the colony's first industries and in 1832 a small shipyard near Perth was established under Governor Stirling.

Shipbuilding was able to flourish as an important local industry because of the availability of suitable timber and the occurrence of tidal estuaries where vessels could be built and launched with comparative ease. The superior qualities of Western Australian jarrah (*Eucalypus marginata*), with its high resistance to teredo worm attack, meant that it was recommended as a shipbuilding timber.

It was the need for vessels to ply the Swan River that led the Government to establish, in 1834, a shipyard at the foot of Mount Eliza, near Perth. This venture failed, however, and was abandoned after only one vessel was completed. Captain Scott employed a shipwright named Edwards who is credited with building the State's first complete vessel, *Lady Stirling* (Halls, 1965:25).

Apart from the larger vessels built for the coastal trades, many cutters, ketches, sloops and lighters were built during the 1840s. As steamers began to make an appearance on the Swan River in the following decades, Perth and Fremantle became the recognised centres for shipbuilding in Western Australia. In its heyday a dozen private shipowners were operating out of Fremantle.

The initial success of the shipbuilding industry was fuelled by the yearly loss of vessels as more encountered the little known seas around Western Australia. However, the shortage of skilled labour in the shipyards and experienced seamen to sail the coastal traders, are thought to have fore- shadowed the collapse of the shipbuilding industry. Also, the introduction of steamers in the coastal and intercolonial trades meant that a new era was approaching (Halls, 1965:27).

There continued to be a demand for the small sailing vessels in the pearling industry during the 1880s. Brown's yards at Fremantle constructed many vessels. Between 1895 and 1920 a number of launches and river ferries were built.

Three vessels appearing as wrecks in the survey region were locally built. Some information of their construction and builders is appropriate here, giving insight into the nature of those involved in the shipbuilding industry. *Belle of Bunbury* (1876–1877) was built by the emigrant from England, James Dagley Gibbs , who arrived in Fremantle in 1844. His trade was that of carpenter although he also made coffins, and was a wheelwright before he turned to shipbuilding (Dickson, 1994:70).

The Mews family of Perth and Fremantle had a shipbuilding association in Western Australia which lasted over five successive generations. They tended to confine their craft to all wooden vessels, building river craft, barges, fishing boats and yachts. *Star* (Figure 8) was built by the Mews family in 1876 as a two-masted schooner and was launched from the building site at Arthur Head in Fremantle. The vessel was wrecked four years later on Sisters Reef (Dickson, 1994:188–197).

David James Storey was born in Western Australia in 1845 and after he finished his schooling he went into apprenticeship as a shipwright. In 1878 he built *Janet*. This vessel was a three-masted schooner which he owned himself, although he did take on two partners before the ship was wrecked in 1887 on Transit Reef (Dickson, 1994:165–166).

Fisheries

Apart from the main areas of overseas, intercolonial and coastal shipping, exploitation of marine resources was another realm of maritime endeavour. The first local bay whaling companies at Fremantle were formed in 1837 to exploit the slow swimming Southern Right Whales that frequented these waters (Figure 9). The Americans had been involved in deep sea whaling since the 1700s, and fished off the Western Australian coast. American whalers initially sold equipment to local inhabitants. Western Australia was, however, restricted to bay whaling because of the lack of experience, capital and equipment needed for successful offshore competition (Broeze & Henderson, 1986:28). A decline in the number of whales meant that the last recorded return of whale oil for export was in 1870.

Scale fish were also exploited and most were sold locally. Salt fish sold well on the Mauritian markets and a fishing station was established on Garden Island. Despite the predictions only 2 000 pounds in weight of fish was exported, as it was recorded in the annual returns for 1900.

Pearl shell was the most valuable colonial commodity of the nineteenth century (Broeze & Henderson, 1986:29). Starting in Shark Bay in 1850 pearl-oyster fishing took place in Nickol Bay and Broome. By 1900 it employed 200 vessels and 1 300 men, including a large proportion of Aboriginal people.

Hazards of shipping at the Port of Fremantle

It has been identified in a number of the early reports by sea captains and officials that the major problem for shipping calling at the Port of Fremantle was the lack of safe anchorage. As mentioned earlier ships had to ride at anchor in Gage Roads or Cockburn Sound. In discussing the early stagnation of the Swan River Settlement, the difficulties encountered by the vessels entering or leaving have frequently been cited. In 1829 both HMS *Success* and *Parmelia* had lucky escapes while *Marquis of Angelsea* was driven ashore and wrecked in a gale. In the following year, five vessels were lost in Cockburn Sound including local shipowner T. Peel's *Rockingham*. These wreckings had lingering effects on the colony and in reference to *Marquis of Angelsea* one settler commented:

> The loss of this vessel is a very unfortunate occurrence, as it will give the underwriters an excuse for throwing the roadstead and the anchorage into disrepute (cited in Henderson, 1971:6).

Figure 8 Star , *constructed at Fremantle by the Mews family (Bateman Collection MA 2316)*

Lloyd's had already examined Captain Stirling's report and the bar at the entrance of the Swan River in order to fix a proper premium for insuring vessels proceeding to the colony.

It was insurance companies which normally demanded that improvements be undertaken of harbour facilities, including proper buoying of channels, establishing regular pilots, building jetties for the unloading of cargo, and the construction of boathouses and warehouses. For the struggling Swan River colony the resources to fund these kinds of development were not available. However, a harbour-master and pilot, Daniel Scott, was appointed from 1829.

All casualties tended to confirm the suspicion that the anchorage at Cockburn Sound was dangerous, even when the wrecking of vessels was a fault of their condition or the breaking of

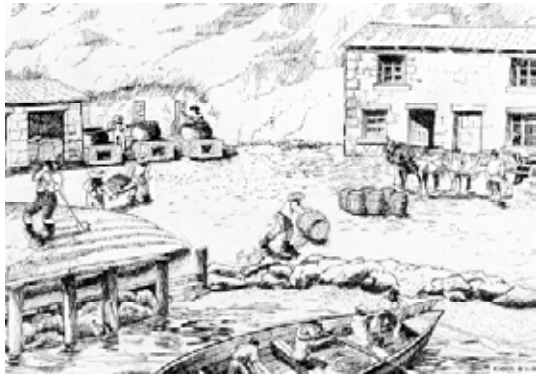


Figure 9 A whaling scene at Bathers Bay, Fremantle (MA 3733)

anchor cables, and other limitations inherent in the equipment used. Incorrect navigational procedures, calculations and the failure of navigational equipment, drunkenness and poor decisions due to inexperience or fatigue of the commanding officer, were often cited as significant factors in wrecking.

> It is difficult to estimate the effect of drunkenness on the captains. The Bussel diaries make numerous references to the poor influence of sea captains and crew on farm labourers. Doubtless many sea captains especially those in charge of the smaller coastal vessels, drank excessively and hence caused a number of shipping casualties (Henderson, 1971:2).

This premise is confirmed by examining the Register of Deaths kept by law after 1843. The cause of death of the majority of mariners indicates excessive intoxication and then drowning. There are, however, divergent opinions as to the cause of wrecking described in the testimony of captains, the public and court findings, based on submitted evidence. Reasons for this may be an overall intention to protect the integrity of Fremantle as a viable port or, perhaps, for insurance payouts.

Weather conditions including adverse winds, fog and rainfall reduced visibility at sea. Also, the time of day at which the approach to land was made was perhaps a factor in wrecking, the absence of light making it almost impossible to take an accurate fix. This is of obvious significance in an area where lighthouses had not been built or were temporarily not functioning. Further analysis of the causes of foundering can be found in PART 3, Appendix.

At the colony the distance between Fremantle and Garden Island anchorages continued to be an inconvenience. Ambitious plans for harbour works that could facilitate access to the Swan River were put forward. It was suggested that difficulties would be much reduced if a lighthouse was erected at Rottnest Island, another at Fremantle and one on the western extremity of Garden Island (Henderson, 1971:Part 6:4).

One valuable aspect of the port was discovered during the 1830s, that being the passage to Owen Anchorage which provided safety reasonably close to the Swan River. Together with a gradual reduction in the accident rate, this was beneficial in reducing the insurance premiums in later years. However, the disastrous gale in 1839 was responsible for the wreck of five vessels anchored in Gage Roads and the loss of *Elizabeth* and *Lancier* brought forth the following announcement in the *Perth Gazette*:

> The recent disasters which have occurred to the shipping of this colony being attributable, in a great measure, to the dangerous practice of anchoring and discharging vessels in Gage Roads during the winter months, and especially at the period of the equinoctial gales, notwithstanding the caution of the late governor, Sir James Stirling, to the contrary, which has been posted at Lloyd's and is annexed to a chart of the anchorage published by Arrowsmith in the year 1833— His Excellency the Governor has been pleased to direct the Harbour Master and Pilots of the Port of Fremantle to refuse to bring vessels to anchor in Gage Roads from the 1st of May to the 1st of October, and to require them always to proceed either to Owen's Anchorage, or over to Garden Island, both of which positions have been proved to be perfectly secure at all times of the year (quoted in Henderson, 1971:Part 7:1–2)

The losses incurred by the colony with the wrecking of *Elizabeth* and *Lancier* (refer to PART 2, Maps 3 and 4) in all probability would have exceeded the value of the imports and exports for the entire colony for that year (Henderson, 1980:160). Further tragedies continued at irregular intervals but due to the absence of official enquiries it is often difficult to assess contributing factors. Once again, the drunkenness of captains and crew was an issue and these problems were often mentioned in personal diaries. The governor at the time continued to insist that pilot services be offered at the port free of charge which reduced the department's income, leaving fewer resources for adequate equipment. Fremantle was considered to be the worst port of call for international shipping in Australia.

Navigational aids

Pilots

Accusations about the shipping difficulties were directed at the first harbour-master, Daniel Scott, in 1848, for paying more attention to his roles as a trader, shipbuilder, shipowner and whaler than to his governmental duties. Knowledge of the shoals and passages had developed only slowly and the passage to Owen Anchorage at the southern end of Garden Island was not properly examined until 1838. Not until 1848 was a report made by Scott on the channels between Garden Island and the

Stragglers Reefs.

The harbour-master's duties also included the maintenance of equipment, the replacement of lost buoys and cables, and the repair of the pilot's whale boats. Scott's letter book indicates that there were insufficient funds to carry out these tasks (Henderson, 1971, Part 8:9). Significantly, one of Scott's early private commercial enterprises was to build the first Fremantle jetty.

Scott had initially worked out of Fremantle but this was quickly found to be unsatisfactory and the pilot station was relocated to Rottnest, as most of the overseas shipping made their way to the Port around the island's northern coast. Pilots had to rely on small jolly boats to board the vessels and many visiting ships were delayed in getting the pilot aboard, some being wrecked as a consequence. The master of *City of York,* for example, mistook flares used to signal the approach of the pilot and his barque was subsequently wrecked (Figure 10).

The introduction of a steam pilot boat was a considerable improvement to the services at the Port. The pilot station at Rottnest Island was abandoned and replaced by a lookout and signal station from which the pilot boat was summoned (Broeze & Henderson, 1986:51).

LIGHTHOUSES

After initial settlement there were few tasks more important for the colony of Western Australia than the charting of the coastline and the erection of lighthouses, beacons and buoys. The provision of navigation aids was usually stimulated by a wreck event. However, despite the calamities at Fremantle and the perceived needs for navigation aids, the first lighthouse was not built until 1842.

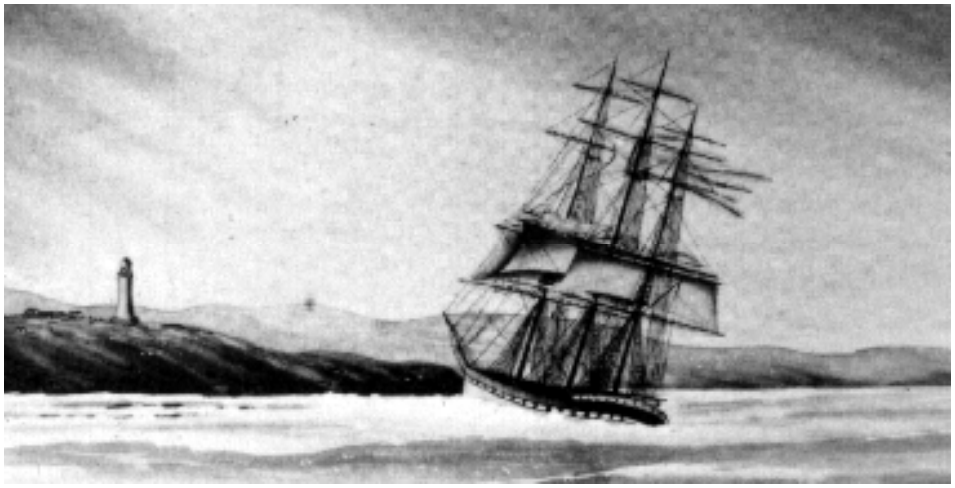


Figure 10
City of York *wrecked on the coast of Rottnest Island with the lighthouse in the background (CY 42)*

The site for the main lighthouse at Rottnest Island was selected by Western Australia's surveyor general, John Septimus Roe. Lieutenant Stokes, aboard the HMS *Beagle* noted on March 1840:

> We moved the ship to Rottnest Island, to collect a little material for the chart and to select a hill for the site of the lighthouse. The one we chose lies towards the South East end of the island bearing N76°W (true) twelve miles and a quarter from the Fremantle goal (cited in Moynihan, 1988:3).

Later in that year, in the *Directions for the Navigation About Rottnest Island ,* it was stated:

> Rottnest Island…may now be distinguished from the mainland and Garden Island by a white obelisk, 15 feet in height, with a pole in the middle, of the same length, which has recently been erected on its highest part near the centre of the island. This sea-mark being elevated about 157 feet above sea level may be seen from the ship's deck in clear weather at the distance of 7 or 8 leagues, and will shortly give place to a lighthouse of greater elevation…(cited in Moynihan, 1988:4).

The lighthouse was constructed using Aboriginal prison labour. The first lighthouse keeper was Samuel Thomas, appointed in 1849, although the light was not added until 1851. On 1 June, both the lighthouse at Rottnest and one at Arthur Head were officially lit. While the Arthur Head light was a fixed light the one at Rottnest Island was a revolving catoptric light exhibiting a flash every five seconds. The tower was 16.2 metres high surmounted by a lantern 3.4 metres high. The centre of the lantern was 64.31 metres

above sea level and the beam of the lantern was visible in clear weather conditions up to a distance of 38 kilometres.

After the construction of Fremantle Harbour, a new lighthouse was erected at Bathurst Point, between 1895 and 1896. It was 40 metres high and had an effective beam that could be seen 40 kilometres away. The lights situated on the newly constructed moles at the port also added to a more comprehensive navigation system.

Ship to shore communications

The Admiralty issued its first publication on Australia's west coast in 1863. With reference to Rottnest it was stated that :

> On the approach of a vessel by day, the lighthouse keeper makes a signal to the pilot, stationed at the north-east extreme of the island, showing whether the vessel is about to enter the channel North or South of Rottnest Island, the pilot will then proceed aboard…A vessel arriving off Rottnest Island at night, and requiring a pilot, should show her position by lights, blue lights or rockets, or by firing guns, when the light keeper will give notice to the pilot, who will board the vessel as quickly as possible (cited in Moynihan, 1988:16).

The Bathurst Point signal tower was first shown on Admiralty charts in 1876. A flagstaff stood close by to signal the ships during the day and flares were used at night. The method of passing information from the lighthouse to the look-out tower or to the pilot was generally with flag or flare up, or fire (and sometimes by messenger on horseback) until a telephone line was established on the island in 1892.

A further four flagstaffs were erected next to the lighthouse to indicate when a vessel had been sighted, whether the vessel had called for a pilot or was exempt from the requirement of a pilot in its approaches to Fremantle. Flags also indicated whether the vessel was a steamer. The look-out would observe the flags at the lighthouse and would call the pilot if necessary. These flags were about 2.7 metres square so that they could be sighted at Arthur Head on a clear day. Here also flare ups or fire were used at night (with lamps, boats, rockets and guns). Mechanical semaphore and homing pigeons used for communication at other ports were never employed at Fremantle (Moynihan, 1988:19).

Jetties

Bathers Bay at Fremantle was chosen for the site of the first sea jetty in 1831. It was a rough limestone lightering jetty and its construction was followed in 1837 by the Fremantle Whaling Company's jetty at Arthur Head. The South Jetty was built in 1857 and served as the colony's main berthing facility for twenty years until the Long Jetty, originally known as the Ocean Jetty, was completed in 1873 (Garratt, 1994b:1).

The jarrah jetty measured 4.57 metres wide and extended in a south westerly direction to a length of 288.6 metres, with the depth of the water at its extremity of 3.6 metres. It could accommodate vessels up to 700 tonnes and larger vessels were still required to anchor offshore (Garratt, 1994b:1). Since much of the colony's exports were bulky cargoes such as wheat and wool and timber, the vessels suitable for their transport were generally too large to berth at Ocean Jetty. Thus, lightering remained the primary way of transferring cargo between ships and shore.

After successful lobbying, the Ocean Jetty was extended by the addition of another section, bringing the new length to 864.7 metres with a depth of water of 6 metres. The Ocean Jetty was extended again in 1896 to a total length of 1 200 metres providing a great number of berths. It was, however, extremely exposed to the prevailing winds in winter and summer.

> As the trade increased, particularly in the boom years of the nineties, the cumulative effect of a single jetty neck servicing an exposed berthing head, with other vessels being serviced at anchor in Gage Roads by the lighter, caused delays of up to 75 days with sometimes up to 30,000 tons of cargo being involved (The Institute of Engineers, 1989:4).

The relatively high freight and handling charges associated with the port reflected these difficulties.

The Long Jetty (Figure 11) reached the peak of its activity in the early 1890s. However, with the opening of the Fremantle Harbour by the turn of the century it was made redundant, and by 1904 it had been converted into a promenade. Given the importance of the jetty as a focal point for shipping between 1830 and the 1900s, a maritime archaeological excavation of the area was begun in 1984 by the Western Australian Maritime Museum. As a result of this work, 283 artefacts are currently on display at the Museum including glassware, personal items, crockery, clothing, coins, ships

fittings, clay pipes, whale bones and a harpoon.

Construction of the Port of Fremantle

The colony's first appointed civil engineer, Reveley, was the first of many to advance proposals for the development of a harbour at Fremantle. However, the proposed breakwaters, whether associated with the development of a harbour facility or not, were beyond the early colony's resources, and trade shipping continued to rely on unprotected jetties jutting out from the semi-exposed coastline (The Institute of Engineers, 1989:3). It was noted that:

> The bar at the mouth of the river prevented it from being used for navigation, while any jetty that advanced beyond the shelter of Arthur Head became subject to the full force of the north easterly weather (The Institute of Engineers, 1989:4).

As late as 1892 an American sea captain reported the following on his experiences at Fremantle:

> It was a terrible place. No place to put a vessel. No shelter whatever. All the ships have to lay and discharge at the wharf or pay lighterage. It is blowing a gale from the sw…and takes all our time to hold her. She had done considerable damage to herself. It is certainly the worst place I or anyone else ever saw. No place to send a ship of this size. Any man who would come or send a ship a second time is a damned ass (Captain Shaw quoted in The Institute of Engineers, 1989:5).

During the years that construction of a safe harbour at Fremantle was under discussion, steam power was providing a revolutionary improvement in transportation, and its application at sea increased the mobility of both passengers and merchandise. With the use of steamers and the railways there was a need to create harbour and docking facilities to keep pace with the increasing demands that this technology brought.

Figure 11
The Long Jetty at Fremantle, in the 1890s (Jon Carpenter Collection)

While the early Swan River settlers were agreed on the disadvantages of the current port, there was little consensus as to the location, type and costs involved in the establishment of an alternative facility. By 1891 various schemes had been narrowed down to three possibilities: a cut at Rocky Bay thus by-passing the river bar; a channel across Success bank opening up Owen Anchorage to Gage Roads; or the opening of the entrance to the Swan River. After much debate:

> …Public opinion gathered force as many realised the advantages of having a harbour inside the river. Oddly, as far back as 1848 Fremantle residents had opposed the removal of the bar for fear that ships would make Perth their port and by-pass Fremantle, but the Fremantle Traffic Bridge, opened in 1867, now made the river unnavigable for trade to Perth (The Institute of Engineers, 1989:18).

The planned works consisted of several principal features: the throwing out of the two ocean moles from the north and south heads of the river estuary to protect the entrance; the blasting and dredging of a channel through the rocky bar; the dredging of an inner basin; the reclamation of land including 54 acres to the south of the river and 22 acres to the north. The formal program of construction under the direction of chief engineer C.Y. O'Connor commenced in November 1892.

The erection of the breakwaters began as the first priority and stone came from limestone quarries at Rocky Bay. This required a railway connection, rolling stock and steam cranes. Dredging at the bar began and the first item of the dredging plant to arrive was the Priestman grab which had been imported in parts in August 1893 and assembled at the colony. A Priestman dredge was overturned and wrecked in the adjacent Bathers Bay in 1894 and is now an historic wreck site in the survey region (refer to PART 2, Map 3).

The resulting efficiency of the harbour works enabled the port to achieve a profit from its earliest years:

> …it is evident from the brief history of events during construction that the harbour was a great commercial necessity. This conclusion is emphasized by the fact that whereas in 1894 the whole tonnage of vessels visiting Fremantle was 337,820 tons…the corresponding figure in 1902 was 1,322,584 tons, and in 1905 it was 1,462,995 tons…This trade could not have been accommodated at all at the old outer jetty,

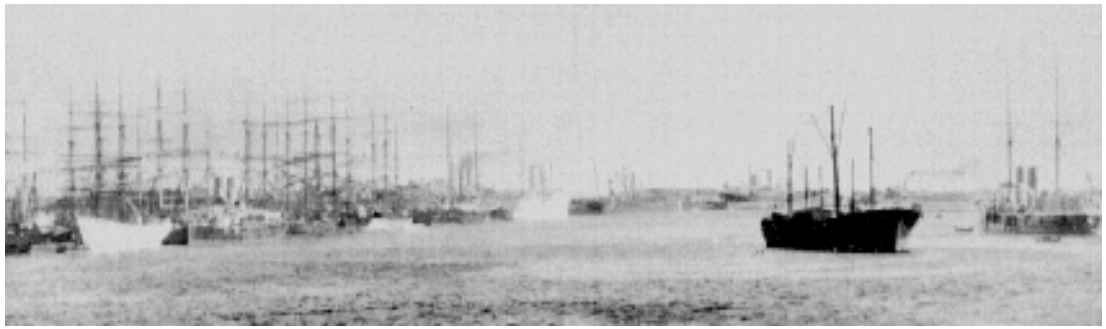


Figure 12 Shipping at the entrance to the Swan River and the Port of Fremantle (Jon Carpenter Collection)

on account of both its volume and the large size and deep draught of much of the shipping (The Institute of Engineers, 1989:41).

Port of Rockingham

The other major port that falls within the survey region is that of Rockingham. The development of this settlement between 1870 and 1900 revolved around the timber industry.

With the establishment of a sawmill close to Rockingham, T. and W. Wanliss were obliged to build suitable jetties in Mangles Bay with a rail link between the two. A deep sea jetty was constructed in December 1872 and measured 74 metres long, had 8.6 metres of water beneath it and was able to accommodate two ships at once.

The success of the timber industry and increasing use of the Port necessitated the building of a second jetty completed in 1882 of 108 metres with two berths, and then a third in 1898. However, the opening of the Perth to Bunbury rail link in 1893 and the construction of the harbour works at Fremantle, marginalised the Port. A contributing factor to this was the increasing size of vessels that, when fully loaded, were unable to pass over the Parmelia Bank on their way out to sea or through Challenger Passage between Carnac and Garden Islands (Fall, 1972).

Overview

Introduction

The guide to location and historical significance of the shipwrecks of Perth has been organised in five sub-regions, each with a corresponding map. The overall map for location of these sub-regions is shown overleaf.

Each site is detailed in terms of location, historical information, and description. For those intending to visit a site directions are provided, together with GPS reference and visual transits. The most recent wreck site plan held at the Department of Maritime Archaeology is also included. The information recorded in the vessel data summary includes that contained on the Australian Shipwrecks Database. Historical details including the shipwreck event itself and contemporary salvage provide a background for the interpretation of the site. Description of each wreck site and details of any excavation that has been undertaken on it are also included.

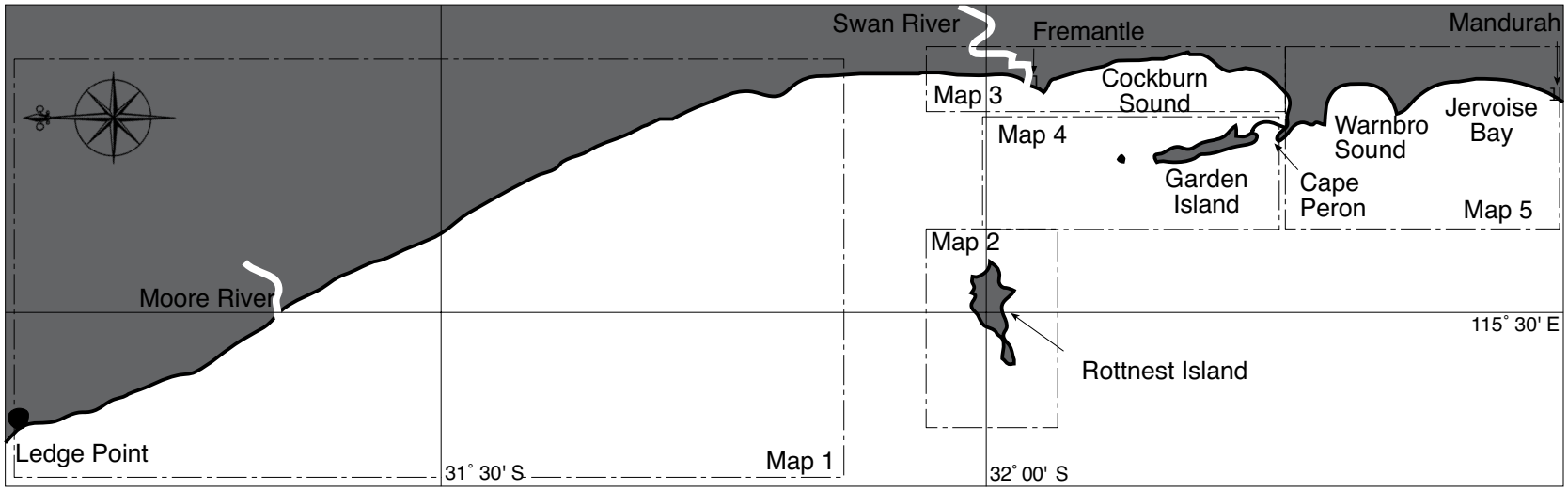
Significance statements

Included in the summary of the vessel's specifications is a code for the statement of significance that defines the value that our culture places on heritage sites. These evaluation critieria are discussed in PART 3, 3.1.2. A numerical code has been used to represent the following critieria:

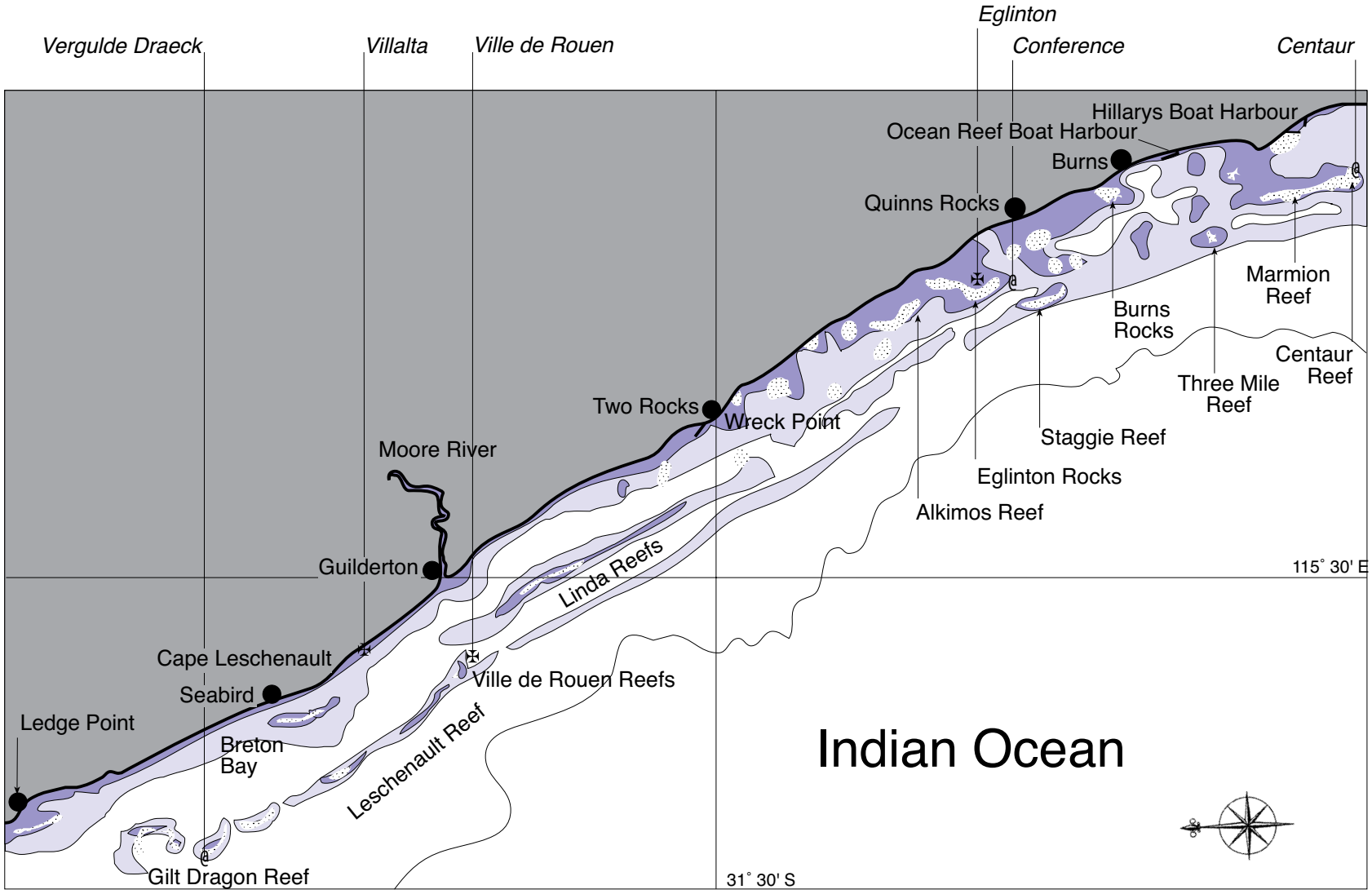
1. Historic
2. Technical
3. Social
4. Archaeological
5. Scientific
6. Interpretive
7. Rare
8. Representative

Wreck sites on each location map

Overall map of the survey region



Map 1. Ledge Point to Marmion Marine Park (south)



MAP 1

Wreck sites on Map 1

Vergulde Draeck—'*Gilt Dragon*' (1653–1656)

Figure 13
The wreck site plan for Vergulde Draeck

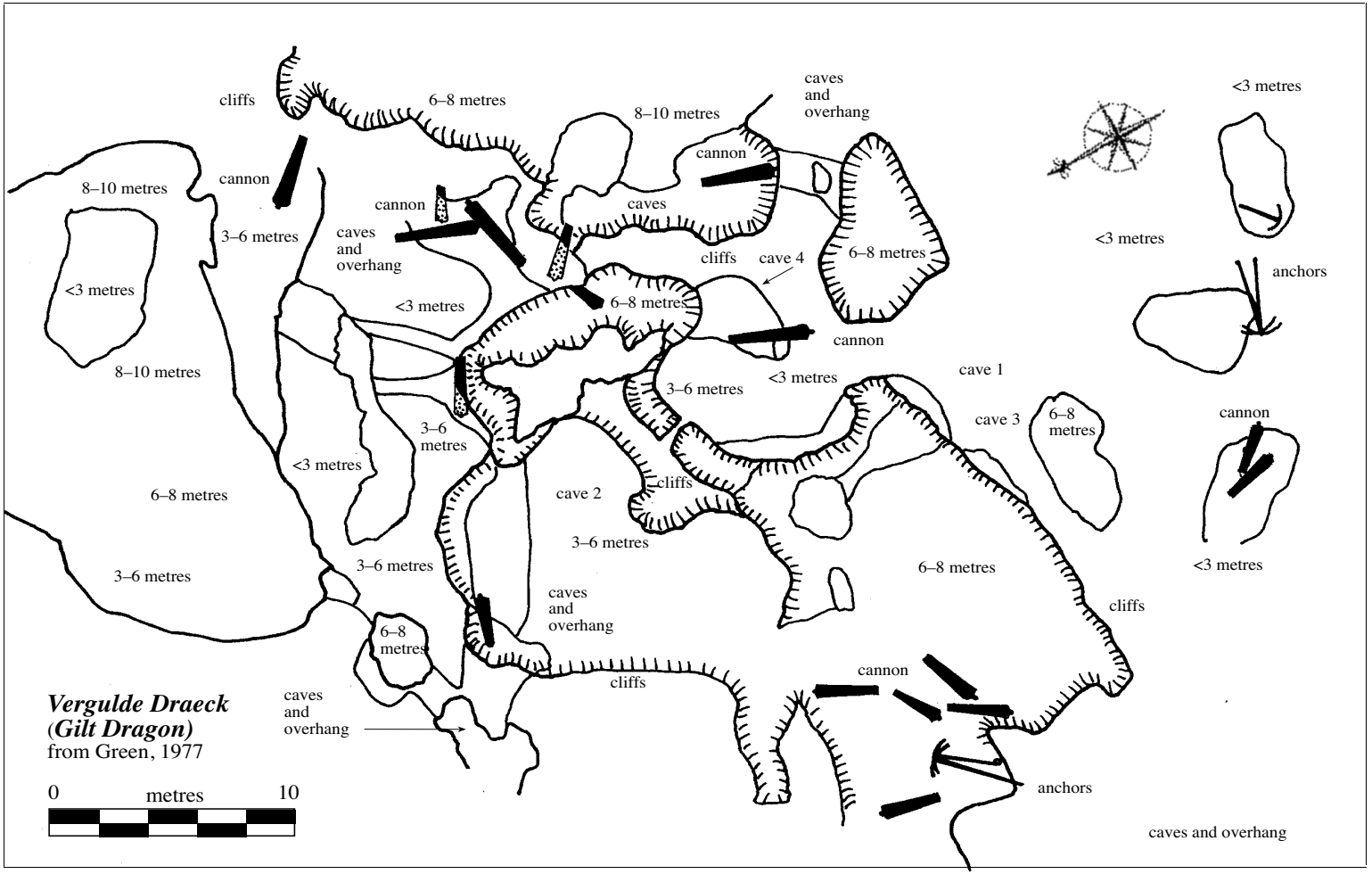


Figure 14
Transit photographs for the wreck site of Vergulde Draeck *(MA 1179)*

Where built:	Holland
Registered:	Texel
Rig type:	*jacht*
Hull:	wood
Tonnage:	130 lasten (260 tonnes)
Length:	41.8 metres (137.3 feet)
Breadth:	9.8 metres (32.0 feet)
Depth:	4.1 metres (13.5 feet)
Port from:	Texel
Port to:	Batavia
Date lost:	28 April 1656
Location:	5.6 kilometres west of coastline, Moore River area
Chart number:	DMH 087
GPS position:	
•	Latitude 31° 13.3600' S
•	Longitude 115° 21.4800' E
Finders:	G., J. and A. Henderson, J. Cowan and A. Robinson (14 April 1963)
Protection:	*Historic Shipwreck Act 1976* (gazetted 1973)
Unfinished Voyages,	volume 1:25–7, 29, 31, 41, 65, 252
MA file number:	585/71, 9/72 & 424/71
ASD number:	WA 380
Significance criteria:	1, 2, 4, 5, 6, 7

The vessel

Vergulde Draeck was a *jacht* with a cargo capacity of 130 lasten. The vessel was purchased by the Amsterdam Chamber of the Dutch East India Company in 1653, and its first trading voyage was between Holland and the East Indies. On 4 October 1655 *Vergulde Draeck,* under the command of Pieter Albertsz, set sail for Batavia. Aboard was a crew of 193 men, eight chests of silver coin worth 78 600 guilders and a cargo of trade goods worth 106 400 guilders (Green, 1973:267).

Following the Brouwers route, *Vergulde Draeck* left the Cape of Good Hope with the intention of making use of the trade winds to cross 5 000 miles of Indian Ocean before turning north toward the East Indies. However, without the ability to establish longitude and distance with any accuracy, the vessel struck a reef off the Western Australian coast north of Yanchep, near Ledge Point, on the morning of 28 April 1656.

The wreck event

The vessel began to break up immediately. Two of the ship's boats were launched but only 75 of the crew were able to make it to shore, along with a few of the provisions and stores. Seven of the crew were immediately dispatched to seek assistance in Batavia, while Albertsz and the rest of the crew remained behind (Green, 1973:267). Forty-one days later, with news of the wreck, the *jacht Goede Hoop* and the *fluit Witte Valke* left Batavia in search of survivors. Several other expeditions were mounted in the following year, but all failed to turn up any of the missing crew, although some wreckage was noted in the region of Fremantle.

Rediscovery

The English translation, in 1859 and 1899, of the documents relating to the *Vergulde Draeck* gave rise to much speculation as to the whereabouts of the vessel and its valuable cargo. In 1931 A. Edwards discovered 40 silver coins in the sand-hills just north of Cape Leschenault (Green, 1973:272). The wreck was not found, however, until 14 April 1963 by a group of spear fishermen.

Site location

The site is located just north of Moore River on a reef 12 kilometres south-south-west of Ledge Point, 5.6 kilometres west of the coastline.

Legislation

Together with the discovery of the seventeenth century Dutch wreck *Batavia* the significance of these wreck sites led to the enactment of legis-

lation through the mechanisms of the *Museum Amendment Act 1964*. This deemed sites of wrecks that occurred prior to 1900 in Western Australian waters, to be archaeological sites. This protection was amended by and transferred to the *Maritime Archaeology Act 1973* (Western Australia). The Dutch Government as heirs to the VOC have transferred their rights of ownership to the Dutch vessels wrecked in Western Australia to the Commonwealth Government, through the Australian Netherlands Committee on Old Dutch Shipwrecks. These are contained in the Separate Schedules of the *Historic Shipwrecks Act 1976*.

Site description

The wreck site covers an area 50 metres long by 40 metres wide, bound on one side by honeycomb reef. The shallowest part of the reef is less than 1 metre at low tide. The maximum depth over the site is 8 metres. The site itself lies scattered throughout a complex cave system. An inspection of the site in 1972 provided the following description:

> The only wreck material noticeable on the site is overgrown (with weed) and a heavily concreted cannon and anchors [sic], most of the site being covered with a light seaweed and algae…Numerous small, yellow bricks are scattered over the site, and a closer examination may reveal pottery and brass candle-stick (Green, 1977:72).

Excavation and artefacts

Following the discovery of the wreck the first material raised and recorded was an elephant tusk (African) and some ballast bricks. However, the wreck site was not protected at this time and the details of the artefacts are only gleaned through contemporary newspaper references. Reports of blasting at the site encouraged State Government intervention and the responsibility for the excavation and protection of the wreck site was vested in the Museum.

Exposure of the site to the Indian Ocean swell made any work undertaken on *Vergulde Draeck* hazardous. However, in early 1972, a full expedition was mounted to systematically excavate the remains of the cargo and ship's fittings. Little remained of the vessel's structure and stratigraphy had been disturbed by the action of looters. Over several months a quantity of artefacts was recovered including beardman jugs, ceramic masks and medallions, clay tobacco pipes, bronze and brass utensils (e.g. a bronze mortar with the inscription *Amor Vincit Omnia* (Love Conquers All), shown below), tools and accessories, glass bottles, a tool-box, various armaments and much organic material.

Statement of significance

HISTORICAL

This site is significant in the early European exploration of Australia and parts of the Western Australian coast. It demonstrates the difficulties of early navigation and the inability to establish accurate measures for longitude without the aid of a chronometer. Dutch commercial activity and the development of trading routes across the Indian Ocean meant that several other vessels including the seventeenth-century *Batavia* were wrecked on this coast. They represent a unique aspect of international maritime trade. Their wrecking led to further expeditions in search of survivors and en-

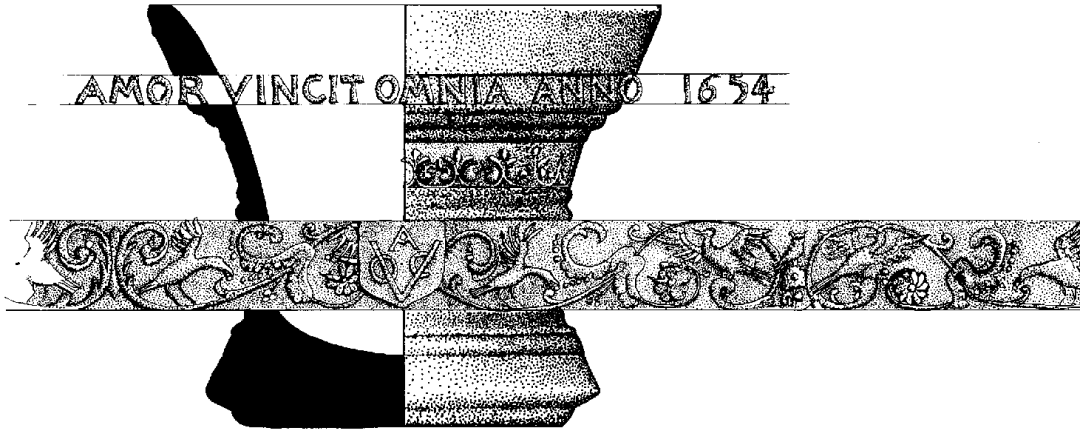


Figure 15
A mortar from Vergulde Draeck *(MA 294)*

couraged the mapping of the little known Western Australian coastline, that was hitherto regarded as The Great Southland.

References

Green, J. N., 1973, 'The wreck of the Dutch East Indiaman the *Vergulde Draeck*, 1656', *International Journal of Nautical Archaeology,* 2.2:267–89.

1977, *The AVOC Jacht* Vergulde Draeck *wrecked off Western Australia 1656*, British Archaeological Reports, Supplementary Series 36, Oxford.

1983, 'The *Vergulde Draeck* excavation 1981 & 1983', *Bulletin of the Australian Institute for Maritime Archaeology,* 7.2:1–8.

1985, *Treasures from the* Vergulde Draeck, Western Australian Museum, Perth.

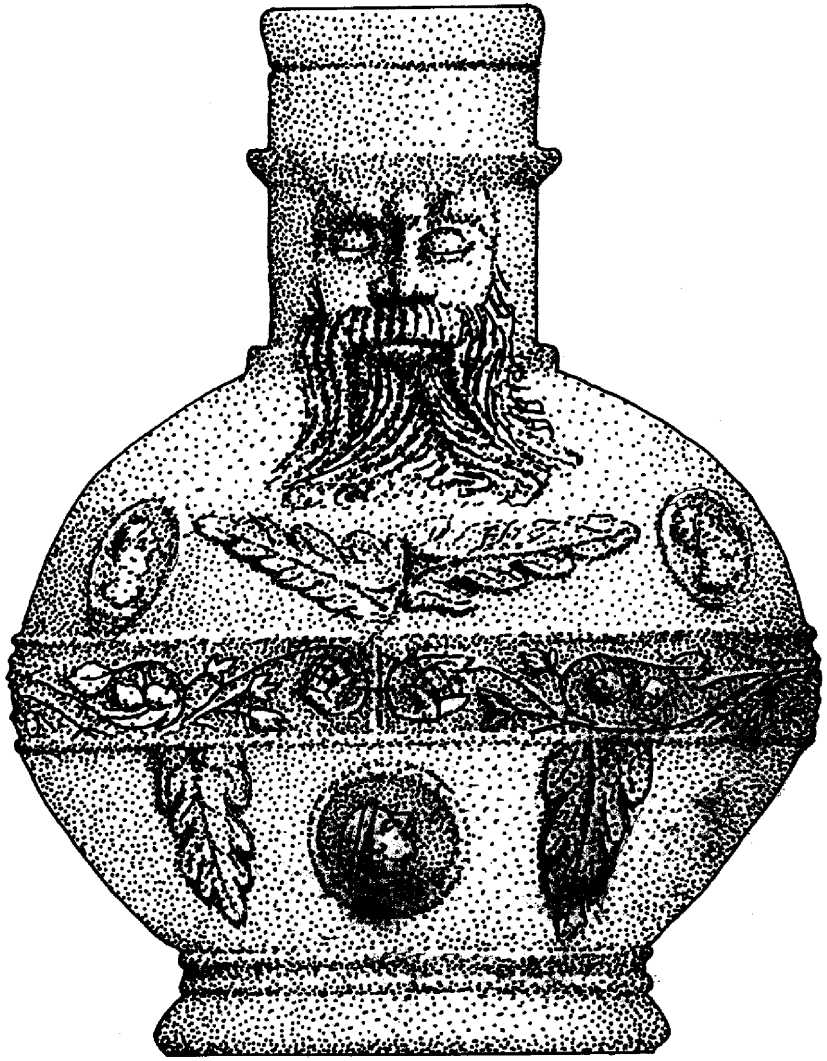


Figure 16
A beardman jug from Vergulde Draeck *(Green, 1977)*

Villalta (1883–1897)

Figure 17
The wreck site plan for Villalta

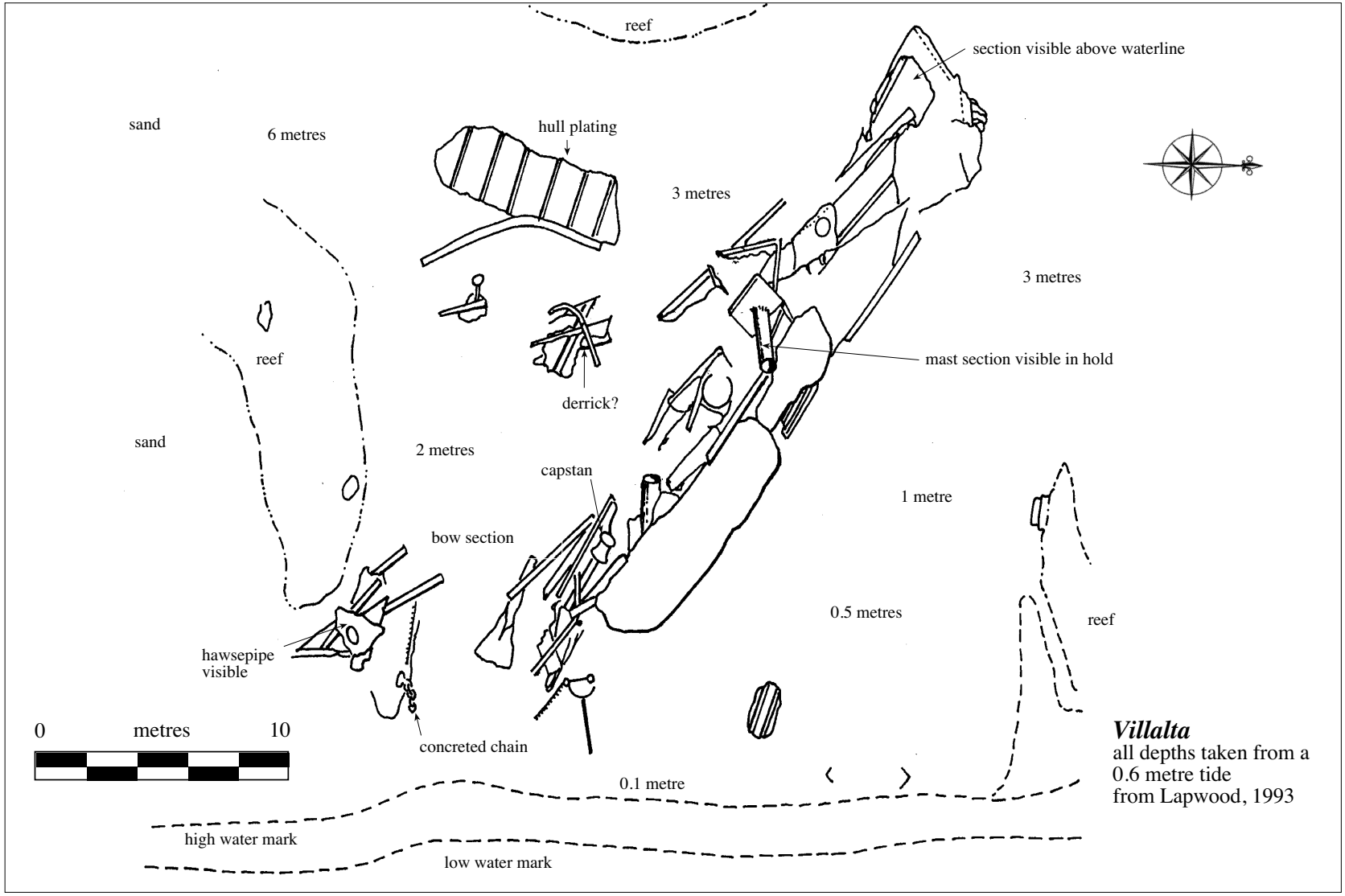


Figure 18
Transit photographs for the wreck site of Villalta *(MA 4272)*

Official number:
Where built: Glasgow, Scotland
Registered:
Rig type: barque
Hull: steel
Tonnage: 866
Length:
Breadth:
Depth:
Port from: Tomac
Port to: Fremantle
Date lost: 28 February 1897
Location: 6.4 km north of Moore River, Guilderton, on shore
Chart number: DMH 280
GPS position:
- Latitude 31° 17.9729' S
- Longitude 115° 27.2729' E

Finder: W. Marshall (1981)
Protection: *Historic Shipwrecks Act 1976* (gazetted 1981)
Unfinished Voyages, volume 3:106–7
MA file number: 21/80
ASD number: WA 384
Significance criteria: 1, 4, 5, 6

The vessel

Villalta was built in Scotland in 1883 by J. Reid and Company. Its owner at the time of wrecking was Nicholson and McGill of Liverpool and the master was Captain Harland. The vessel was on a voyage from Tomac to Fremantle with a cargo of timber, and was expected to arrive toward the end of February 1897.

The wreck event

The vessel was coming down the coast in the early afternoon of 28 February 1897, with the second officer on deck. The vessel was running at about six knots, close hauled, on the starboard tack and under topsails and fore-and-mainsail courses. The ship's officer had told the captain that land had been sighted but Harland had refused to act on the advice.

Leschenault Reef was suddenly and heavily struck. Because of the heavy seas it seemed unlikely that the vessel could be got off so the captain gave orders to board the lifeboats. Large waves upturned one of the lifeboats almost immediately. The master and two others were lost. There were, however, sixteen survivors from the wreck.

The steamer *Colac* visited the wreck site in the following week and waves were found to be breaking almost continuously right over the wreckage. All moveable items including the timber that was stacked on top had been washed overboard. It was still thought that the vessel could be got off, but every few minutes the fierce waves caused the timbers to move in the holds, finally breaking through the vessel's steel plates at the side. The vessel soon broke up with timber strewn all round.

The barque lay on its side with the deck towards the sea approximately 4 kilometres offshore on the broken piece of reef. Two weeks later the vessel had slid off Leschenault Reef and drifted to a position 6.5 kilometres north of Moore River and could be boarded from the shore. The mizzen-mast was still standing, but the fore and mainmast had disappeared and the vessel had broken in two at the fore rigging (Cairns & Henderson, 1995:106).

When asked the captain of *Colac* stated that the current could not have caused *Villalta* to strike because at this point the current runs out to sea, not in toward the land as the vessel had gone. The current, he further stated, would wash the remaining cargo and loose pieces from the wreckage out to sea and there would be little hope of salvage (*The Inquirer and Commercial News*, 5 March 1897:11a & b, cited in Cairns & Henderson, 1995:106).

Inquiry and salvage

The preliminary inquiry found that the loss could be attributable to the careless navigation of the captain. There was criticism of this decision at the time with the suggestion that the dead man was just a convenient scapegoat for factors which may have been beyond his control (Cairns & Henderson, 1995:106).

The vessel which had been abandoned by the underwriters was sold in March 1897 to Connor and Doherty for £80 and £210 for the cargo. The hull and cargo were subsequently sold to James Lilly and Company for £315. Over the following months the salvaged timber was transported to Fremantle (Cairns & Henderson, 1995:107).

Site location

The vessel is located in the breakers on the beach, approximately 100 metres offshore, 3 kilometres south of the settlement of Seabird, 1 kilometre south of Cape Leschenault.

Site description

Part of the port bow is the only section of the wreck that has not collapsed. Concrete cement fills the water-ways. The depth of the hull below the bow deck level is 4.5 metres at a distance of 3.5 metres abaft of the stem. From this point on, the wreckage becomes more jumbled and buried under sand until 51 metres toward the stern. The extent of the remains is indicated on the site plan.

The site lies on an axis of north-west to south-east with the bow facing north-west at 40˚ off the parallel to the shore. Although the keelson is not often visible, there is nothing to indicate that it was broken in the wrecking process. About 20 metres from the bow a windlass is located. Near the shore there appears the external lip of the hawsepipe or possibly part of the mast-ring lying flat on the hull plating. There is little evidence of cargo. Other items on the site include a grindstone in the stern section, some wooden sheaves, a steel mast, timber yards, a winch, a rudder shaft, square bricks (possibly fire-bricks), a barrel and fairleads. Superimposed on the site is the wreckage of a blue fibreglass cray fishing vessel (Clarke, 1994, pers. comm.).

References

Clarke, J., 1994, personal communication, April.

Lapwood, 1993, Department of Maritime Archaeology Western Australian Maritime Museum File No. 21/80.

Sledge, S., 1978b, *Villalta*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 34.

The Inquirer and Commercial News, 5 March 1897:11a and b.

Ville de Rouen (1891–1901)

Figure 19
The wreck site plan for Ville de Rouen

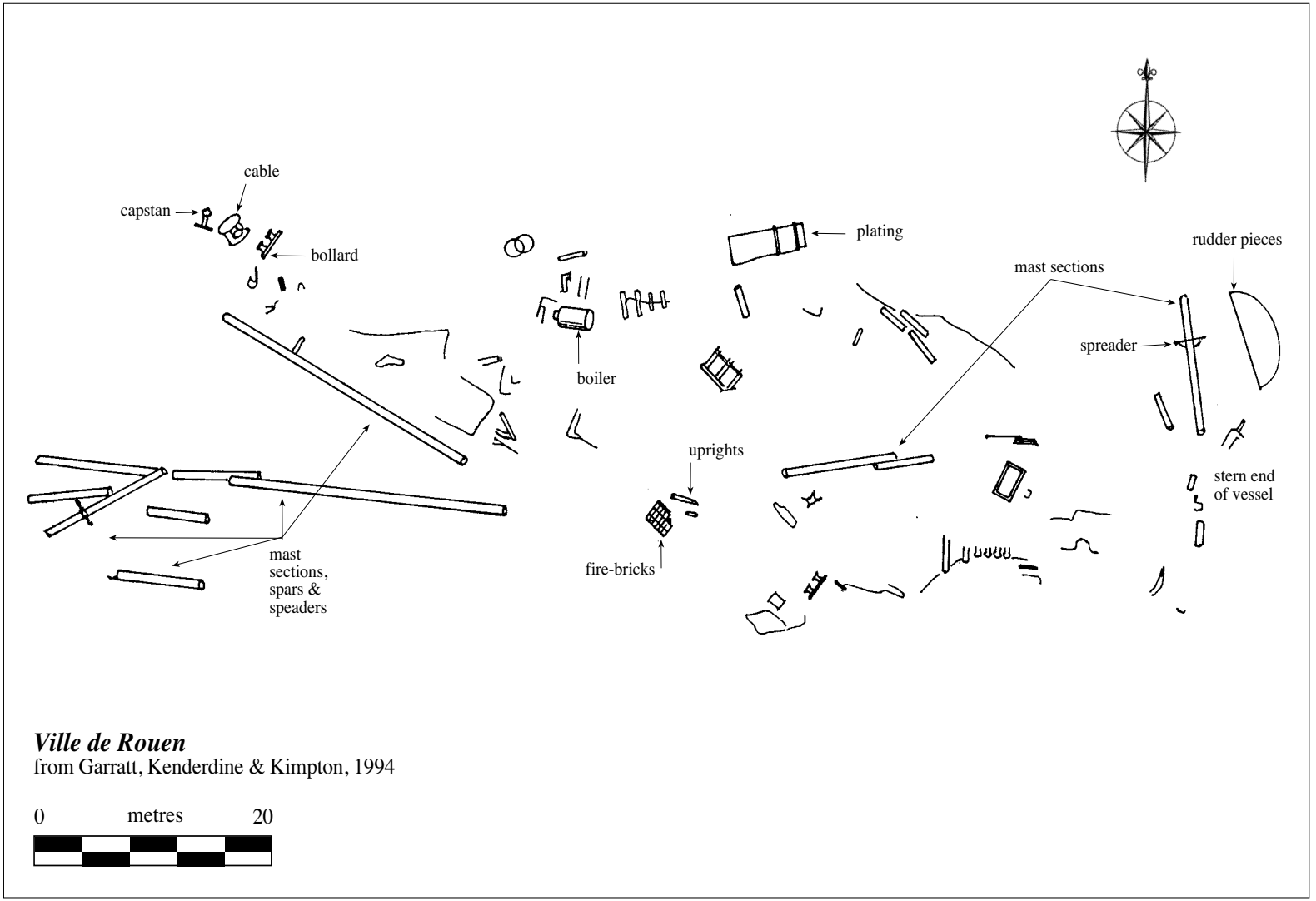


Figure 20
Transit photographs for the wreck site of Ville de Rouen *(MA 4272)*

Where built:	St Nazaire, France
Registered:	Rouen, France
Rig type:	barque
Hull:	steel
Tonnage:	1 303 gross, 1 114 under deck, 1 125 nett
Length:	66.9 metres (291.4 feet)
Breadth:	10.5 metres (34.6 feet)
Depth:	6.4 metres (21.0 feet)
Port from:	Cardiff
Port to:	Fremantle
Date lost:	30 October 1901
Location:	Ville de Rouen Reefs, Moore River area
Chart number:	PWD 52015
GPS position:	
•	Latitude 31° 21.6345' S
•	Longitude 115° 26.7824' E
Finders:	W. & H. Scott, A. Davies and R. Sonneman (16 January 1964)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1991)
MA file number:	14/86/1 & 14/86/2
ASD number:	WA 385
Significance criteria:	1, 4, 5, 6

The vessel

Ville de Rouen is listed in the register as having four masts, one bulkhead and one deck. It was described as having two tiers of deck beams indicating that another set of beams had been laid, with or without additional decking on top. On this sort of vessel there would be no hatch coamings, with the beams being further apart to allow easier movement of the cargo than a between-deck vessel.

Owned by A. Prentout-Leblond and E. Boniface of Rouen the vessel left Cardiff on consignment to the Fremantle Smelting Works on 25 July 1901. The cargo consisted of 1 247 tonnes of coke, 25 000 fire-bricks and 50.8 tonnes of pig iron. The wrecking was observed by a fisherman (Fraser) in the Moore River area at the time of the disaster, on 28 October.

The wreck event

Fraser first saw the barque 16 to 24 kilometres offshore heading for the land. It then struck the reef about 4.8 kilometres off the coast. He thought at the time that there was no imminent danger of the vessel remaining stranded and did not report his observation until the next day. When the news was passed to the harbour-master the government steamer *Penguin* was sent to investigate.

The vessel was found to be bumping on the reef in a strong swell. There was 2.54 metres of water in the hull, but it stood erect and was sitting on sand over a rocky bottom. Some hours later, however, a fresh breeze caused *Ville de Rouen* to shift and it drifted 1.2 kilometres to the southern part of the reef. It was now in 7.2 metres of water and the decks were awash.

Communication with the French-speaking crew was difficult and it was not until *Penguin* made to leave that they could be persuaded to return to Fremantle. Two crew were left to take care of the gear. Using an interpreter the master of *Ville de Rouen,* Captain Bathelweld, indicated that he had decided to abandon the vessel, as he thought there was no chance of saving it. The two crew who had remained at the site were ordered to return to Fremantle. No charges were laid against master or crew and they eventually returned to France.

Site location

The site is located about 4.8 kilometres off the shore from Moore River on a bearing of 082°, on the inside of the Ville de Rouen Reef.

Site description

The site lies on a reef bottom with sand surround

at a depth of 7 to 9 metres. The wreckage itself has collapsed with only the topside features of the vessel discernible. At the time of last inspection it was largely covered in seaweed and was heavily concreted (Kenderdine, 1994:5).

The wreckage is orientated on an axis south-west by north-east at 70˚ to the bow. Masts and spars lie mainly to the south and middle of the site indicating a list to port. A stockless anchor can be seen but it is well hidden in the wreckage. One anchor has already been removed from the site.

From bow to stern, chain is visible as is a two-cylinder steam winch and some bollards. Plating obscures the floors. Amidships there is a donkey boiler and a stack of fire-bricks. Mast and spars are located at the stern of the vessel. Hatch covers have been located, and a pulley sheave block and hawsepipe piece. Two large metal uprights are associated with the fire-bricks and the pig iron ballast. These extend up toward the surface to within 1 to 2 metres. Coke has been recorded during various site visits.

Conservation assessments on the site indicate that it is deteriorating at a rate twice that which is normal for iron wreck sites in marine conditions. This reflects the high energy environment in which the wreck is situated.

Statement of significance

HISTORICAL

This site is of historical significance for its association with the development of the smelting industry in Fremantle. The loss of the cargo bound for the Fremantle Smelting Works came at a time when the works appeared to be thriving. The type of cargo carried by the vessel reflects a move to counteract isolation from the northern mining towns through diversification into steel production. When the supplies of rich gold and lead ore ran out the plant was forced to close for several years before alternative sources stimulated its reopening in 1916 (Cairns in McCarthy, 1991b:13).

ARCHAEOLOGICAL

This site has the potential to yield information on the construction of a particular ship design. The French-built barque is the only known shipwreck of its kind in Western Australia, and is the remains of the largest of the sailing vessels employed in the latter days of the maritime colonial trade with Europe.

References

Kenderdine, S., 1994e, *Ville de Rouen* (1891–1901), unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 113.

McCarthy, M., 1991b, The wreck *Ville de Rouen* (1901): a re-submission to DASETT on its historic status, Department of Maritime Archaeology, Western Australian Maritime Museum File No. 14/86/2.

McKenna, R., 1990, The *Ville de Rouen*, Maritime Archaeological Association Reports, Vol. 4, July 1989–June 1990.

Figure 21
Anchor from Ville de Rouen
(MA 3312)

Figure 22
Divers searching amongst the iron frames of the Ville de Rouen *(VR54)*

Eglinton (1842–1852)

Figure 23
The wreck site plan for Eglinton

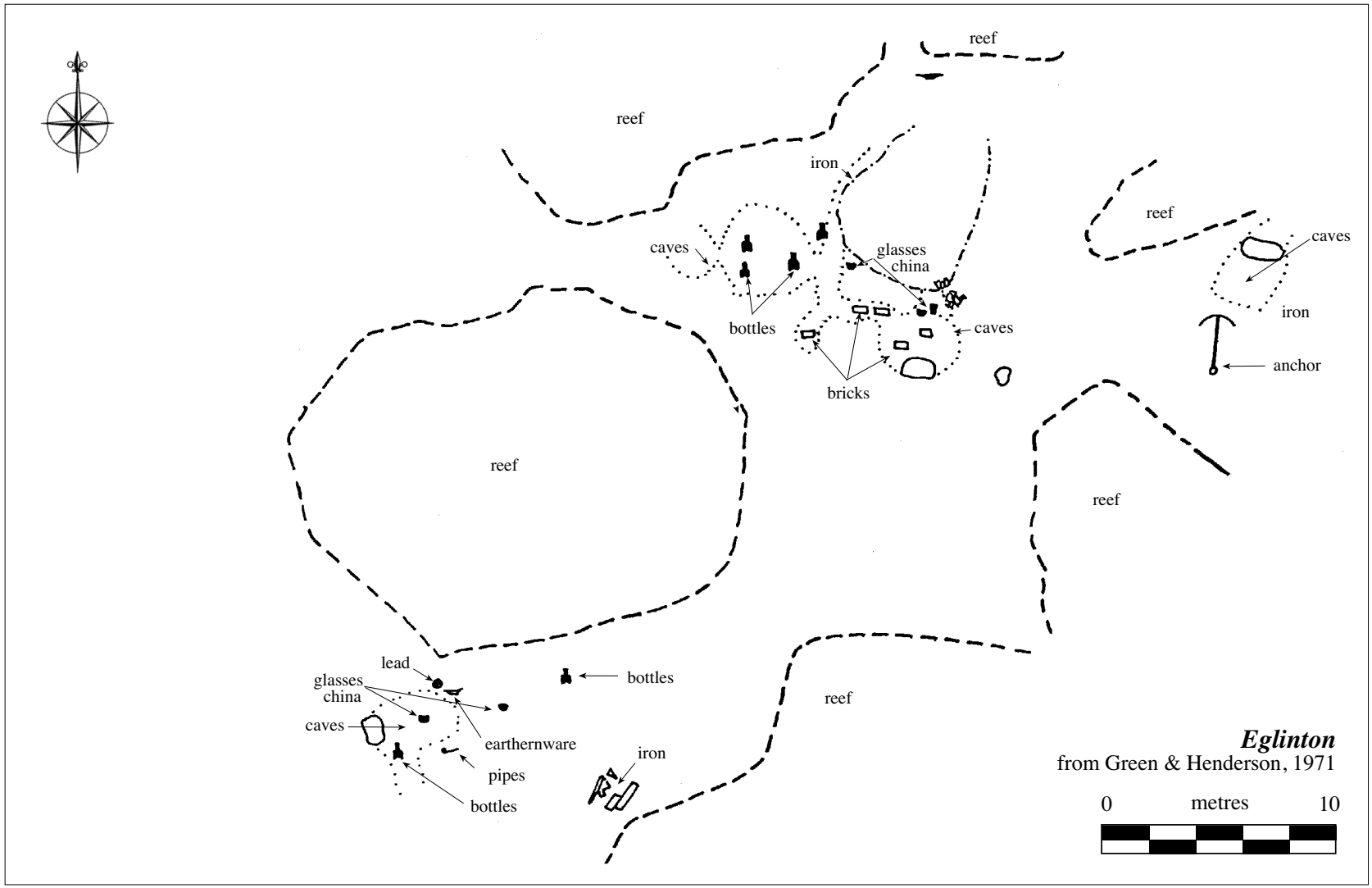


Figure 24
Transit photographs for the wreck site of Eglinton *(MA 3812)*

Official number:	9353
Where built:	Quebec, Canada
Registered:	
Rig type:	barque
Hull:	wood
Tonnage:	462
Length:	66 metres (135 feet)
Breadth:	8.2 metres (27 feet)
Depth:	5.5 metres (18 feet)
Port from:	London
Port to:	Fremantle
Date lost:	3 September 1852
Location:	Eglington Reef
Chart number:	AUS 51346
GPS position:	
•	Latitude 31° 38.4500' S
•	Longitude 115° 39.5400' E
Finders:	P. Bonan and B. Castle (23 August 1971)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1991)

Unfinished Voyages, volume 2:12–14
MA file number: 416/71
ASD number: WA 116
Significance criteria: 1, 3, 4, 5, 6

The vessel

Eglinton was built in 1848 at Quebec, Canada, as a three-masted carvel-built barque. Lloyd's Survey Register recorded the vessel as having a standing bowsprit with a female figure-head, a square stern, with a poop deck in addition to the full deck. The extent of the Lloyd's survey means that full measurements for the barque are available although no plans are known to exist.

Eglinton was described by its agents as a 'splendid fast sailing ship'. It was employed at a time of increasing competition in the clipper trade where attributes of speed, good cargo capacity and low operating costs were desirable. In January 1852 the agents of Felgate invited application for freight and passengers for an intended voyage between Gravesend and the Swan River, via Capetown and various ports in Asia and Australia (Henderson & Millar, 1994:20).

Under Captain Bennet, with 23 passengers aboard, *Eglinton* sailed on 11 April 1852. On 29 July the vessel left Cape of Good Hope, having taken more passengers aboard. Before leaving the Cape the captain noticed that the chronometer was giving incorrect readings and, when his request for a replacement was refused, he was forced to rely on his own instrument for the voyage. On 3 September a discoloration in the water was noticed and it was estimated that land lay 240 kilometres away. The sails were shortened with an expectation that land would be sighted the following day.

The wreck event

At 9.45 p.m. the look-out called 'breakers ahead'. Almost immediately the vessel struck a reef, rendering the rudder useless. *Eglinton* now ran over the first reef towards a second line of reef about 1 kilometre ahead. Moments after the vessel struck the stern frame was broken in. There was confusion aboard as the crew and passengers had been celebrating the near completion of the voyage. The masts were cut down and the boats were made ready for launching.

> The water was up to the seats and we were chilled! The night increased in severity: terribly dark and dreadful squalls of hail and rain and a fearful sea (Mrs James Walcott, letter, 4 December 1852, Henderson papers, Reel 133–1, Norfolk Record Office, England, quoted in Henderson & Henderson, 1988:13).

The next morning, with no response forthcoming from Perth to the guns that were fired, the task of transferring the passengers to safety began.

One passenger lost her life when one of the ship's boats overturned. The boatswain also drowned in his effort to save the ship's chronometer which had fallen into the sea.

Salvage

Eglinton had a valuable cargo aboard for the merchants and other colonists of Western Australia. Much of it was uninsured. While a quantity of goods from the wreckage had floated ashore, plans were made to salvage the vessel. Lloyd's agents arranged for a third of the value of the cargo to go to the Fremantle boatmen on its recovery (Henderson & Millar, 1994).

Many of the survivors from the wreck received little attention. Concern was directed toward retrieving the cargo. Salvors recovered £15 000 of gold sovereign originally bound for the Colonial Government. The operation was directed by the superintendent of water police who was later to lay personal claim to the third share of the cargo offered by Lloyd's (Henderson & Henderson, 1988).

By September, gales had torn up the lower deck, washed away all the bulkheads and smashed many of the deck beams. In Perth and Fremantle daily auctions continued to realise high prices for damaged and retrieved cargoes. The hull of the vessel was sold in November but it is unlikely that much remained of it for salvage.

Inquiry

Captain Bennett was charged with negligence,

Figure 25
Artefacts from Eglinton *(EG 01)*

Figure 26
Printed earthernware plate with 'wild rose' pattern from Eglinton

convicted for not obtaining fresh ratings for his chronometer and for not laying out the anchors, and fined £50. This sum was paid by a group of sympathetic colonists. One of the crew was found guilty of stealing some personal effects from the wreck and was imprisoned for six months (Henderson & Millar, 1994).

Site location

The site lies approximately 49 kilometres north of Perth, 2.4 kilometres from Eglinton Rocks, and 2 kilometres from the mainland, on Eglington Reef.

Site description

Inspection of the site revealed that little of the ship's structure remains. Material was almost entirely confined to cargo including quantities of earthenware, chinaware, glassware, bottles and metal artefacts. Much of this material was located in the extensive limestone cave system that forms part of the reef.

The wreckage extends over an area of approximately 50 metres by 35 metres. It lies on part of a chain of offshore reefs running parallel to the coast and rises within 1 metre of the surface from a sand bottom about 10 metres deep on the outer side.

In 1993 much of the site was covered by concretion and kelp, including the artefact concentrations, iron concretions, bricks and ballast. In some places artefact concentrations were up to 0.5 metres thick.

Excavation and artefacts

In 1971 and 1972 excavations of the site were undertaken. The large collection of material is held by the Museum. It includes over 700 registered articles which form part of permanent and travelling exhibitions. Among the items collected were hundreds of glass tumblers, wine goblets, assorted glassware, jars of preserved fruits, china dinner sets, pharmaceutic supplies, clay pipes, a toothbrush and comb (Henderson & Henderson, 1988:14).

Statement of significance

HISTORICAL

This site is of particular historical significance as an immigrant ship that brought people to the colony during the Australian goldrush era. It is also significant as a wreck event for the impact it had on the local community. The fledgling colony would have been affected economically by its loss, though this was in part offset by the extensive salvage operations.

ARCHAEOLOGICAL

The archaeological assemblages that remain *in situ* and the excavated material are of significance because they offer the opportunity for Western Australia's colonial history to be re-examined. The origin, value, quantity and quality of goods offer possible reinterpretation of colonial trade and dependency on imported and mass produced items.

References

Green, J. & Henderson, G., (file report), Preliminary report of the discovery and work on the *Eglinton*.
Henderson, G. & Millar, K., 1995, *Eglinton* site report, Department of Maritime Archaeology, Western Australia Maritime Museum, in progress.

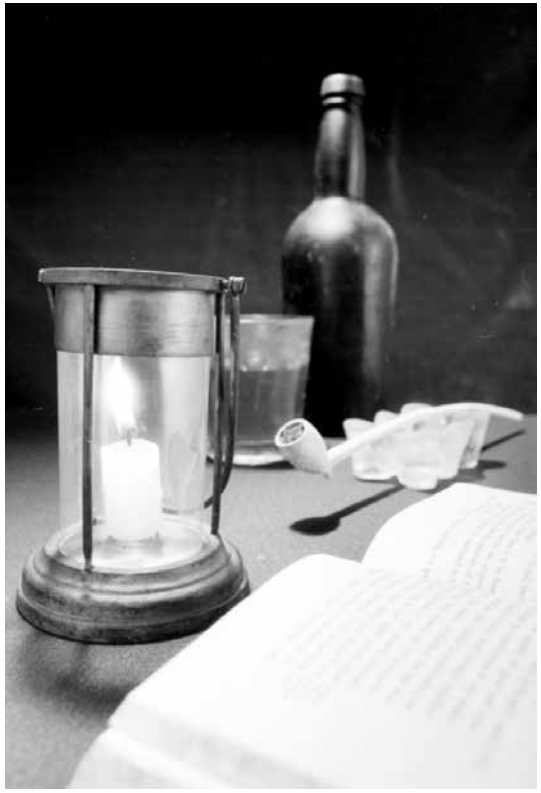
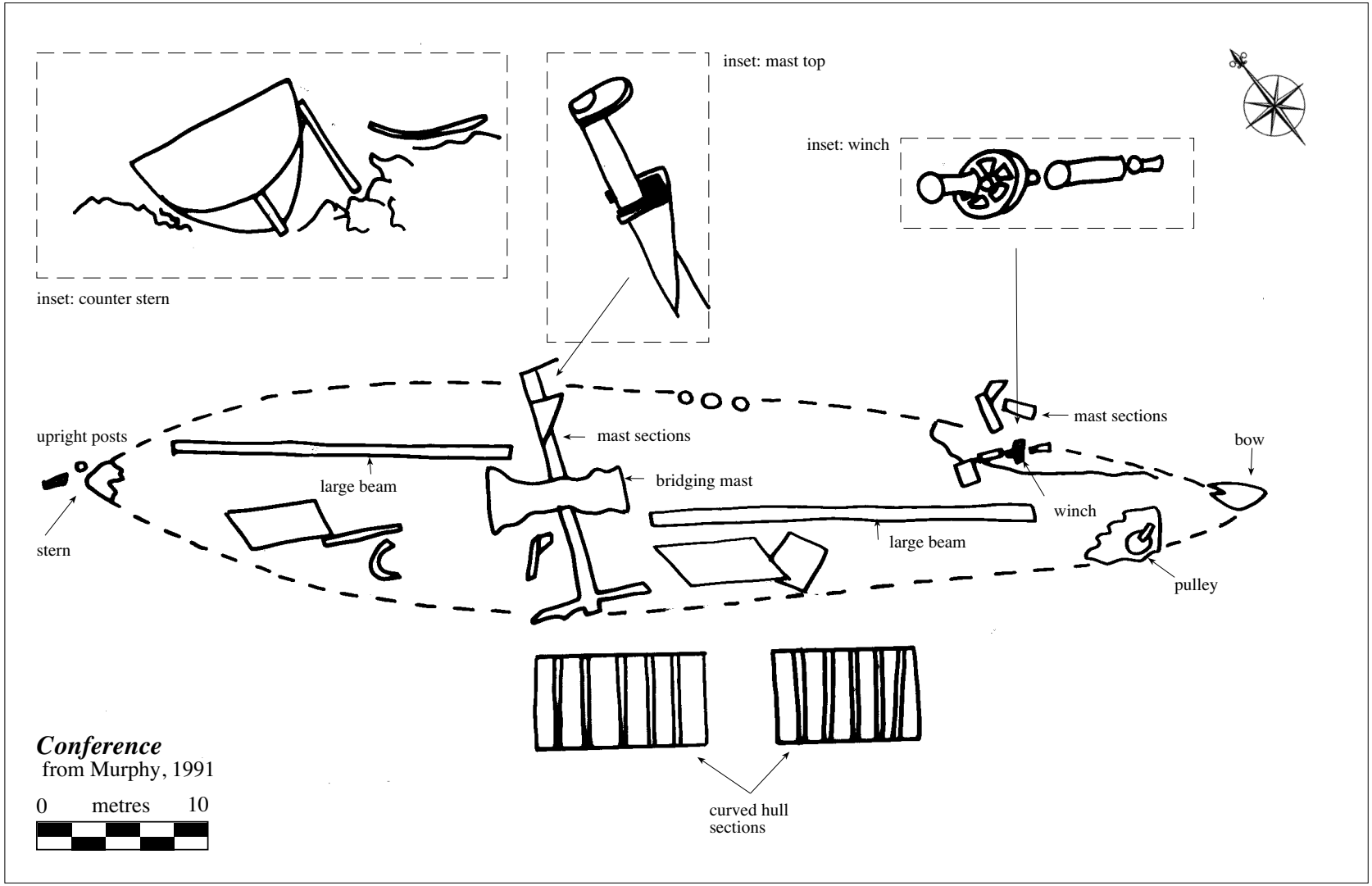


Figure 27 Artefacts displayed from Eglinton *(MA print file)*

Conference (1855–1904)

Figure 28
The wreck site plan for Conference



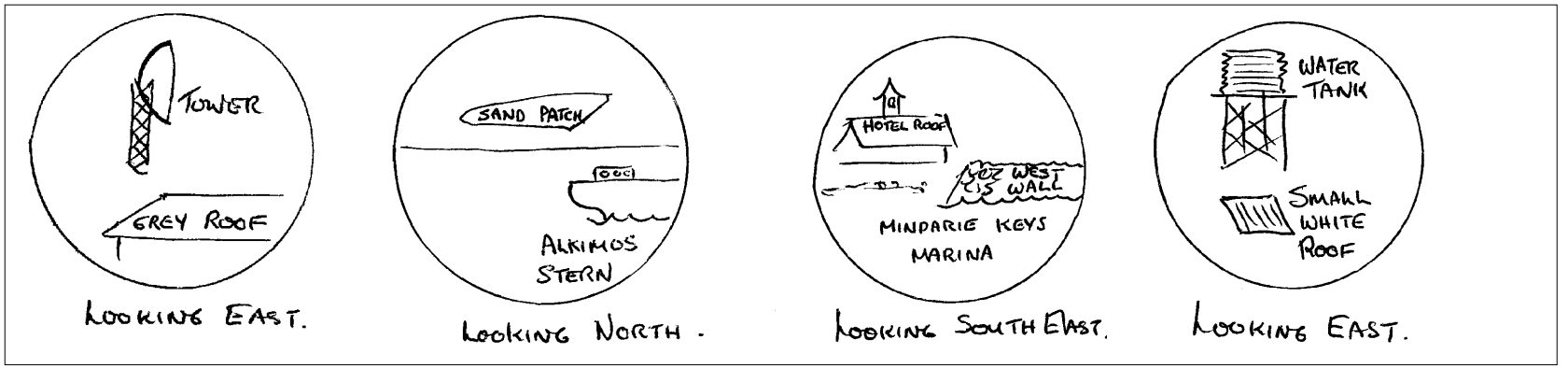


Figure 29 Hand-drawn transits for Conference *(Clarke, 1994)*

Where built:	Lancashire, United Kingdom
Registered:	Sydney (1897/98 & 1899)
Rig type:	three-masted barque
Hull:	iron
Tonnage:	421 gross, 399 net, 416 underdeck
Length:	50.2 metres (164.8 feet)
Breadth:	8 metres (20.3 feet)
Depth:	4.8 metres (15.9 feet)
Port from:	scuttled Quinns Rocks
Port to:	scuttled Quinns Rocks
Date lost:	21 April 1904
Location:	Quinns Rocks area
Chart number:	PWD 51346
GPS position:	
•	Latitude 31° 40.2850' S
•	Longitude 115° 39.6400' E
Finder:	John Clarke
Protection:	*Historic Shipwrecks Act 1976*
MA file number:	207/80 & 194/79
ASD number:	WA 819
Significance criteria:	1, 4, 5, 6

The vessel

Conference was a three-masted iron barque built by Taylor and Company, Warrington. The vessel had many owners and ports of registry, including Liverpool, Geelong, Sydney and Adelaide, and Christchurch and Wellington in New Zealand. After 1895 it was owned by the Adelaide Steamship Company and was involved in the coastal trade. Eventually the vessel was purchased for use as a hulk at Albany and was then employed as a coal hulk at Fremantle.

The wreck event

On 21 April 1904, *Conference* was scuttled on a reef 32 kilometres north of Fremantle:

> …under Captain Tait's supervision the hulk *Conference* was towed yesterday twenty miles north of Fremantle, several holes punched in her hull and then allowed to drift onto the reef. The hull was hard and fast and filling with water quickly when Captain Tait left her so that she is now safely disposed of (Irvine, 1904 in McCarthy, 1979).

In the period before 1910, it was customary to dispose of redundant vessels north of Fremantle and in Jervoise Bay. After that time they were generally scuttled in the ships' graveyard off Rottnest Island. This area was designated under the terms of the *Beaches Fishing Ground and Sea Routes Protection Act 1932* (McCarthy, 1991a:3).

Site location

The wreck site is reached by launching from Mindarie Keys and sailing due west, and is located 2.8 kilometres due west of Quinns Rocks. Transit drawings can be used to relocate the site.

Site description

The site lies at a uniform depth of 12 metres on a submerged 1 to 2 metres high reef on an axis of c.300°. It measures 51.5 metres in length and approximately 9 metres across, with only the sternpost and the starboard section of the counter stern standing above the sea-bed. The angle of the stern indicates that the vessel is canted over to the port side between 30° and 45°. The wreck has collapsed, leaving plating and frames visible with the keelson and a section of the deck framing amidships. Little remains of the bow section and this was mainly

covered in weed at the time of the last inspection in 1991. The stem-post and the barrel of the windlass are still visible.

A short stump of iron mast is visible at 13.4 metres, and at 31 metres aft, and a large section lies across the port side of the wreck. No mizzen-mast stump was visible. Two lumps of coal are the only other artefacts visible on the site although the finder's report refers to the presence fire-bricks. The apparent removal of masts, except one, was common practice with coal hulks. All masts above the fore, main and mizzen tops were removed and their lower stumps retained as useful mounts for derricks loading coal (McCarthy, 1991:3).

Statement of significance

SCIENTIFIC

The site has the potential to yield data useful in the study of deterioration and preservation of iron ships. It is significant that the bow of this vessel has collapsed. The study of iron vessels has indicated that the bow section is usually the strongest part of the vessel. Further investigation on this site may contribute to the knowledge on the nature of the wrecking process.

References

McCarthy, M., 1979, *Jervoise Bay shipwrecks*, Report, Department of Maritime Archaeology, Western Australian Mari___ime Museum, No. 15.

1991a, The *Conference*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 94.

Murphy, M., 1992a, The *Conference*, Maritime Archaeological Association of Western Australia, Reports, 1990–1992:15–18.

Centaur (1849–1874)

Figure 30
The wreck site plan for Centaur

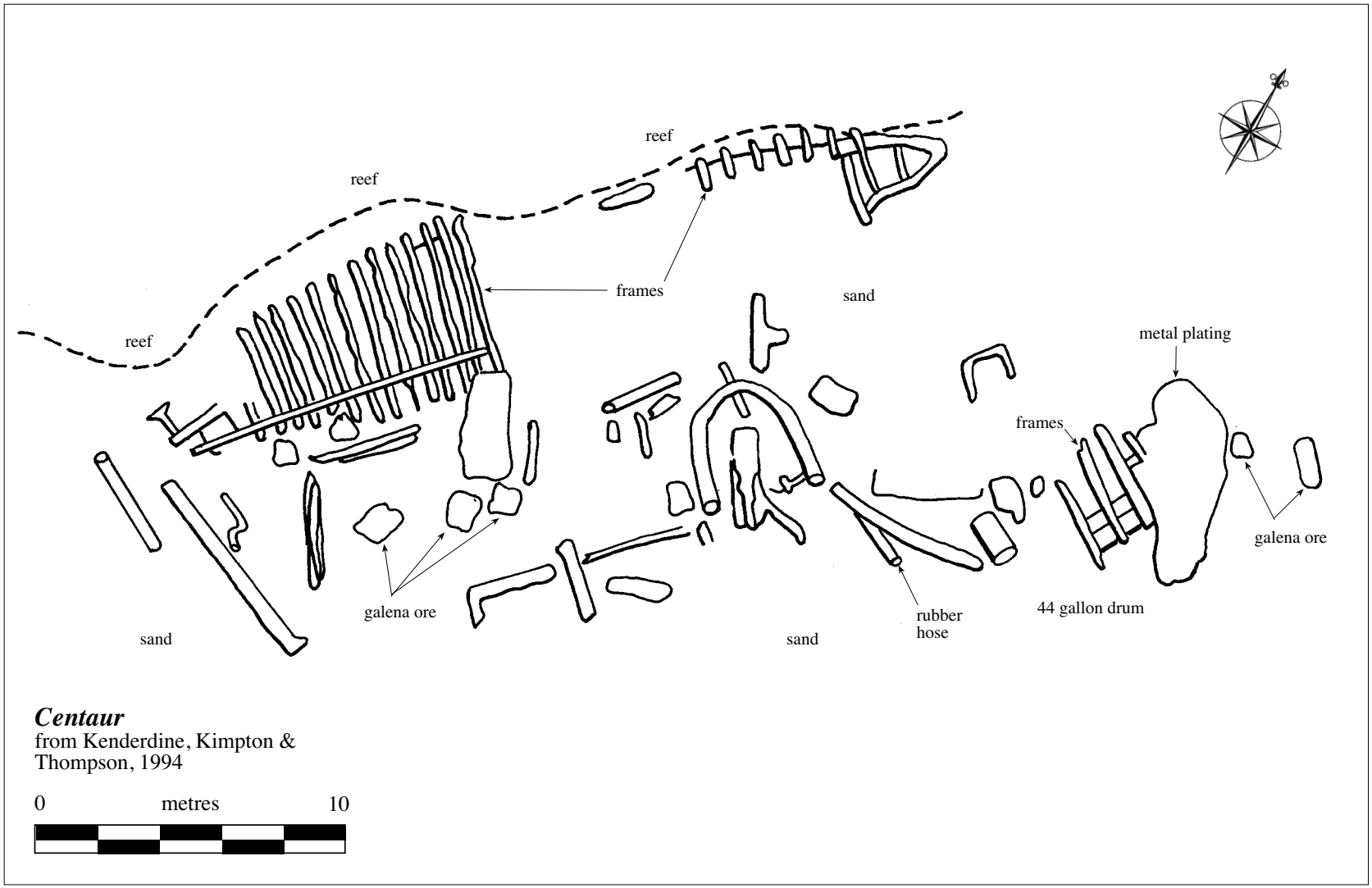


Figure 31 Transit photographs for the wreck site of Centaur *(MA 4273)*

Official number:	17568
Where built:	Aberdeen, Scotland
Registered:	Scotland
Rig type:	brig
Hull:	iron
Tonnage:	188
Length:	30 metres (98.9 feet)
Breadth:	
Depth:	3.3 metres (10.8 feet)
Port from:	Champion Bay
Port to:	Fremantle
Date lost:	9 December 1874
Location:	Marmion Marine Park, south-eastern side of Centaur Reef
Chart number:	DMH 001
GPS position:	
•	Latitude 31° 51.8256' S
•	Longitude 115° 42.6671' E
Finders:	N. Willsea and the Blue Water Wanderers Club (1959)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)
Unfinished Voyages, volume 2:156–7	
MA file number:	408/71
ASD number:	WA 74
Significance criteria:	1, 4, 5, 6

The vessel

Centaur was an iron-hulled brig with one deck, a square stern and male bust figure-head. Built in Aberdeen in 1849 by Messrs Blaikie Brothers, it was initially employed in the conveyance of machinery to Mauritius. Entry of its movements are recorded in the Aberdeen Directory until 1865–66 (Hayes, 1976:13–4).

In the early 1870s, *Centaur* was employed in the trade between Champion Bay and Melbourne and was described as one of the pioneer line traders. The shallow harbours of the Geraldton–Northhampton mining region were ideally suited to the use of small brigs. The usual return cargo from the colony of Western Australia was galena (lead ore) and it was with a cargo of 200 tonnes of ore that the *Centaur* left Champion Bay on 4 December 1874. Also aboard were nine crew and four passengers including the surveyor general and Commissioner for Crown Lands, the Honourable Malcolm Fraser. The vessel was under the command of Captain Brabham.

The wreck event

After leaving Champion Bay the vessel encountered adverse winds. Rottnest Island was sighted on 9 December at 3.30 p.m. Conditions were hazy and a strong southerly breeze was blowing. Brabham put the brig on a starboard tack and headed for Trigg Island. The order was given for the ship to go about, but before the manoeuvre could be completed *Centaur* struck a reef at about 6 knots at 5.00 p.m., the momentum carrying the vessel fully onto it.

Captain Brabham set about trying to free his vessel and the sails were set 'full aback'. However, the ship would not budge due to the extra metre that the cargo had added to the depth. The rudder was soon smashed off by the swell and the order was given to abandon ship while it remained in an upright position. Two lifeboats were lowered over the port side and soon all that remained of the hull above the water was a section of the starboard poop.

At the subsequent inquiry, Captain Brabham estimated that his vessel had been 8 to 10 kilometres offshore at the time of the shipwreck. The court employed Lieutenant Archdeacon to calculate the distance of the vessel from the shore and it was estimated at 3.4 kilometres. The Captain was found exclusively to blame for the wreck of the *Centaur,* for incautiously allowing the vessel to stand on an east-south-east course on the starboard tack until it struck. The chart in his possession showed the whole part of the coastline to be dangerous at 2.5 kilometres from shore. His certificate was suspended for six months although this was reduced to three months after petition (Hayes, 1976:15).

The wreck and its cargo were auctioned and sold for £150 on 11 December 1874 to Fremantle businessman and politician, Mr Marmion. It was reported that, after two weeks, a large portion of the cargo had been salvaged.

Site location

Centaur Reef, south-eastern side, 3 kilometres west-south-west of North Beach.

Site description

The wreck site lies in 7 to 9 metres of water adjacent to a section of reef on the port side of the remains of the vessel. The starboard side lies on a sand bottom with weed surround. Distributed along the port side of the vessel are sections of iron frames and plating that rise above the wreck to 5 metres below the water surface. Small amounts of galena ore are spread throughout the wreckage and a lead scupper is also visible. The overall dimensions of the site are 26 metres by 7 metres. Extraneous material associated with the wreckage includes a 44-gallon drum and a rubber covered metal pipe (Kenderdine, 1994a:6).

Statement of significance

Recreational and educational

This site lies in the Marmion Marine Park and is associated with a reef that supports diverse flora and fauna population. There is significant recreational dive activity in the area, and the wreck site is marked on the associated CALM publication about the reserve. The site, however, is not generally well known or visited by divers. Interpretation of the site and its history can demonstrate the importance of early coastal shipping, the development of the Western Australian mining industry, the hazards of navigation along the coastline, and the importance of wreck site protection.

References

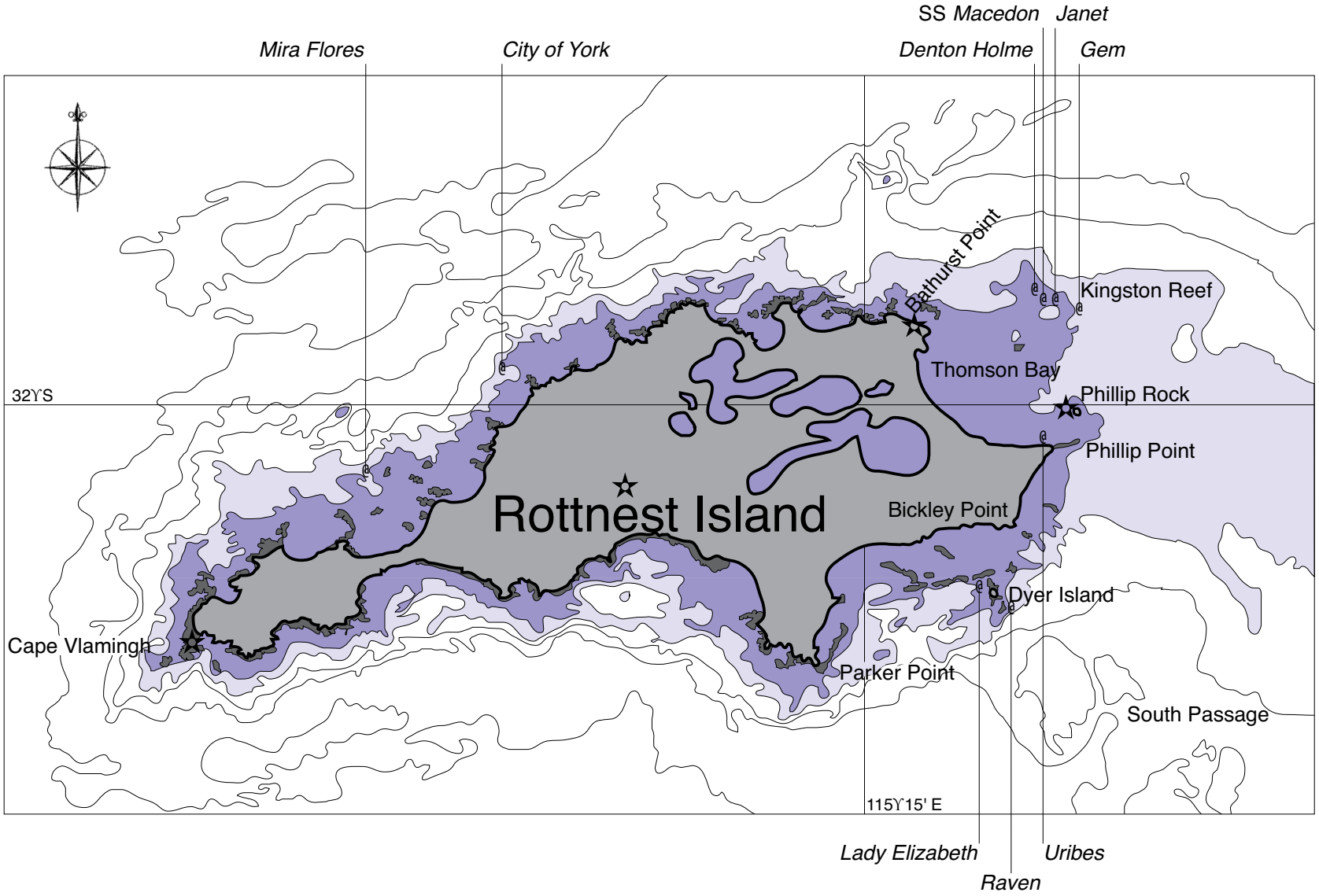
Hayes, K., 1976, 'Wreck of the Brig *Centaur:* pioneer trader of the WA coast', *Port of Fremantle Magazine*, Spring, pp. 12–15.

Kenderdine, S., 1994a, *Centaur*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 116.

Figure 32
Diver inspecting the Centaur *wreck site (CEN 11)*

Figure 33
Sketching the remains of the Centaur *(CEN 17)*

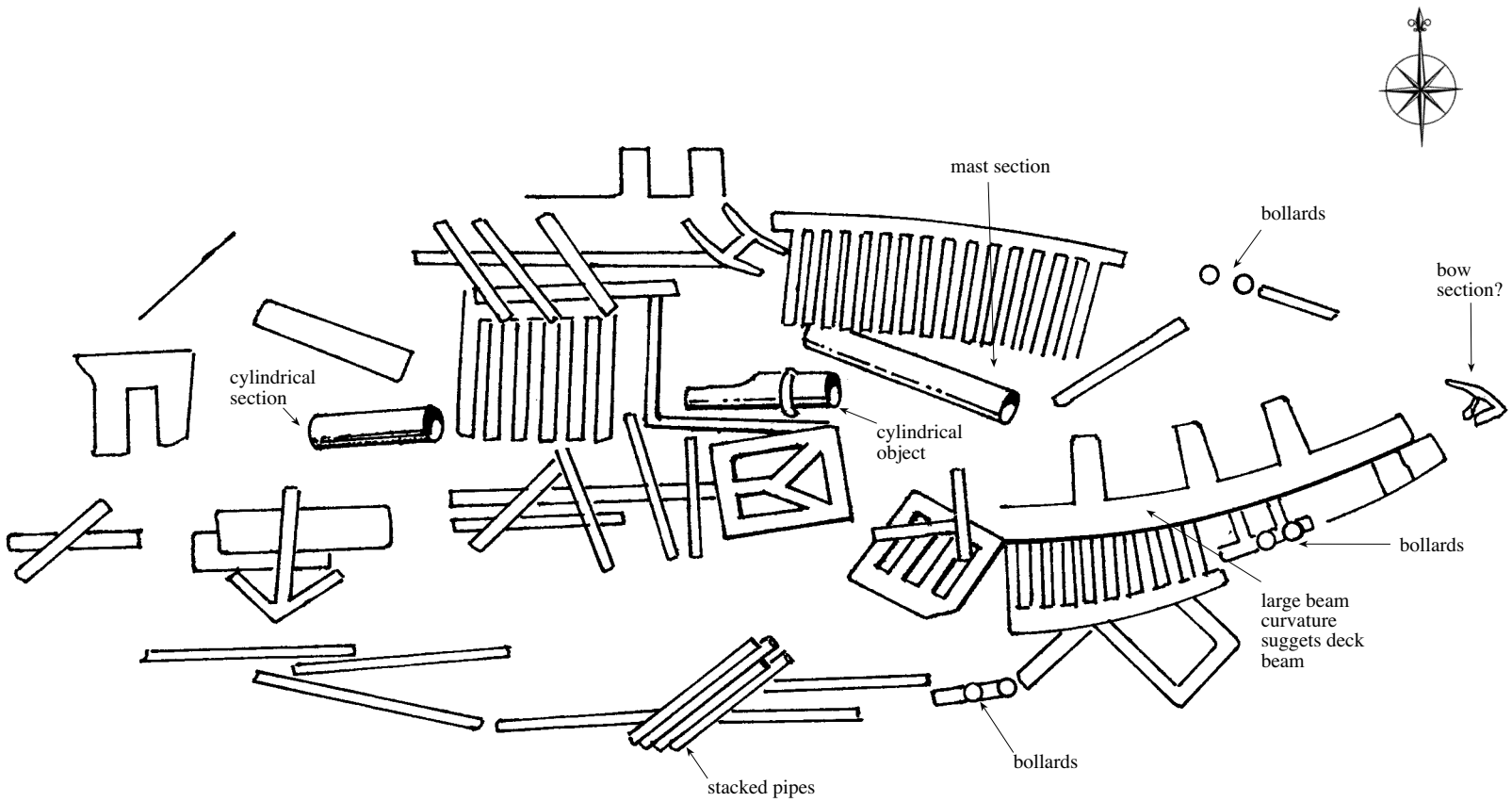
Map 2. Rottnest Island



Wreck sites on Map 2

Denton Holme (1863–1890)

Figure 34
The wreck site plan for Denton Holme



Denton Holme
not to scale
relative positions of prominent features indicated
from Murphy, 1990

Figure 35
Transit photographs for the wreck site of Denton Holme *(MA 4293)*

Official number:	47182
Where built:	Belfast, Ireland
Registered:	Belfast
Rig type:	barque
Hull:	iron
Tonnage:	998
Length:	
Breadth:	
Depth:	
Port from:	Glasgow
Port to:	Fremantle
Date lost:	25 September 1890
Location:	Rottnest Island, Thomson Bay
Chart number:	DMH 001
GPS position:	
•	Latitude 31° 59.2551' S
•	Longitude 115° 33.3139' E
Finders:	H. Edwards and the Underwater Explorers Club (1956)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:158

MAD file number:	855/71
ASD number:	WA 109
Significance criteria:	1, 4, 5, 6

The vessel

Denton Holme, built in Belfast, was owned by J. P. Corry and Company and formerly known as *Star of Denmark*. The ownership was transferred to the Hines Brothers in 1890 and that appears to have been when the vessel was renamed. Information in Lloyd's Shipping Register indicates that the vessel often made voyages from Liverpool or London to India.

On 23 June 1890 *Denton Holme* sailed from Glasgow to Fremantle with a cargo including 1 275 tons of iron pipes for the new Perth waterworks, cement and 250–300 tons of general cargo, a large portion of which appears to have been alcohol. The master was Captain Rich who had visited the colony six years previously.

The wreck event

Rottnest Island was sighted on the evening of 24 September. The blue light signal for a pilot was burned but by the time an answer was received the vessel had come quite close to land. Captain Rich gave orders to change tack as breakers were seen on the starboard beam. The yards were trimmed but the vessel struck reef at a point between Transit Reef and Kingston Spit.

The pilot boat was sent out and efforts were made to get *Denton Holme* off the reef. Orders were given to clew up the sails to prevent the vessel from moving forward to a more dangerous position. The boats were launched.

News of the stranding was given to the harbourmaster and SS *Rescue,* with harbour and pilot crews aboard, was dispatched. *Denton Holme* was found to be lying heavily on the reef, bow toward the south and a heavy sea breaking over its stern driving the vessel further forward. The vessel was threatening to break up and the seventeen crew made ready to leave the stranded barque, together with their personal belongings (Cairns & Henderson, 1995:158).

Despite the moderating sea at Fremantle, conditions at Rottnest were still very rough. All the moveable fittings on the main deck, such as hatchways and skylights had been washed away, and much of the cargo was waterlogged. The surveyor believed that the vessel's back was not broken but the possibility of refloating *Denton Holme* was considered hopeless.

Inquiry

Prompted by the loss of £20 000 of cargo an official inquiry was held. It was found that Captain

Figure 36
A porcelain doll's head from the Denton Holme *(MA 4765)*

Figure 37
A china cup from the Denton Holme *(MA 4765)*

Rich failed to heave to, after signalling the pilot, and also failed to cast the lead. His certificate was suspended for three months.

During the course of the inquiry it became apparent that for the three weeks prior to the wrecking the cargo of iron pipes in the lower hold had been shifting. It is possible that this rendered the vessel unsafe particularly in bad weather. The captain, aware of this, was trying to get his vessel to anchorage as quickly as possible and therefore did not heave the lead.

The role of the harbour pilot was also called into question. It was revealed that the local authorities at Rottnest Island had nothing other than flares to warn vessels that they were in danger. Following the inquiry it was suggested that the light from the Rottnest Lighthouse be made more powerful, that a telegraph across the island be established and that a red flashing beacon be permanently established on Transit Reef.

Salvage

Due to the awkward position of the vessel, attempts at salvage were very difficult. However, a number of cases of the ship's stores were recovered. By 1 October the wreck was reported to be broken in two forward of the mainmast, the rift being about 1 metre wide (Cairns & Henderson, 1995:159). The mainmast had gone overboard together with the mizzen topgallant mast and gear. By 8 October the beach from Robb Jetty to Woodman Point was strewn with empty cases and barrels that had washed ashore.

The cargo that had been saved was sold and included cases of spirits, lamp glass, bacon and drapery. Early the next year salvage continued, using the services of a diver. Two of the salvors were fined for smuggling spirits and beer from the wreck.

Site location

This site lies on Transit Reef, Thomson Bay, Rottnest Island. On leaving Thomson Bay wharf sail north-west between the reef.

Site description

The wreck site lies on a similar axis to the wreck of the SS *Macedon* with the bow to the east on a reef bottom and at a depth of 7 metres across most of the site, but one section of the hull is lying within 2 metres of the surface.

The vessel's floors are evident with the collapsed hull section scattered around. The bow section lies proud of the sea-bed and is the most prominent feature on the site. Water pipes are evident but few artefacts, hull structure or ship's fittings can be seen.

Statement of significance

HISTORICAL

This site is of historical significance as the remains of a vessel important in the development of Western Australia. Its loss would have significantly delayed the progress of building the public waterworks. Also, the shipwreck stimulated the improvement

of navigation facilities at Rottnest Island and at the approaches to Fremantle. The wreck highlights the hazards faced by colonial shipping. The loss of two other vessels, *Janet* and SS *Macedon*, on the same reef during this period also verifies the difficulties of making approaches to Fremantle.

References

Cockram, C., 1990, The *Macedon* and the *Denton Home*, Maritime Archaeological Association of Western Australia Reports, No. 4, July 1989–June 1990:18–21.

McCarthy, M., 1980, *Denton Holme*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 63.

Murphy, M., 1990, in Cockram, C., 1990.

Figure 37
Bow structure of the Denton Holme *(DH 17)*

SS *Macedon* (1870–1883)

Figure 39
The wreck site plan for SS Macedon

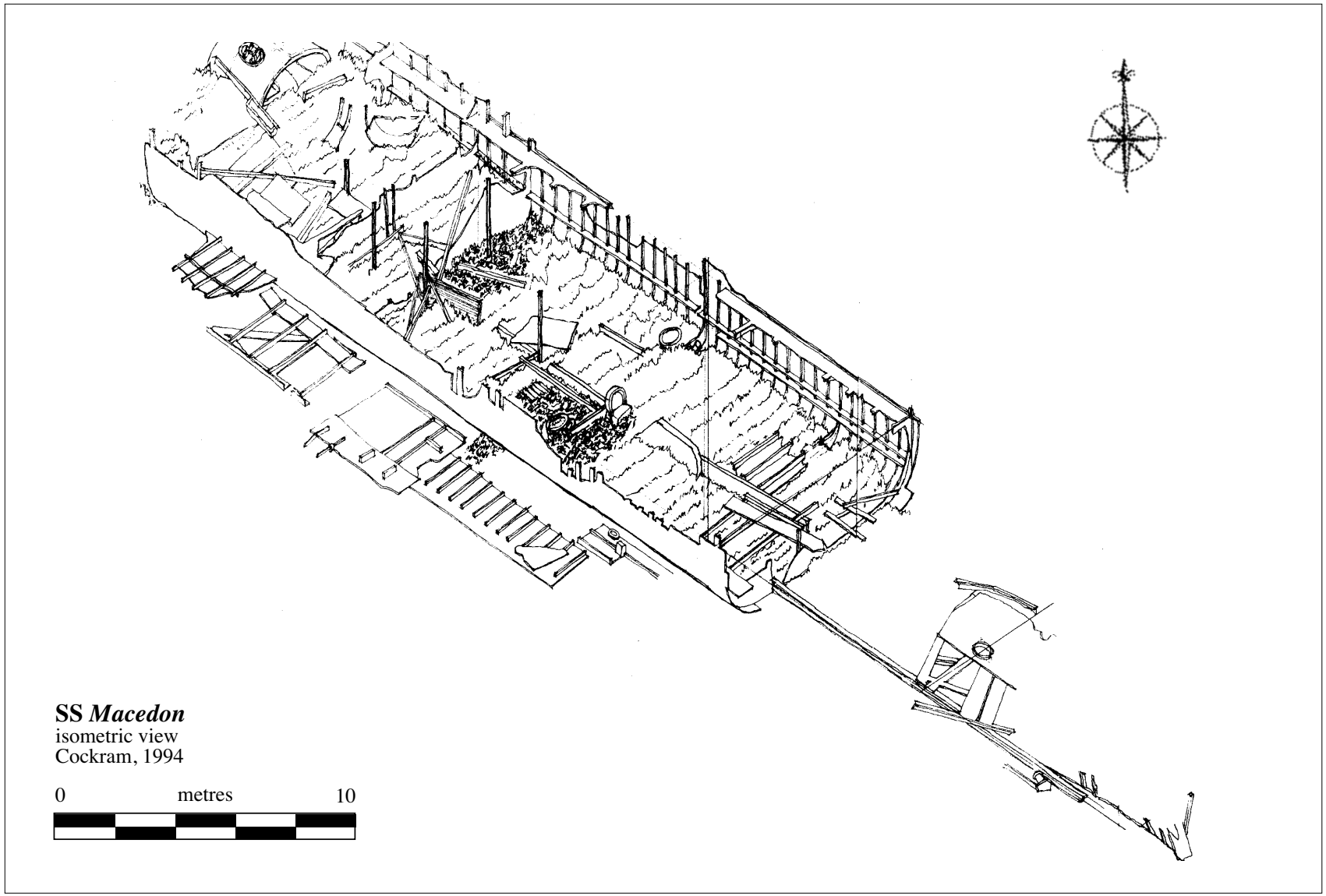


Figure 40
Transit photographs for the wreck site of SS Macedon
(MA 1223)

Official number:	63253
Where built:	Liverpool, England
Registered:	Melbourne
Rig type:	screw steamer
Hull:	iron
Tonnage:	532
Length:	67.2 metres (220.5 feet)
Breadth:	9 metres (29.6 feet)
Depth:	4.7 metres (15.4 feet)
Port from:	Fremantle
Port to:	Kimberley
Date lost:	21 March 1883
Location:	Rottnest Island, Transit Reef
Chart number:	DMH 001
GPS position:	
•	Latitude 31° 59.2700' S
•	Longitude 115° 33.3300' E
Finders:	T. Snider *et. al.* (1950s)
Protection:	*Historic Shipwreck Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:46–47
MA file number: 856/71
ASD number: WA 214
Significance criteria: 1, 3, 4, 5, 6

The vessel

SS *Macedon* was a 532-ton iron screw steamer, built in Liverpool, England in 1870 by W. H. Potter. The Register of British Ships, Melbourne recorded that the barque-rigged vessel with one deck was powered by 96-hp engines. The original owner was W. H. Smith.

Immediately after launch, SS *Macedon* sailed to Victoria to take part in the extensive coastal trade that serviced Western Australia. The following year the vessel was involved in a dramatic sea rescue of passengers and crew from the SS *Auckland* which ran aground near Cape Everarde, Victoria. For ten years the steamer serviced ports along the eastern seaboard until it was purchased by the Western Australian shipping company, James Lilly and Company.

The vessel was engaged in the transport of the Kimberley Survey Party together with horses and equipment to the North-West, under Captain Craig. There had been considerable pressure to open up this area of Australia. Fifty-seven horses were required, seven of which had already departed on *Amur* together with four men and supplies. On board SS *Macedon* on the afternoon of 21 March 1883 were 50 passengers, supplies, government mails, bullion and 200 tons of general cargo.

On the previous day it had been realised by the harbour authorities that the marker buoy on Kingston Spit had disappeared but notification of this did not reach Captain Craig before the vessel set sail. After dropping officials and supplies off at Rottnest Island, SS *Macedon*,with engines full steam and the helm hard to port grazed over a section of reef. The missing Spit buoy may have caused the captain to misjudge the distances (Cairns & Henderson, 1995:46).

The wreck event

About three minutes later, at 5.40 p.m., the steamer struck Transit Reef. The full astern order was given and a stream anchor and winch used to try and heave off the vessel. This process continued through the night. It was finally refloated at 6.30 a.m., only to strike a pinnacle of rock, which broke through the plate and immediately filled the vessel with water.

The crew began the work of lightening the vessel as it began to break up. The passengers and their luggage were taken ashore. About 6.00 p.m. that evening the captain finally left the vessel.

Inquiry

Captain Craig admitted that he had made an error in judgement with regard to the SS *Macedon*'s position but that the absence of the Kingston Spit

buoy had been the cause. The setting sun, the large number of passengers and perhaps the glass of whisky consumed were factors contributing to the loss. The captain was found negligent in that he deviated from the proper course, had failed to take soundings, compass bearings and to consult the Admiralty charts. His certificate was suspended for three months (Cairns & Henderson, 1995:47).

Salvage

Lilly and Company managed to salvage the anchor chains, sails and rigging before rough weather caused the vessel to further break up. On 7 April it was reported that the hull and lead ore ballast had been sold to H. Atwell and by May he had retrieved 26 tonnes of lead ore and a steam winch. Further attempts at salvage using a diver failed due to stormy weather, and some diving equipment was lost.

There has been a high incidence of illegal salvage on the site. This was prolific during the 1970s when the importance of shipwreck protection was not widely understood. Small items such as bottles and clay pipes have been the main target for divers (Garratt, 1994a:3).

Site location

The site lies approximately 20 kilometres off Fremantle on the eastern side of Rottnest Island. It is 1.6 kilometres (0.85 nautical miles) west-northwest of Bathurst Point .

Site description

The site lies in an area that is prone to strong surging swell and conducive to the active corrosion of iron. The depth of water over the site ranges from 3 to 6 metres. The hull is intact to the main deck line amidships, however the bow is canted over on the starboard side and the stern is completely broken up. The bow area contains a winch, bollards and hawsepipes.

Coal and the remains of cargo of iron can be seen scattered over the site. Small items such as clay pipes and bottle and ceramic fragments can be seen. Inspection of the site in 1992 by the Museum staff revealed that the site had deteriorated since previous assessments in 1987. Two sections of deck beams have collapsed and several sections of hull plating have been dislodged. The boiler has no parent metal remaining. An area of the boiler had been damaged by the illegal use of hull scrubbing machinery resulting in the formation of concretion, and the boiler is now indiscernible from the rest of the site.

Excavation and artefacts

The initial survey of SS *Macedon* took place in 1971, and in 1976 a diving helmet used in the contemporary salvage was recovered from the site by the Museum. In 1980 MAAWA members reported seeing previously unexposed artefacts on the wreck site and evidence of scouring (Murphy, 1991b:22). To prevent further loss of and damage to this material, surface finds were removed from the site. Artefacts included mainly cargo items and ship's fittings, and these are on display at the Museum and the Rottnest Island Museum.

Statement of significance

HISTORICAL

The wreck of SS *Macedon* has historical significance by marking a pivotal event in the history of Western Australian coastal shipping. It signalled the end of a locally-based trade monopoly since the vessel's owners Lilly, Anderson and Marshall never fully recovered from the financial loss associated with the wrecking. The Adelaide Steamship Company was able to take control of the coastal commerce for a great part of Australia.

References

Cockram, C., 1990, The *Macedon* and *Denton Holme*, Maritime Archaeological Association of Western Aust___alia Reports, July 1989–June 1990:18–21.

1994, SS *Macedon* plan provided by artist.

Garratt, D., 1994a, Management plan for the Historic Shipwreck SS *Macedon* 1870–1883, Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 61.

McCarthy, M., 1980b, *Macedon*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 81.

Murphy, M., 1991b, The *Macedon*, Maritime Archaeological Association of Western Australia Reports, July 1990–March 1992, 5:22.

Figure 41
Archaeologists recovering a salvage diver's helmet from the wreck site of SS Macedon
(MA 539 26)

Janet (1878–1887)

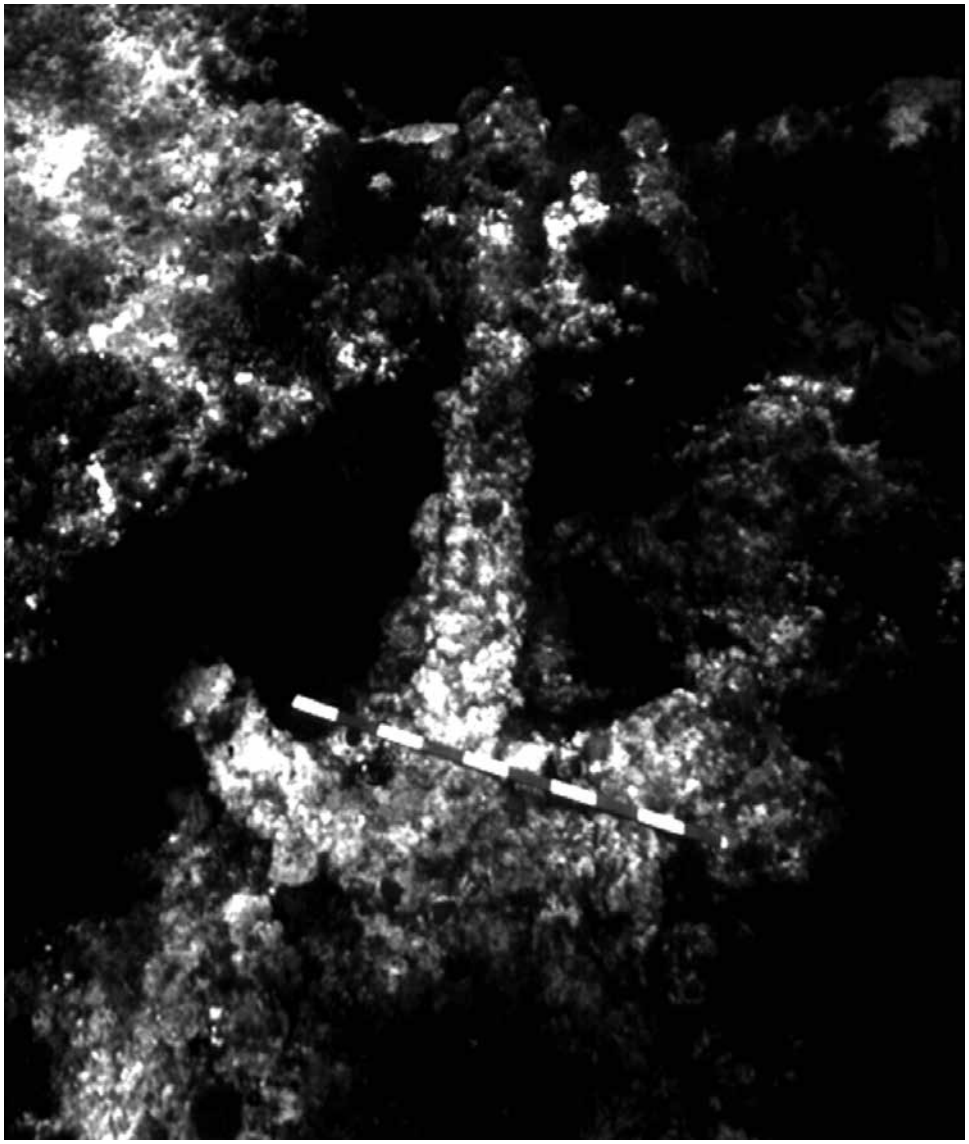


Figure 42
An anchor on the wreck site of Janet
(scale 1 metre, N 5)

Figure 43
Transit photographs for the wreck site of Janet *(MA 1323)*

Official number:	75302
Where built:	Fremantle, Western Australia
Registered:	Fremantle
Rig type:	schooner
Hull:	wood
Tonnage:	211
Length:	33.6 metres (120.0 feet)
Breadth:	7 metres (23.9 feet)
Depth:	3 metres (10.8 feet)
Port from:	Schooner
Port to:	Fremantle
Date lost:	11 December 1887
Location:	Rottnest Island, Transit Reef
Chart number:	DMH 001
GPS position:	
•	Latitude 31° 59.2500' S
•	Longitude 115° 33.4100' E
Finder:	N. Willsea (1970)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:112–115
MA file number: 17/80
ASD number: WA 191
Significance criteria: 1, 2, 4, 5, 6

The vessel

Janet was built in Fremantle by James Storey. The schooner-rigged vessel was reputed to be a 'perfect model' for vessels of this kind and the largest to be built out of this port. It was launched shortly before 27 February 1878. It was carvel-built on a wooden frame, with one deck, three masts and an oval (elliptical) stern.

The vessel was built for the intercolonial trade and by May 1878 was commissioned to transport sandalwood to Singapore. W. D. Moore and Company acted as the ship's agents. Owned by Daniel J. Avery, a well-known horse exporter, the vessel made regular trips to Sri Lanka with horses, usually taking on Indian produce for the return voyage. It also made frequent voyages to Singapore, Mauritius, Hong Kong, Fuzhou, Batavia and Surabaya. Outward journeys also called at the colonial ports of Shark Bay or Bunbury.

The last outward voyage of *Janet* was on the 17 August 1887, to Schooner, with a cargo of horses. The vessel then returned to Fremantle with a cargo of 2 000 sacks of Indian corn and furniture from Ceylon. Also on board were Captain William Miles, a crew of eleven and three passengers, apparently the grooms who had cared for the horses on the outward journey (Cairns & Henderson, 1995).

The wreck event

The Rottnest Island light was sighted at 7.30 p.m. on 11 December. At the time the vessel was on a course east by south and the island 13 kilometres off. The shoreline was hazy but the captain had twenty years of experience sailing into Fremantle although it was his first as master of *Janet*. At approximately 9 p.m., Miles, who had no harbour chart aboard, believing he had gone far enough around the island, 'hauled the ship up', after which the Fremantle lights were seen off to the bow of the vessel (Cairns & Henderson, 1995).

The news that *Janet* had been wrecked on Transit Reef, off Bathurst Point during a gale was conveyed by the pilot boat that had responded to the signals of the distressed vessel. The decks of *Janet* were completely covered with water and the crew were clinging to the spars in order to keep above the rising water (Boocock, 1990:4).

Despite Miles' previous experience of the port, the schooner must have been hugging the island too closely because it sank just 90 metres from where SS *Macedon* was lost on Transit Reef in 1883. By early the next morning the vessel had begun to break up. *Janet* was equipped with only one very leaky boat that could not transfer all the crew at once, so a whaleboat was enlisted to take the extra men ashore. Following the rescue there was little hope of salvaging any of the cargo. Two days later quantities of furniture were washed up

on North Beach.

Inquiry

The preliminary inquiry charged Captain Miles with neglect for failing to call the pilot, and neglecting to take adequate bearings or soundings. His certificate was suspended for four months. Avery insured the vessel's cargo for £23 000, however, The British Insurance Company was reluctant to pay out and a lengthy legal battle ensued (Cairns & Henderson, 1995). This caused significant hardship for Avery and to the Western Australian economy as failure to find a quick replacement for *Janet* meant that the Schooner horse trade was subsequently supplied by South Australia.

Site location

The wreck lies 113 metres on a bearing of 55° from the wreck site of SS *Macedon*'s bow, west-north-west of Bathurst Point .

Site description

The *Janet* wreck site lies on a shallow honeycomb reef in a depth of 3 to 4 metres rising to 1 metre from the surface. The most conspicuous features on the site are a small donkey boiler measuring 0.5 metres across, and two anchors that lie nearby. One anchor lies on its side with the stock missing while the other stands in a deep hole with only the square and stock visible. Glass and ceramic shards are also present. There are few other removable fittings or other artefacts on the site (McCarthy, 1980a:1).

Statement of significance

TECHNICAL AND HISTORICAL

The wreck of *Janet* is of particular significance as an example of Western Australian shipbuilding. It was described as the most 'perfect' ship and the largest vessel to have been built at the colony at the time. The site is also significant as the remains of a vessel involved in the export of Australian goods overseas and the development of the sandalwood trade. This was vital to the development of the Western Australian colony and the repercussions of the wrecking resulted in the loss of a significant export to interstate competition.

References

Boocock, A., 1990, The loss of the *Janet* , Rottnest 1887, unpub. Post Graduate Diploma Course Report, Department of Maritime Archaeology, Western Australian Maritime Museum.

McCarthy, M., 1980a, *Janet* , unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 59.

Gem (1835–1876)

Figure 44
The wreck site plan for Gem

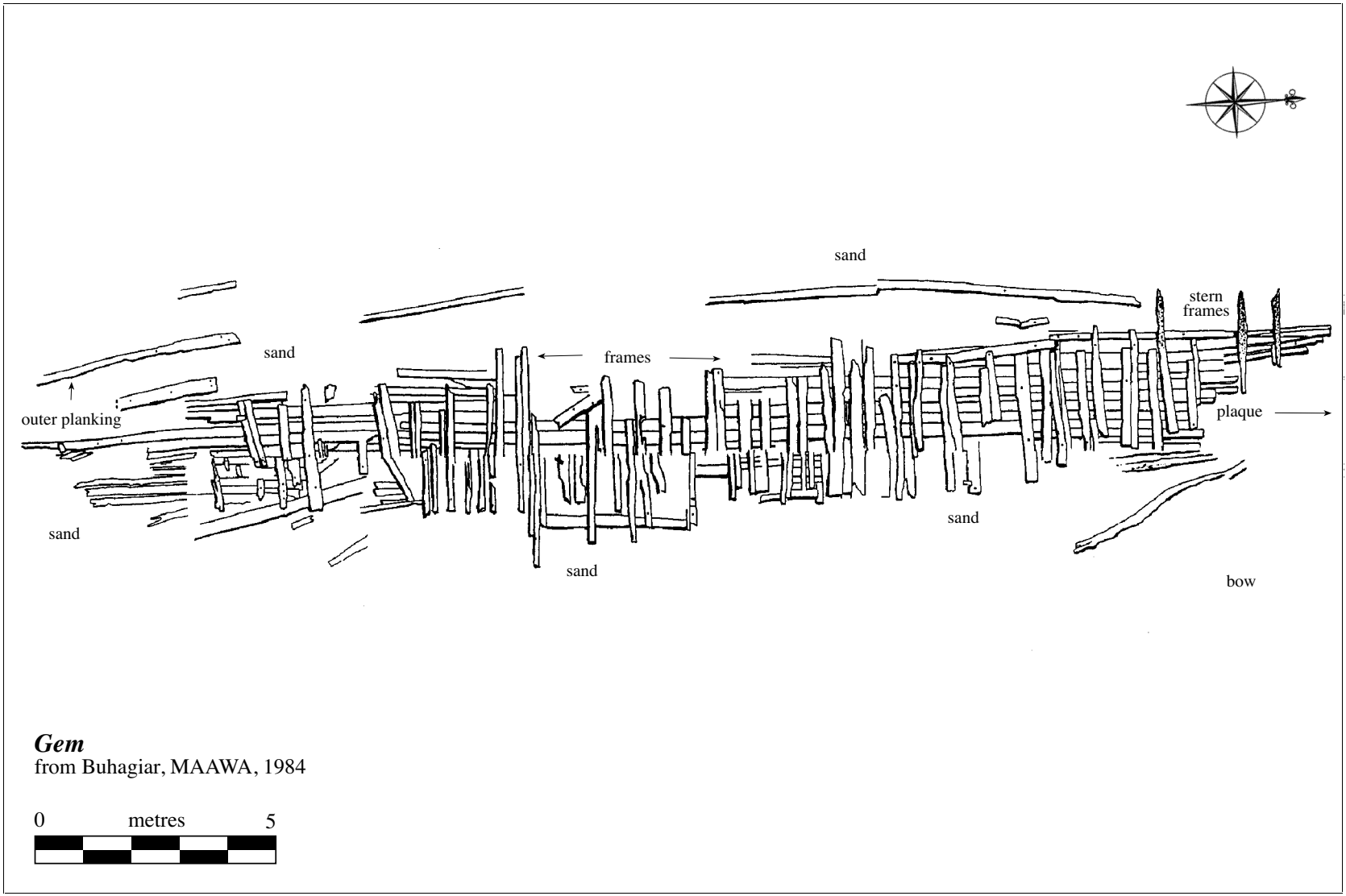


Figure 45
Transit photographs for the wreck site of Gem *(MA 1322)*

Official number:	31520
Where built:	Cowes, Isle of Wight
Registered:	Fremantle
Rig type:	cutter
Hull:	wood
Tonnage:	52
Length:	20.1 metres (65 feet)
Breadth:	4.8 metres (14.6 feet)
Depth:	2.8 metres (8.1 feet)
Port from:	Port Irwin (Dongara)
Port to:	Fremantle
Date lost:	18 May 1876
Location:	Thomson Bay, Rottnest Island
Chart number:	DMH 001
GPS position:	
•	Latitude 31° 59.3300' S
•	Longitude 115° 33.6500' E
Finder:	N. Willsea (1971)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:192–5
MA file number: 67/72
ASD number: WA 156
Significance criteria: 1, 3, 4, 5, 6

The vessel

Gem was originally constructed as a yacht, built in Cowes, England. It was of carvel construction with one deck, no figure-head, a square stern. Some time after construction the vessel came out to Australia and was involved in trade between the colonies although one voyage to Singapore is recorded. *Gem* was also known to have operated as a pilot boat (Passmore, 1984:5).

With 500 tons of wheat on board the vessel left Port Irwin on 17 May 1876 before a strong north-easterly wind, and made good progress to Fremantle. Early the next morning the assistant lighthouse keeper at Rottnest Island reported seeing the vessel 3 kilometres east of the island. The lighthouse keeper at Arthur Head also noticed the vessel, but when he returned his attention to it saw only the top mast and crosstree visible above the water.

The wreck event

The contemporary newspaper reports described the vessel as having sunk while standing on her course as the mainsail was set, with ensign flying, and the vessel's head pointing straight for Fremantle (Passmore, 1984:7).

The harbour-master had some difficulty in reaching the vessel due to a strong wind and northerly sea. He found *Gem* lying on the bottom, resting on the bilge, mainsail set but the topmast carried away at the cap. No survivors could be seen. He went to Rottnest and after finding no rescue attempt had been carried out returned to the wreckage, cut away the topsail and retrieved an overcoat containing personal belongings.

Several boats were sent to search for *Gem*'s crew near Carnac Island, the Stragglers Rocks and the Mewstone Reef but it soon became apparent that all hands had gone down with the vessel.

Two days after the vessel foundered a cutter and several whale-boats returned to the site with a number of Macassan divers. Examination of the captain's cabin revealed only a rug. The companion way was littered with rigging and too narrow for the divers to examine but it was thought that here most of the bodies would have been found. From 21 to 24 May numerous police reports recorded decking, personal items and sacks of grain washing ashore. The vessel was breaking up quickly as the wheat cargo became swollen and its planks split apart.

The loss of all hands led to some speculation as to the cause of the wreck. It was possible that *Gem* had sprung a small leak early in the voyage, causing the wheat to swell and split open the hull. It is possible that the ensign that had been observed by the lighthouse keeper was in fact upside down and thereby signalled distress. Another theory was

that the vessel had struck nearby Kingston Reef and foundered as a result of being holed. A cover-up by the harbour-master was also suggested because of the discrepancies in the information he gave about the vessel's position. He is thought to have profited from unlawful salvage.

Site location

The site lies 300 metres (0.16 nautical miles) approximately south-east of Kingston Reef, 1 kilometre north-east of Phillip Rock.

Site description

The wreck lies on a sand bottom in about 10 metres of water and consists of the keelson, with ribs and frames protruding, and substantial planking. Copper alloy bolts can been seen on most of the timbers. Extensive timbers and planking also extend below the sand. Following the line of the keel southwards more wreckage appears. This is less cohesive and consists mainly of separate timbers. Scattered around the reef nearby are pieces of wood attached to copper alloy bolts.

In 1984 a swim search made in the vicinity of the main *Gem* shipwreck located a section of wooden wreckage. This material lay on top of a small mound of sand and was covered by weed, at a depth of 6.5 metres. The size of the timbers and the combination of iron bolts for major joints and copper pins to hold the planks to the ribs, and the position just south-east of the main wreck site, tend to suggest that it is probably part of the same vessel (Passmore, 1984: comm. in MA 67/76).

The extremities of the site are 8.7 metres long and 2.5 metres wide. At the northern end there is a mound of concretion and a flared lead pipe (possibly a scupper) stands vertically at the eastern edge approximately 15 centimetres clear of the timbers that surround the base. An elongated jawbone from a sheep, complete with teeth was found wedged between the frames at the southern end of the site.

Further inspection revealed that a section of inverted bow timbers was with the frames uppermost and with the ceiling timbers (35 mm thick) underneath. The lead scupper was attached to an iron cleat, and many of the copper fastenings were concreted. The hawse timbers were thicker than those found on the rest of the site.

Statement of significance

Social

The wreck event had a significant social impact because all crew members perished and there was controversy over the process of wrecking, and the testimony of the harbour-master.

References

Passmore, N., *et al*. 1984, 'The loss of the *Gem*,' *Bulletin of the Australian Institute for Maritime Archaeology*, 8.1:5–12.

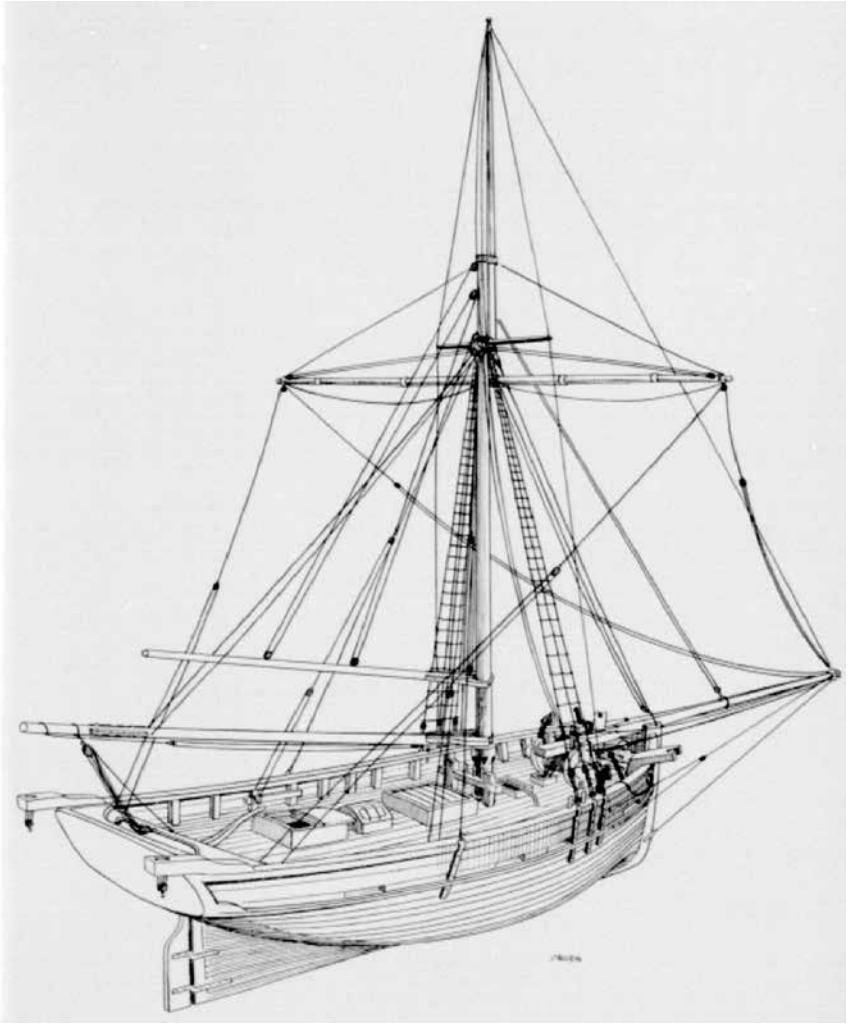


Figure 46
Drawing of Gem
(MA 1025)

City of York (1861–1899)

Figure 47
The wreck site plan for City of York

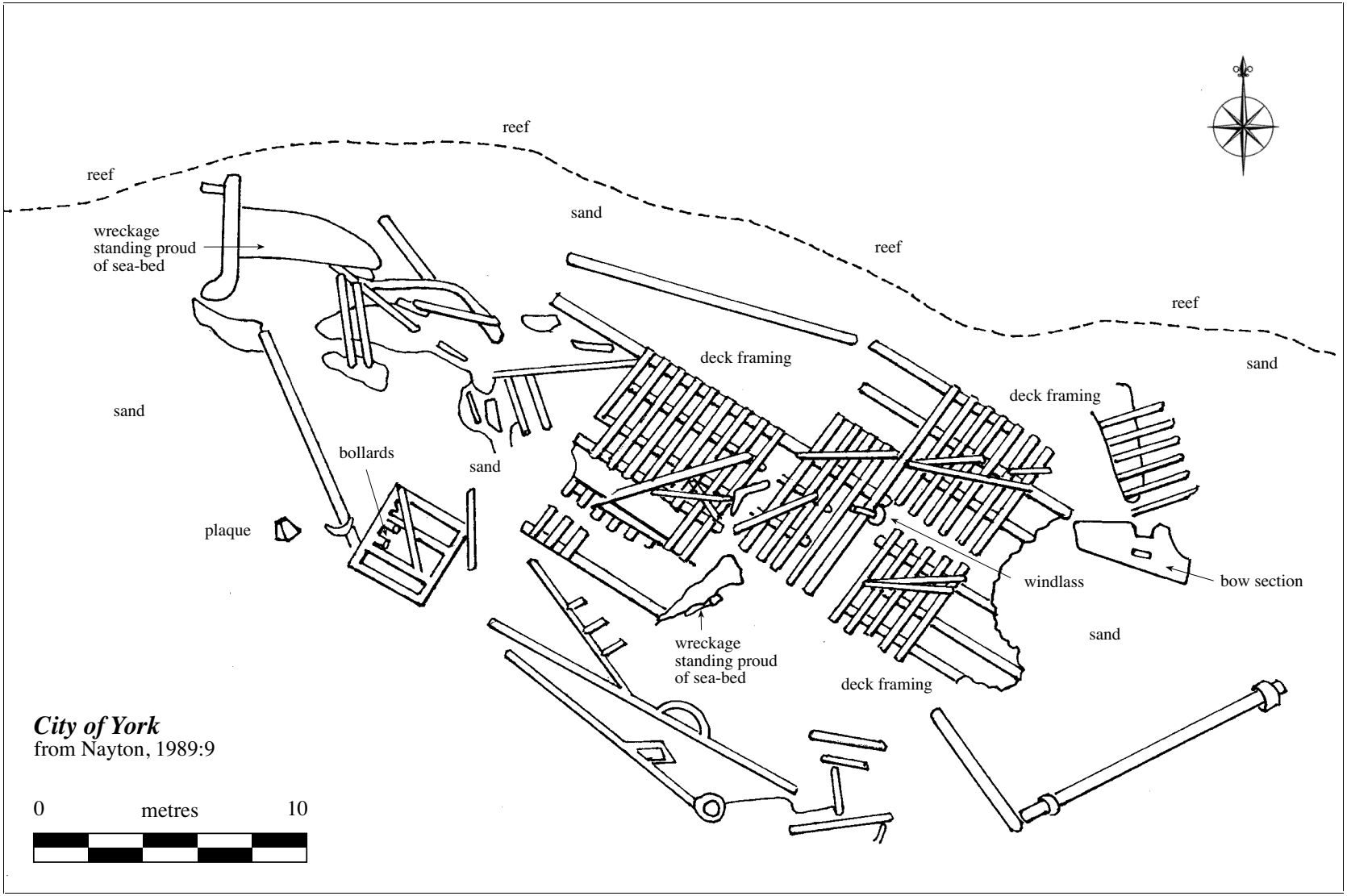


Figure 48
Transit photographs for the wreck site of City of York *(MA 1325)*

Official number:	60871
Where built:	Glasgow, Scotland
Registered:	Glasgow
Rig type:	barque
Hull:	iron
Tonnage:	1167 (1899)
Length:	67.9 metres (222.7 feet)
Breadth:	10.9 metres (35.8 feet)
Depth:	6.6 metres (21.7 feet)
Port from:	San Francisco
Port to:	Fremantle
Date lost:	12 July 1899
Location:	Rottnest Island, City of York Bay
Chart number:	DMH 001
GPS position:	
•	Latitude 31° 59.7200' S
•	Longitude 115° 29.2500' E
Finders:	Underwater Explorers Club
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:289–292
MA file number 661/71
ASD number: WA 89
Significance criteria: 1, 3, 4, 5, 6

The vessel

City of York was built under special survey in 1869 by J. Elder and Company in Glasgow. It had two decks and three masts. It was registered to the Ship City of York Company.

Under the command of Captain Jones, *City of York* sailed from San Francisco for Fremantle on 13 April 1899 with a cargo of timber (743 444 feet) and 3 638 doors. The vessel made a record passage to Western Australia and approached Rottnest Island late in the afternoon of 12 July. The night turned stormy with blinding rain and a heavy sea (Cairns & Henderson, 1995:289). The pilot on the island sent up a flare asking if the vessel required a pilot boat. The ship's captain thought that the flare came from a pilot boat and acknowledged an acceptance of the offer. The lighthouse keeper telephoned Thomson Bay and the flare up signalled that the pilot was coming.

The wreck event

On the vessel the captain hove to thinking the pilot boat was ahead and the lead was cast three times, with five minutes between each cast indicating 24 metres (16 fathoms) and then 9 metres (5 fathoms). Soon after this, breakers were seen ahead. The vessel could not be steered away from the reef and *City of York* struck.

The sea started breaking over the vessel with force. Jones, believing the vessel was in danger of breaking up ordered that the boats be got out. Before this could happen it appeared that the mast was going to fall. Orders were given for all crew to board the starboard boat but it was found to be too small. Other crew got into the port boat and this capsized almost immediately. Eleven crew including Captain Jones perished and eight men reboarded *City of York*. One man was picked up by the first mate's boat. The other lifeboat was also swamped soon after launching, but seven men were able to reach the shore after about four hours. Two men made their way to the lighthouse to raise the alarm.

On 13 July, the steam tender vessel *Penguin* left Fremantle for Thomson Bay, followed by Captain Douglas in the tug *Dunskey*. He took off eight survivors in three trips using his dinghy. The first newspaper accounts of the wrecking did not appear until 14 July and it was soon apparent that the same storm was responsible for the wreck of the *Carlisle Castle* that same day.

Inquiry

The court of inquiry in Fremantle found that the wreck was caused by the 'gross carelessness and want of judgement shown by the master' (cited in

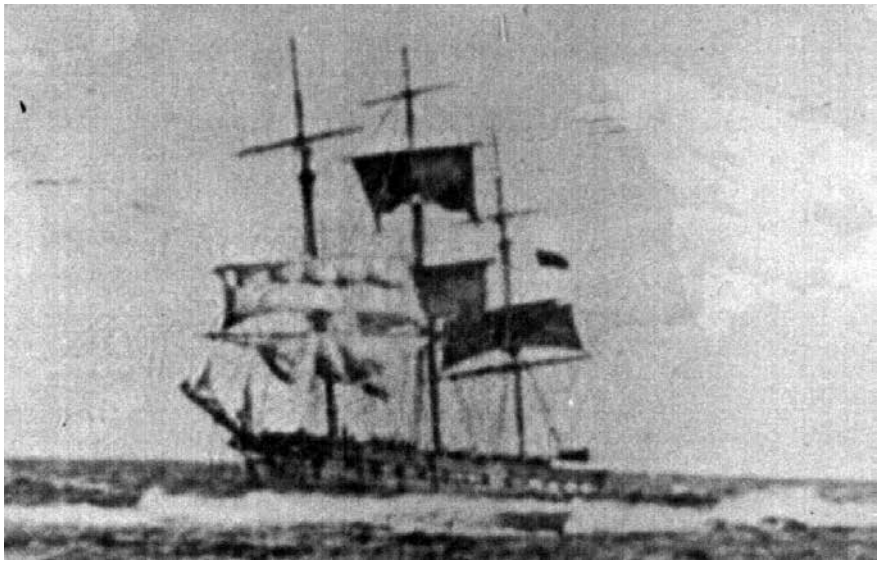


Figure 49
An historic photograph showing the wrecking of City of York *(CY 42)*

Cairns & Henderson, 1995:291). Any potential for the lighthouse keeper's signals being at fault was ignored by the inquiry. However, concern about the case led to the setting up of a Joint Select Committee of both Houses of Parliament to investigate the harbour and pilot services of the colony which overturned the findings of the initial inquiry (Moynihan, 1988:39). It was found that the equipment and instructions supplied to the Rottnest Island lighthouse were completely inadequate and that the keeper gave misleading signals through ignorance. The Captain was exonerated. The Ship City of York Company instituted proceedings against the Crown for the recovery of damages for the loss of the ship, alleging that it was due to misleading lights. Settlement was eventually reached through the Privy Council and the Company awarded £5 000 plus costs.

Salvage

City of York was abandoned by the underwriters and there was general agreement that there was no chance of saving the hull. Much of the timber cargo was salvageable and was bought for £323/5/- by a Perth syndicate who also bought the cargo from *Carlisle Castle*.

One anchor from the wreck site of the *City of York* was raised on 15 November 1959 (by John Körner and the Blue Water Wanderers), and this is mounted near Thomson Bay, Rottnest Island. Another has also been raised and is displayed at the Perth Flying Squadron, Nedlands.

Site location

The site lies 200 metres offshore west of City of York Bay.

Site description

The wreck lies in 7 metres of water, with the bow facing to shore on a reef bottom. It appears the vessel may have broken in two amidships with two sections of deck framing off centre. Several sections stand proud of the sea-bed. The hull has largely disintegrated with only the vessel's floors and the stern section recognisable. Plating, frames and stringers are strewn throughout the wreckage with one deck winch and sections of windlass the only machinery apparent. The anchors that were removed from the site are of the Pering's Improved type.

Statement of significance

HISTORICAL

This site is of historical significance as the remains of the vessel whose loss led to the examination of the Rottnest Island communication system. The aftermath of the tragedy led to a major upgrading of communications using more modern technology.

SOCIAL

The loss of *City of York* and *Carlisle Castle* had a significant impact on the local community at Fremantle.The double tragedy prompted members of the community to start a fund for the survivors of the wreckings. A monument was erected at Fremantle cemetery in memory of the victims.

References

McCarthy, M., 1986, *City of York*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime

Museum, No. 66.
Nayton, G., 1989, The *City of York*, Maritime Archaeological Association of Western Australia Reports, December 1988–June 1989.
Moynihan, J., 1988, *All the news in a flash*: *Rottnest communications 1829–1979*, Telecom Australia and the Institute of Engineers, Australia, Western Australian Division.

Figure 50
Divers above deck support knees of City of York *(CY 11)*

Mira Flores (1867–1886)

Figure 51
The wreck site plan for Mira Flores

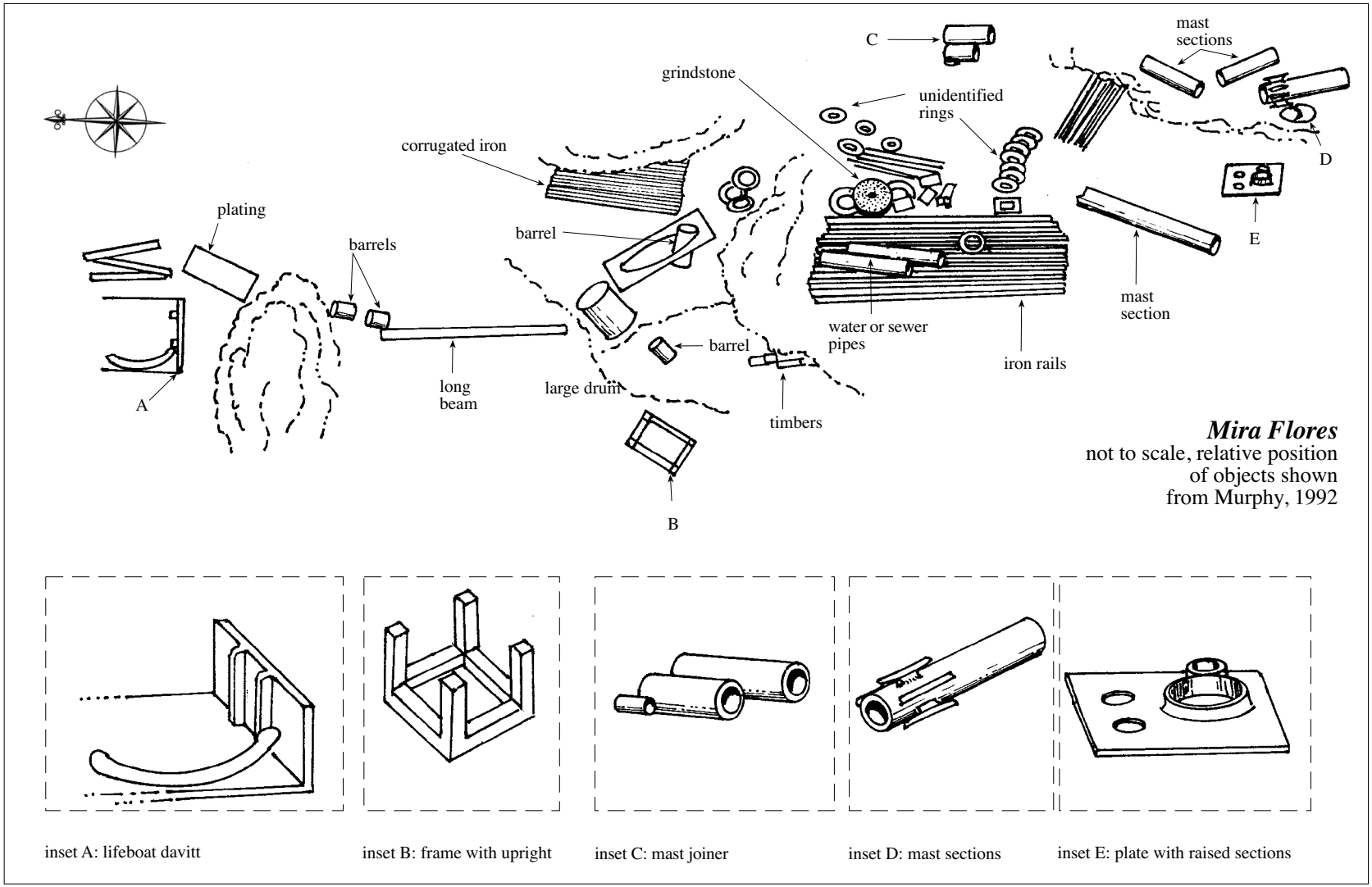


Figure 52
Transit photographs for the wreck site of Mira Flores *(MA 3381)*

Official number:
Where built: Liverpool, England
Registered: Rockstod, Germany
Rig type: barque
Hull: iron
Tonnage: 499
Length: 49.2 metres (161.5 feet)
Breadth: 8.3 metres (27.1 feet)
Depth: 5.25 metres (17.1 feet)
Port from: London
Port to: Fremantle
Date lost: 30 November 1886
Location: Rottnest Island, Horseshoe Reef
Chart number: DMH 001
GPS position:
- Latitude 32° 00.4100' S
- Longitude 115° 28.1500' E

Finders: H. Roberts & Underwater Explorers Club (1956)
Protection: *Historic Shipwrecks Act 1976* (gazetted 1977)
Unfinished Voyages, volume 3:75–6
MA file number: 66/72
ASD number: WA 243
Significance criteria: 1, 4, 5, 6

The vessel

Mira Flores was built in Liverpool by Bowdler, Chaffer and Company, and was owned by W. Moach of Germany. The vessel was used for general cargo purposes but became involved in the Western Australian Shipping Association's (WASA) rivalry with English shipping firms (Cairns & Henderson, 1995:75).

When *Mira Flores* left London for Fremantle in 1886 it was the vessel's second voyage out to the colony. Aboard was Captain Witt and a crew of twelve, together with an immense assortment of cargo including alcohol, medicines, books, earthenware, drapery, furniture, machinery, rope, hardware, building materials and ammunition.

The vessel approached Rottnest Island on 29 January 1886, with an easterly wind and a smooth sea. Captain Witt stood *Mira Flores* off the island to northward and waited for daybreak, tacked and then stood in for the north-west corner.

The wreck event

Despite having visited the port before and being familiar with the chart of the harbour, Captain Witt drove the vessel up onto one of the outlying reefs. By 9.30 a.m. the acting harbour-master had received the first report of the disaster and the police boat and a flotilla of local harbour craft were dispatched. *Mira Flores* had stranded on one of the inner patches near Narrowneck and quickly became a total wreck. None of the perishables could be saved although there was some hope of salvaging the remainder of the cargo.

Inquiry and salvage

A policeman was sent to watch over the removal of the ammunition, and all goods were later sold by auction. Disputes between authorities led to costly delays and a large portion of the cargo could not be salvaged before the vessel completely broke up (Cairns & Henderson, 1995:75).

An inquiry into the wrecking was held in Rockstod, as local administration had no jurisdiction of the foreign registered vessel. The harbour-master provided evidence that the captain was at fault and that danger could have been avoided if a proper watch had been kept. Following this case initiatives were sought to amend the legislation to allow for inquiries to be held locally into the wrecks of foreign vessels.

Site location

The wreck lies approximately 1 kilometre offshore from Narrowneck, and is best approached from

the north.

Site description

The shipwreck lies bow onto the shore with the most intact section of the site being the stern which stands proud above the sea-bed. This section lies in a hole of about 12 metres deep on a sand bottom. The remainder is a flat section of wreckage which lies on a kelp-covered reef top varying in depth from 5 to 7 metres. This section is 15 metres sternwards of the bow. Overall the site measures 60 metres by 25 metres, and plating and frames are spread throughout the wreckage.

The bow has collapsed back on itself but is fairly intact with much plating still evident. A square-shaped, hollow structure about 3 metres long protrudes from supporting frames and runs at an angle upwards to the tip of a bow and could be the bowsprit housing. The remains of the donkey engine winch can also be observed on the site (Wells, 1990:26).

Several sections of mast winch, a cargo of heavy corrugated iron and a grindstone have been located. Other circular objects thought to be the solidified contents of wooden barrels (possibly Plaster of Paris or cement) are numerous. The plan shows details of lifeboat davit and a mast joiner. An anchor was visible amongst the wreckage and is described as being similar to the iron-stocked Rogers type anchor from the same vessel that is now on display at Rottnest Island.

In 1975 reports were received by the Museum that divers were illegally removing ammunition from the wreck. The Australian Army feared that much of this material was potentially hazardous. The bullets of the Martini-Henry type were removed from the site by the Museum and an army team.

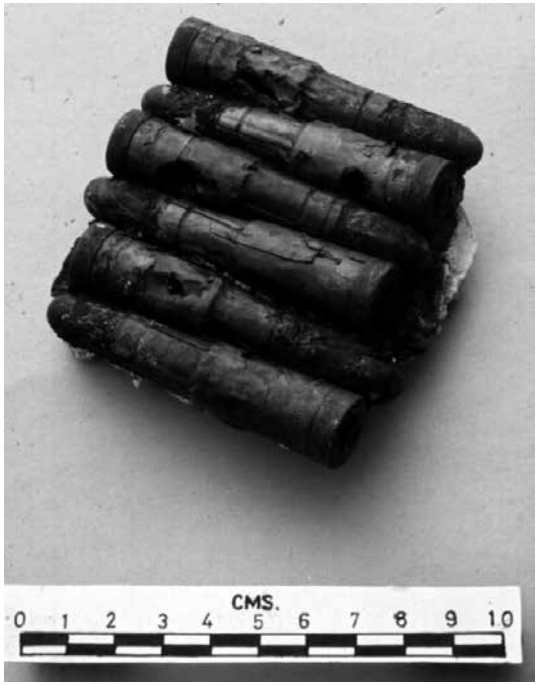


Figure 53 Ammunition recovered from Mira Flores *(MF 22)*

Statement of significance

HISTORICAL

This site is of historical significance as the remains of a vessel that was closely associated with attempts by local merchants to try and break the monopoly over trade held by the British shipowners and brokers up until the 1880s. The majority of shipping agents in Fremantle joined the WASA and the ensuing freight war resulted in cheaper types of goods being added to the normal supply of colonial goods. However, it was expensive for WASA members to get the British-owned vessels loaded and this prompted the use of the German-owned *Mira Flores*. The loss of *Mira Flores* dealt a devastating blow to WASA and the local economy. By 1887 Fremantle merchants and London broking firms had agreed to work together.

The inquiry into the loss of the vessel prompted an attempt to regulate overseas shipping to the colony (Cairns & Henderson, 1995:75).

References

Murphy, M., 1990a, The story of the *Mira Flores*, Maritime Archaeological Association of Western Australia Reports, ___ol. 4, July 1989–June 1990:27–8.

1992c, The *Mira Flores*, Maritime Archaeological Association of Western Australia Reports, Vol. 5, 1990–1992:3–5.

Wells, P., 1990, The *Mira Flores*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990:26.

Figure 54
Filming the wreck site of the Mira Flores
(MF 62)

Uribes (1868–1942)

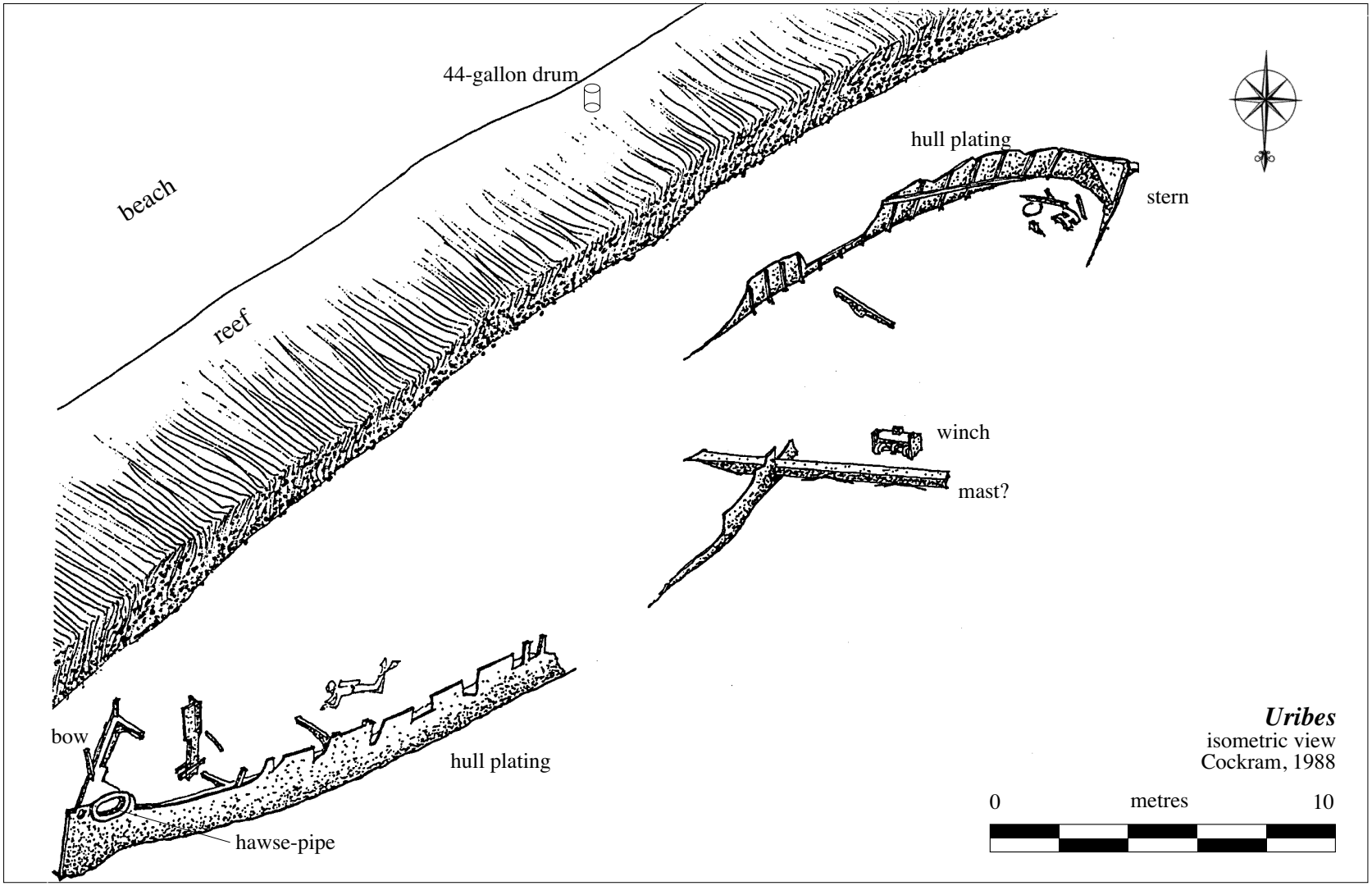


Figure 55
The wreck site plan for Uribes

Figure 56
Transit photographs for the wreck site of Uribes *(MA 1325)*

Official number:	84150
Where built:	Stockton-on-Tees, Scotland
Registered:	Fremantle, Western Australia (1934)
Rig type:	auxiliary schooner
Hull:	iron
Tonnage:	117.9 gross, 81.4 nett
Length:	37 metres (104.3 feet)
Breadth:	7.3 metres (24.1 feet)
Depth:	2 metres (6.6 feet)
Port from:	Thomson Bay
Port to:	Fremantle
Date lost:	June/July 1942
Location:	Phillip Rock, Rottnest Island
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 00.2100' S
•	Longitude 115° 33.3500' E
Finder:	D. Robinson (found 1975, reported 1980)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1982)
MA file number:	3/81
ASD number:	WA 377
Significance criteria:	1, 4, 5, 6

The vessel

Over the period of its lifetime *Uribes* was registered at a number of different ports. It was clinker-built and rigged as a barque with one bulkhead, three masts and elliptical stern. The shipbuilders were M. Pearse and Company and it was registered in Liverpool to the De Uribe family of Spain. After various changes in ownership the vessel was re-registered in Port Adelaide, South Australia in 1883 and it was reported that it was de-rigged and operated as a lighter with a short mast. In 1934 the new owners of the ship cut down to between its decks and rebuilt it as a three masted schooner, with petrol engine and crew accommodation. The kerosene-petrol engine was British built, made in 1929 with six cylinders and capable of speeds of 4.5 knots and operated at 75 BHP. By 16 July 1934 the vessel had been sold to Cossack Lightering and Trade, and was re-registered in Western Australia (McKenna, 1988:8).

The wreck event was described in information given by an army staff officer at Rottnest at the time of the vessel's loss, Mr Gordon Humphries of Tropical Traders and Patersons of Fremantle, (McKenna, 1988:9).

The wreck event

> In either June or July 1942 the *Uribes*, laden with one hundred and fifty six inch shells, stores and a couple of motor vehicles, arrived at Thomson Bay jetty from Fremantle, but owing to a northerly breeze could not remain at the jetty and her master decided to return to Fremantle. Near Phillip Rock the ship's motors cut out and it was found that the anchors would not hold. The ship drifted in a southerly direction and struck a reef about 300 yards from the Natural Jetty. She was holed and sank. She quickly filled with sand to deck level. The motor vehicles and some of the stores were salvaged but owing to the sand it was found impossible to remove any of the shells. She was surveyed as unfit for salvage and remains where she foundered, presumably with the six inch shells still in her (RAN area archives officer n.d., quoted in McKenna, 1988:9)

Site location

The wreck is located 100 metres west of Natural Jetty, just off the beach in front, hard up against the reef.

Site description

The site lies on sand bottom in 2–3 metres of water and the gunwales of the port side break the surface at low tide. The wreck lies hard up against the reef on the shore line and is subject to seasonal scouring which occasionally clears the hull to the bilges. The hull appears relatively stable with the bows intact below the deck line while the rest of the hull except the stern is intact from below the turn of the bilge.

Figure 57
Uribes *is one of the most accessible sites (UR 5)*

With seasonal scouring the diesel engines and other machinery become visible, though the small deck winch, and the remains of the windlass are visible at all times (McCarthy, 1980d:2).

Statement of significance

ARCHAEOLOGICAL

Through the examination of the hull structure significant elements in the changing design of a trading vessel could be examined. Aspects on industrial and military history, and archaeology can be explored through the machinery and shells still left on board.

References

Cockram, C., 1988a, Isometric drawing of the *Uribes*, Maritime Archaeological Association of Western Australia Reports, 1987–1988.

McCarthy, M., 1980d, *Uribes*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 60.

McKenna, R., 1988, History of the *Uribes*, wrecked off Rottnest, Maritime Archaeological Association Reports, 1987–1988.

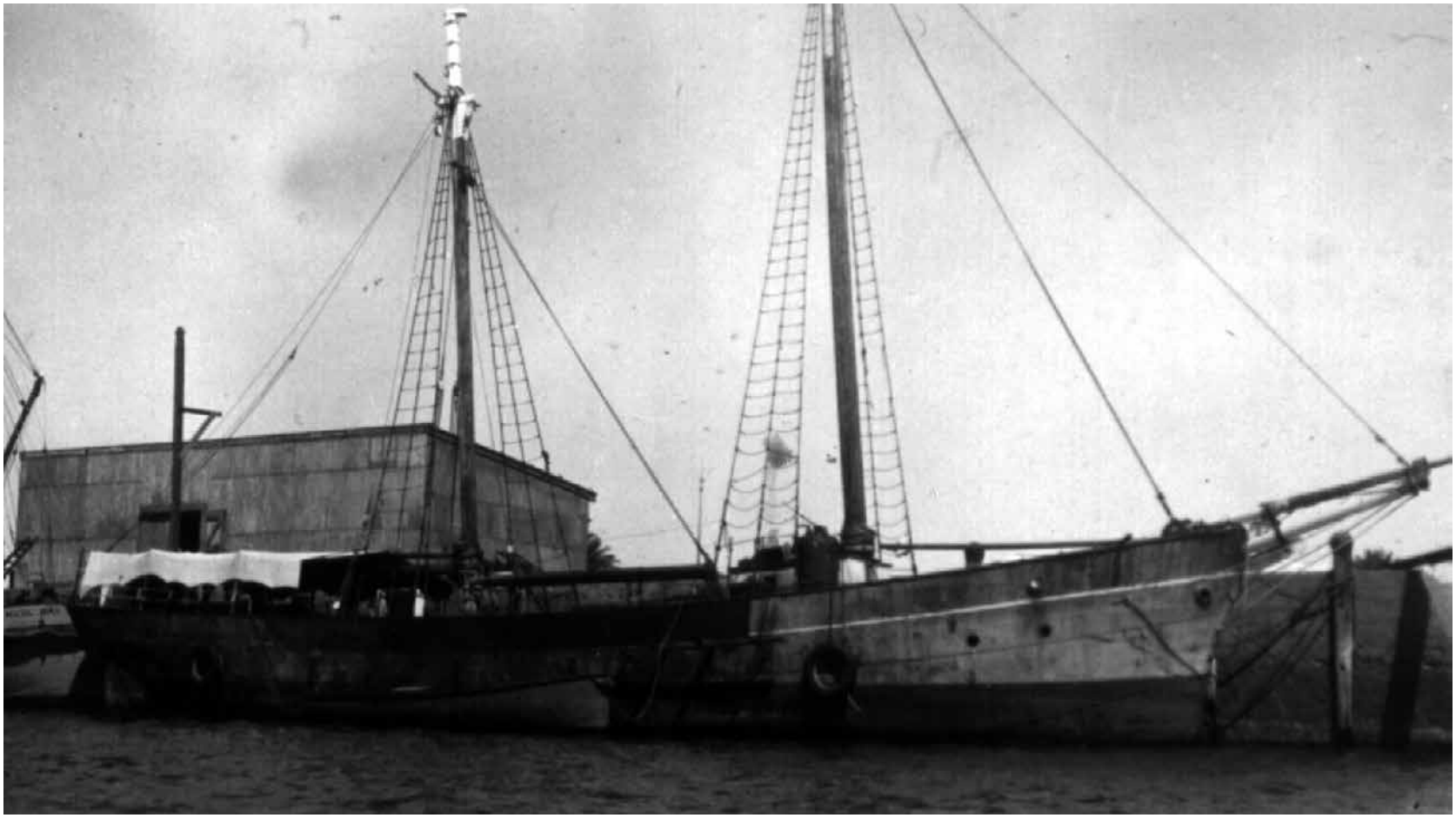


Figure 58
An historic photograph showing Uribes *around the turn of the century (UR 26)*

Lady Elizabeth (1869–1878)

Figure 59
The wreck site plan for Lady Elizabeth

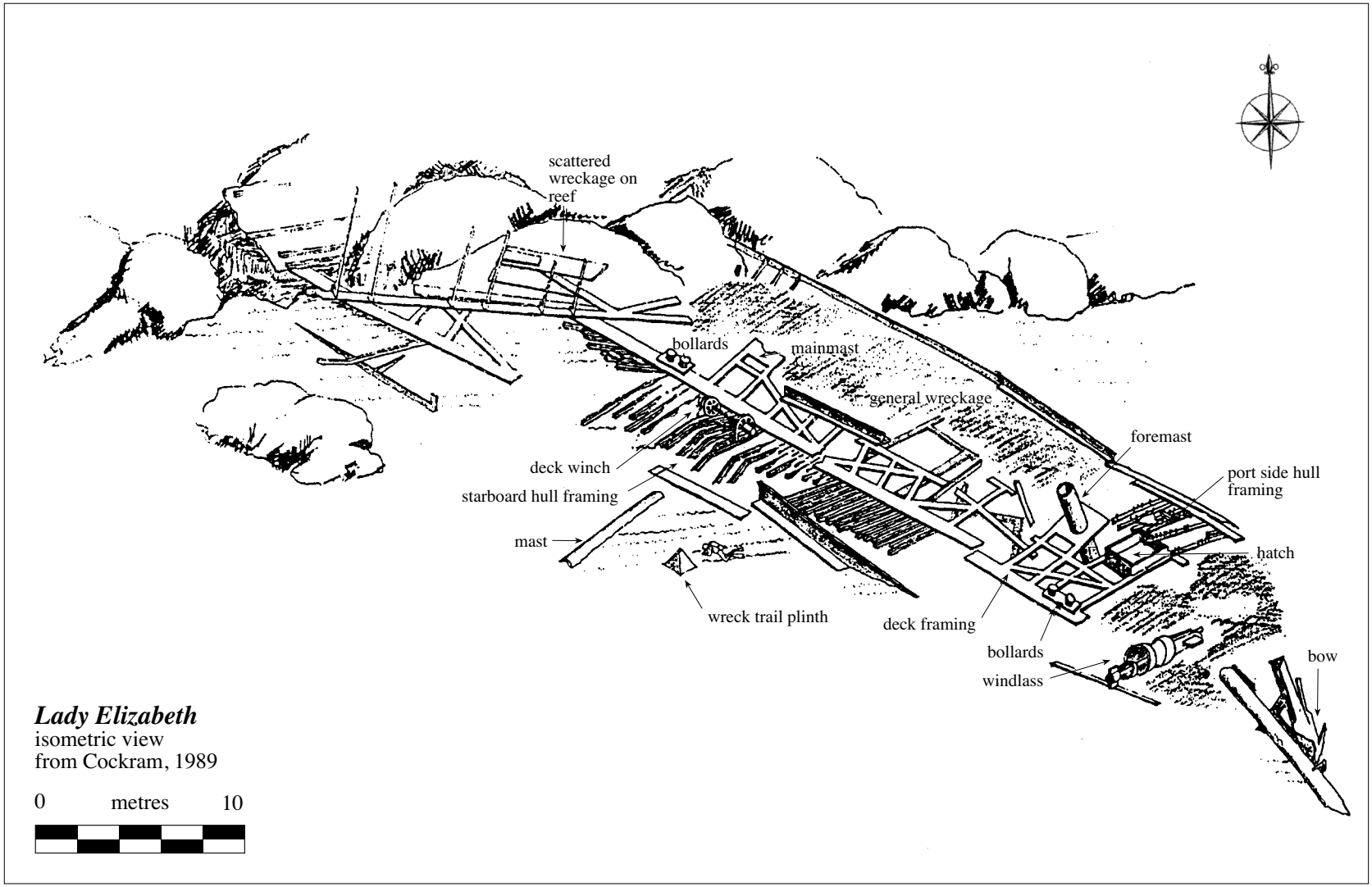


Figure 60
Transit photographs for the wreck site of Lady Elizabeth *(MA 29)*

Official number:	60966
Where built:	Sunderland, England
Registered:	barque
Rig type:	barque
Hull:	composite
Tonnage:	658
Length:	48.7 metres (160 feet)
Breadth:	9.3 metres (30.5 feet)
Depth:	5.5 metres (18.1 feet)
Port from:	Fremantle
Port to:	Shanghai
Date lost:	30 June 1878
Location:	Rottnest Island, Bickley Bay
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 01.1500' S
•	Longitude 115° 32.8500' E
Finder:	B. Martin (1963)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:232–6
MA file number: 857/71
ASD number: WA 198
Significance criteria: 1, 2, 4, 5, 6

The vessel

The barque *Lady Elizabeth* was built at Sunderland by Robert Thompson in 1869. The keel was constructed from American rock elm, with English elm at the fore end. The vessel's stem was made of teak and English oak, its stern-post of teak and the apron and floors of iron. The outer planking was American rock elm. It had one deck and three masts (Henderson & Henderson, 1988:236).

Owned by the local shipping merchants Messrs Wilson and Oliver, *Lady Elizabeth* was regarded as one of the finest vessels engaged in the trade between Fremantle and London. However, when the wool season clip was missed the vessel often called at Chinese ports delivering quantities of timber to the Asian Indian region.

The vessel left Fremantle on 25 June 1878 chartered by Messrs Shenton and Monger to carry a cargo of lead ore and 611 tons of sandalwood to Shanghai. Captain Scott's daughter was the only passenger. After safely reaching the outside of Rottnest Island the vessel was driven southward by heavy weather, making it impossible to take navigational observations. On the morning of the 30 June the captain decided to turn back to Fremantle, which was south-south-east by south about 55 kilometres away (Henderson & Henderson, 1988:233). In the heavy seas a man was lost overboard and no boat could be launched to effect a rescue.

The wreck event

Captain Scott sighted what he thought was Parker Point and course was altered to make for Fremantle via the channel south of Rottnest Island. However, shortly after the tack the barque struck reef in Bickley Bay. The vessel swung round to the south making it impossible to manage and the captain ordered that the port anchor be let go.

By 10.30 p.m. the water was coming over the upper decks and the vessel was listing over to starboard. The pilot at Rottnest Island, Captain Nash saw the blue distress signals but could not approach the stricken ship until daybreak, when he took the crew ashore. The sandalwood began to break free of the hold, and salvors and beachcombers made substantial gains as the cargo lay strewn from Rottnest Island to Bunbury (Henderson & Henderson, 1988:235).

Inquiry

The court of inquiry did not press charges against Captain Scott although it was noted that during the proceedings he had 'made use of expressions …which were both unbecoming and amounted to gross contempt' (Captain Scott, evidence at inquiry, Fremantle, 17 July 1878, C. S. R. 885, fol. 152, quoted in Henderson & Henderson 1988:235). The

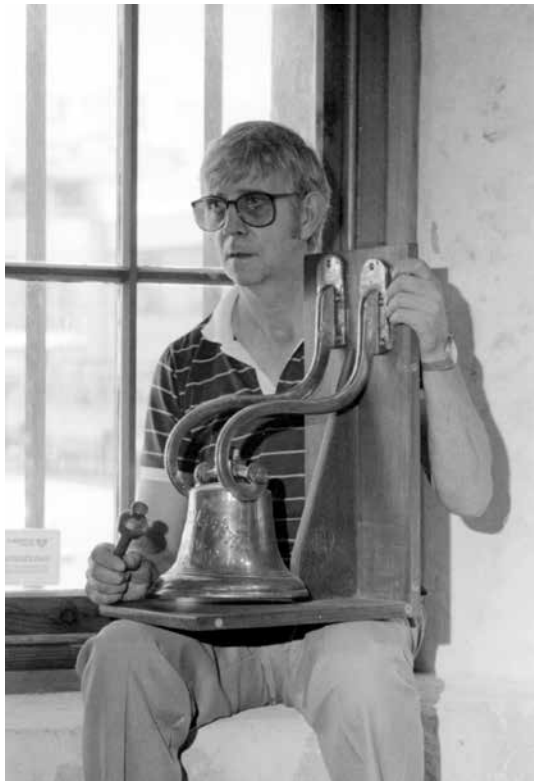


Figure 61
John Parker with the bell from Lady Elizabeth, *donated to the Museum by the Canning Districts Historical Society Inc. during the Commonwealth Historic Shipwrecks Amnesty (MA 4270)*

hull, lead ore and sandalwood were sold at auction for £1 039. The sandalwood had been insured for £5 000.

Robert Thompson built another vessel of the same name for John Wilson, one year after the original was lost.

Site location

The wreck site is located in the sheltered waters of Porpoise Bay, south of Bickley Point on the shoreward side of Dyer Island.

Site description

The wreck lies in 7 metres of water and displays relative structural integrity. From examination of the remains it is possible to demonstrate the process of wrecking and deterioration of *Lady Elizabeth*. The vessel first settled on its starboard side. The port side then collapsed down onto the decking while the starboard side collapsed outward onto the sand.

The port side framing is shown lying across the deck frames while on the starboard side of the vessel the frames are not covered and are therefore more distinguishable. The inside of the starboard hull framing is uppermost and is situated on the outer edge of the decking. This is indicated by the deck frames themselves and the position of bollards both fore and aft. Due to the slope of the wreck both the windlass near the bow and the deck winch near the mainmast step have slipped outwards from their original position (Cockram, 1989a:2).

Statement of significance

Historical

This site is of historical significance as the remains of one of the major trading vessels operating from Fremantle to London in the 1870s. The cargo which the vessel was carrying at the time of its wrecking demonstrates the importance of the sandalwood export to Asia and the economic development of Western Australia.

Archaeological and technical

Through the examination of the hull structure this site has the potential to reveal elements in the design and construction of the early composite vessels of the colonial period.

References

Cockram, C., 1988b, The *Lady Elizabeth*: isometrics produce results, Maritime Archaeological Association of Western Australia Reports, Vol. 2, July–December.

1989a, The *Lady Elizabeth*: a clearer picture emerges, Maritime Archaeological Association of Western Australia Reports, Vol. 3, December 1988–June 1989.

Figure 62 Snorkelling on the Lady Elizabeth *(LE 39)*

Raven (1864–1891)

Figure 63
The interpretive plaque on the wreck site of Raven *(RVN 5)*

Official number:	47684
Where built:	Sunderland, England
Registered:	Port Adelaide, South Australia
Rig type:	barque
Hull:	wood
Tonnage:	343
Length:	36.9 metres (121.4 feet)
Breadth:	8.4 metres (27.7 feet)
Depth:	5.2 metres (17.1 feet)
Port from:	Fremantle
Port to:	Bunbury
Date lost:	11 March 1891
Location:	south-east end of Dyer Island
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 01.2600' S
•	Longitude 115° 33.0800' E
Finders:	Martin and the FISH Club (1955)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:168
MA file number: 18/80
ASD number: WA 283
Significance criteria: 1, 4, 6

The vessel

Raven was registered in Port Adelaide and was owned by W. R. Cave and Company of Adelaide. It was a carvel-built wooden vessel with one deck, three masts and elliptical stern, constructed in 1864. It left Fremantle and was cleared for Bunbury on 11 March 1891 at 4.30 p.m. A fresh southerly breeze was blowing. The vessel sailed through South

Figure 64
Transit photographs for the wreck site of Raven *(RVN 10, 11, 12)*

Passage, passing the Champion Rock buoy when at 7.00 p.m. breakers were seen on the lee bow.

The wreck event

Captain Swain ordered the helm to be put down so that the vessel could be brought round. This failed and *Raven* ran up on Dyer Island (Cairns & Henderson, 1995:168).

The vessel struck twice and was canted to starboard making it unsafe for those on board to remain. All crew left in boats but no cargo was saved. As *Raven* sank the survivors made for Fremantle and were picked up in Gage Roads at 9.00 a.m. the next morning. It was reported that the vessel had slipped into deep water and was gradually breaking up, with much of the cargo washing ashore in the heavy seas.

At about 10.00 a.m. the harbour-master visited the site and found the barque broadside to the reef with only a portion remaining above the water. The main and foremast were completely gone and just the stump of the mizzen-mast visible (Cairns & Henderson, 1995:168).

Inquiry

At the preliminary inquiry held at Fremantle on 13 March, Captain Swain stated that he did not see the island until up close despite the fact that night lights were visible at this time. The captain had not hove the lead as he had not considered it necessary in his experience, in the approaches to Fremantle. He had not known the vessel to miss stays before.

On 20 March the captain was charged with drunkenness and carelessness and want of judgement. The inquiry also debated whether it was safe to attempt South Passage at night. Evidence given to the court confirmed the Captain's lack of sobriety and the dangers associated with the course chosen. North Passage would have been the preferred route at night. The Captain's certificate was cancelled (Murphy, 1990b:25).

Site location

The wreck is located on the Fremantle side of Dyers Island about 200 metres from the rock at the southern end.

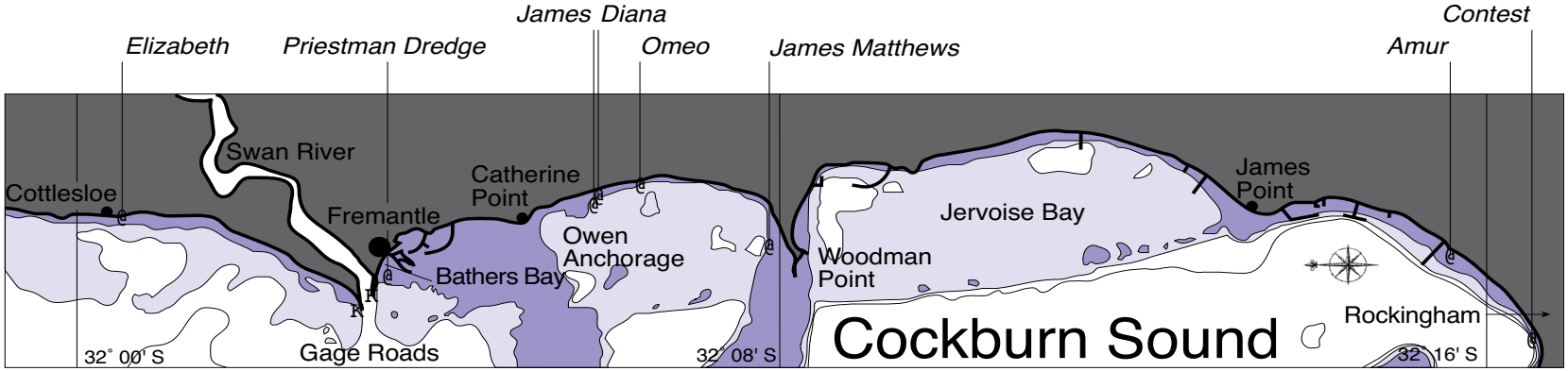
Site description

The wreck site lies partially buried in sand on a sand and weed bottom in 6 metres of water. It is hard to distinguish from the surrounding reef. Timber fragments attached to copper alloy bolts lie scattered around the site. Possible remnants from the wreck may be buried under the sand or under the ledges in the surrounding reef.

References

Murphy, M., 1990b, The *Raven*, Maritime Archaeological Association of Western Australia Reports, July 1989–June 1990:25–6.

Map 3. Cottesloe to Pt Peron (inshore)



Wreck sites on Map 3

Elizabeth (1830–1839)

Figure 65
A cannon from Elizabeth *(EZ collection)*

Figure 66
A chronometer from Elizabeth *(MA 412 17)*

Figure 67
An olive jar recovered from Elizabeth *(EZ 18)*

Figure 68
Transit photographs for the wreck site of Elizabeth
(MA 4268)

Official number:
Where built: Singapore
Registered: Sydney 1837
Rig type: barque
Hull: wood
Tonnage: 194
Length: 23.5 metres (77.2 feet)
Breadth: 7.7 metres (25.1 feet)
Depth:
Port from: Manila
Port to: Sydney
Date lost: 22 September 1839
Location: off shore at Cottesloe Beach
Chart number: DMH 001
GPS position:
- Latitude 32° 00.6300' S
- Longitude 115° 45.0900' E

Finders: B. Martin and J. Crooks (1956)
Protection: *Historic Shipwrecks Act 1976* (gazetted 1977)
Unfinished Voyages, volume 1:159–60
MA file number: 412/71
ASD number: WA 118
Significance criteria: 1, 4, 5, 6

The vessel

The 194-ton wooden barque *Elizabeth* was built at Singapore in 1830. It had one deck and three masts, was carvel-built with a standing bowsprit and female figure-head. It was owned by J. Hicket Grose and registered in Sydney. In late August 1839 the vessel arrived in Fremantle from Singapore and Manila with a general cargo including sugar and sundries.

> ...3828 bags of sugar, 50 bags of coffee, 2 bales of hemp, 20 jars of cordials...180 cases gin, 100 jars of olives, 50 jars of olive oil... 5 ditto (cases) nankeens... (*Perth Gazette* 28/9/1839).

On 21 September Captain Garrett, due to some delay, set sail *en route* to Sydney, after dark. At midnight the vessel was 8 kilometres to the north of Rottnest Island after which time it encountered such a severe storm as to loosen its jib, spinnaker, main topsail and mainsail. The Captain could no longer beat off the lee shore and made the decision to beach the vessel in the best available location (Henderson, 1973:159).

The wreck event

Elizabeth struck the bottom close to shore about 4.8 kilometres north of Fremantle. The two passengers and fifteen crew on board were landed safely although the vessel began to break up rapidly and nothing else was saved. Slewed broadside, the port side broke in first.

Salvage

The hull was sold for £185, an anchor and three cables for £65, and the longboat for £40. Later in October the second mate from the vessel, Charles Lovett was charged with stealing four pieces of grass cloth, three shawls, two silk handkerchiefs and one piece of diaper off the vessel. He was given ten years transportation (Henderson, 1973:159).

The hull was stripped of all accessible fittings. The Museum holds a large collection of material that is believed to have come from the vessel. This material includes a cannon raised in 1923 by Colonel Goadby; chain plates raised in 1937; two large cannon retrieved in 1956 by B. Martin, together with pottery and other fragments of green glass. In 1963, one further cannon with no trunnions, a muzzle section of a large cannon, ballast, copper nails, a small anchor and many other artefacts were raised.

Excavation and artefacts

Systematic excavations have not been carried out on the site although a number of artefacts were removed by Museum staff (1965, 1969, 1970) including cannon and a chronometer. This material was able to provide an approximate date for the remains of the vessel.

Identification of the wreck site as *Elizabeth* was initially complicated by the existence of two other wrecks known to have occurred in the same area and an old rubbish dump on the foreshore from which many items had washed into the vicinity of the wreck. Past speculation as to the wreck identity included a Portuguese vessel dating to the 1600, an early eighteenth century East Indiaman, a longboat from the *Naturaliste* and several other 'notable' colonial vessels.

The most valuable clue for the identification of the wreck site was the chronometer. It was given a date of post–1812. Considered to be a valuable item it is unlikely that it would have been discarded in the rubbish dump. Every attempt would have been made to ensure the safety of the instrument except in the case of total and rapid loss of a vessel due to wrecking.

Site location

The wreck site is located off Cottesloe Beach directly in front of the intersection of Warton Street with Marine Parade. It extends offshore, at a position 100 metres south of where the access ramp meets the beach.

Site description

The wreckage starts just above the low water mark on the limestone reef and extends further out to sea. The depths over the site vary up to 3 metres. Wreckage is uncovered at various times of the year to reveal ballast, ceramics, Chinese porcelain, glass, bottles, cannon and olive jars (Figures 67 and 69). Planking, timber bolts, iron blocks and boxes, and chain are also visible. Winter storms uncover and throw onto the beach many articles that come from the wreck site although this is mixed with extraneous material from an early dump site located along the cliff. Due to the nature of the wreck and the amount of sand covering the site at present a site plan has not been included here.

Statement of significance

Historical

This site is of historical significance as the remains of a vessel important in the overseas and intercolonial trades vital to the development of Western Australia. Lost at the same time as the *Lancier* the two vessels had a combined cargo that amounted to a great value. Their loss would have been a bitter blow to the development of the fledgling economy.

Archaeological

Despite the fragmented nature of the wreckage, the site can reveal information with regard to wooden shipbuilding techniques through the examination of hull timbers and ship's fittings. It is one of the oldest vessels to be wrecked on the Western Australian coast. The remaining artefact material on the site can give insight into the nature of cargoes and personal effects carried in this period. Archaeological investigations on the recovered material could be of use in a comparative analysis of cargoes, manufacturing techniques, quality of goods, and in the development of a chronology for design.

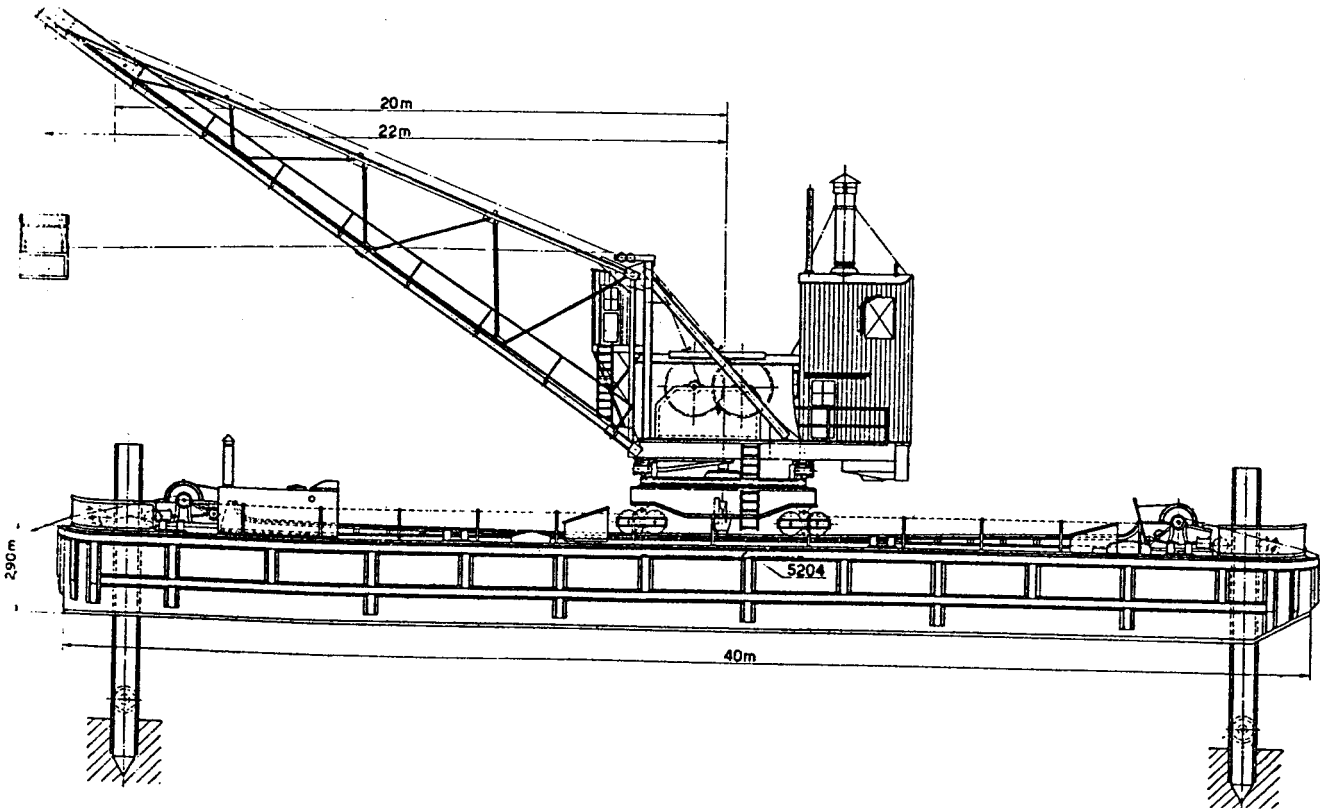
References

Henderson, G., 1973, 'The wreck of the *Elizabeth*', *Studies in Historical Archaeology*, No. 1, Australian Society for Historical Research, Sydney.

Figure 69
Diver with olive jar from Elizabeth
(W 87/32)

Priestman dredge (c. 1889–1893)

Figure 70 Typical arrangement for a Priestman dredge (from MA file no. 191/79)



Priestman Dredge
typical arrangement for dredge from contemporary elevation plan

Where built:	assembled Western Australia
Registered:	not registered
Rig type:	dredge with clam shell grab
Hull:	wood
Length:	40 metres (131.2 feet)
Port from:	at Fremantle
Port to:	at Fremantle
Date lost:	11 May 1893
Location:	Fremantle, Bathers Bay
Chart number:	DMH 001
GPS position:	This site is presently buried and its location needs confirmation. An approximate position is:
•	Latitude 32° 03.5000' E
•	Longitude 115° 44.1000' S
Finder:	Jon Carpenter (1978)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1979)

Unfinished Voyages, volume 3:207

MA file number:	191/79
ASD number:	WA 280
Significance criteria:	1, 2, 4, 5, 6

The vessel

In July 1889, the colonial government of Western Australia took delivery of a Priestman dredge, which arrived aboard the steamer SS *Albany*. The dredge was mounted on the remodelled barge *Pioneer*, and placed in service at Fremantle (Cairns & Henderson, 1995:207).

Fremantle harbour works began in 1892 when the first load of stone was tipped at the commencement of the North Mole (Carpenter, 1984:16). Dredges were used to remove blasted rock from the bar across the mouth of the Swan River, and to clear sand from the inner basin. The grab-crane dredger *Priestman* was mentioned in the Public Works Department Report of October 1896 as having excavated channels in the Swan River.

The wreck event

On the night of 10 May 1893 the dredge was left moored on the south side of Fremantle jetty in Bathers Bay, south of the Swan River mouth. It had been used for putting down mooring buoys. The vessel was afloat late that night, but the following morning it had capsized and was floating bottom upwards.

On board the dredge was a large amount of equipment, including a steam winch and crane, a donkey engine, mooring cables, diver's gear and pumps. Rough seas during the night are thought to have been responsible for the capsize of the top heavy dredge. Suggestions that the vessel was fouled by the SS *Albany* after mooring the dredge were discounted when the wreck was examined by divers who found no sign of a collision (Cairns & Henderson, 1995:207).

On 12 May *Will Watch* and *Rescue* were engaged to try and right the dredge but only succeeded in turning it over and it then sank.

> When trying to do it this way, after upending the crane so that the sheaves were about a foot out of the water, while the platform was resting on the bottom–I got the *Rescue* alongside the jib to lift that while I had a purchase to the platform–he hove all he could but was not able to move it (Russell, 1893:401).

Salvage

It was expected that much difficulty would be encountered in further attempting to raise the vessel and its machinery. However, within a week, most of the screw mooring chains, the mooring anchors, a diving pump and boiler, the crane and other items had been recovered.

Site location

The site is located 120 metres offshore from Bathers Beach in Bathers Bay, south of the South Mole. As this site is currently buried, transit photographs are not available for its relocation.

Site description

The wreck lies in 4 to 6 metres of water on a sand bottom. The covering of weed make the low relief site difficult to distinguish from the sea-bed. The remains (12 metres long by 4.7 metres wide) are composed of limestone boulders weighing up to 20 kilograms, interspersed with iron fittings and some underlying hull timber.

In 1979, at the western end on the site a hawsepipe was found with stud link chain running out northward for 12.6 metres. More chain was evident nearby, and a round axle with three raised cogs was visible. Lumps of coal and a few copper spikes have also been recorded, together with intrusive material

including beer bottles.

The site was inspected in 1982 and was more exposed at this time. A section of keel was identified running approximately north-south and frames were lying partially buried in the sand. The timbers were worm eaten and about 55% deteriorated.

Artefacts

A number of items were recovered from the site and have been conserved at the Museum. They are a wooden pulley block, a piece of coal, a sample of hull planking with felt layer and one copper fastening spike. The artefacts, together with the wreck inspection were able to confirm the identification of the vessel through the size of remains, the oversized chain, and the presence of steam machinery.

Statement of significance

HISTORICAL

This site is of particular historical significance for its association with the dredging operation opening up the mouth of the Swan River. By 1900 dredging had proceeded sufficiently to enable ships to pass safely into the port. This drew the trade away from Albany, and Fremantle became the pre-eminent port of Western Australia.

TECHNICAL

The site has technological significance as the only known wreck site representing this sort of vessel. Historical documents do not record its design and construction details or the machinery on board.

References

Carpenter, J., 1984, 'Early development in the Port of Fremantle, Bathers Bay and the Long Jetty', *Port of Fremantle Quarterly*, 7.10:14–16.

Russell, Capt., 1893, Letter to the Under Treasurer dated 3 June, *Harbour Masters Letterbook*, 6:401, Battye Library.

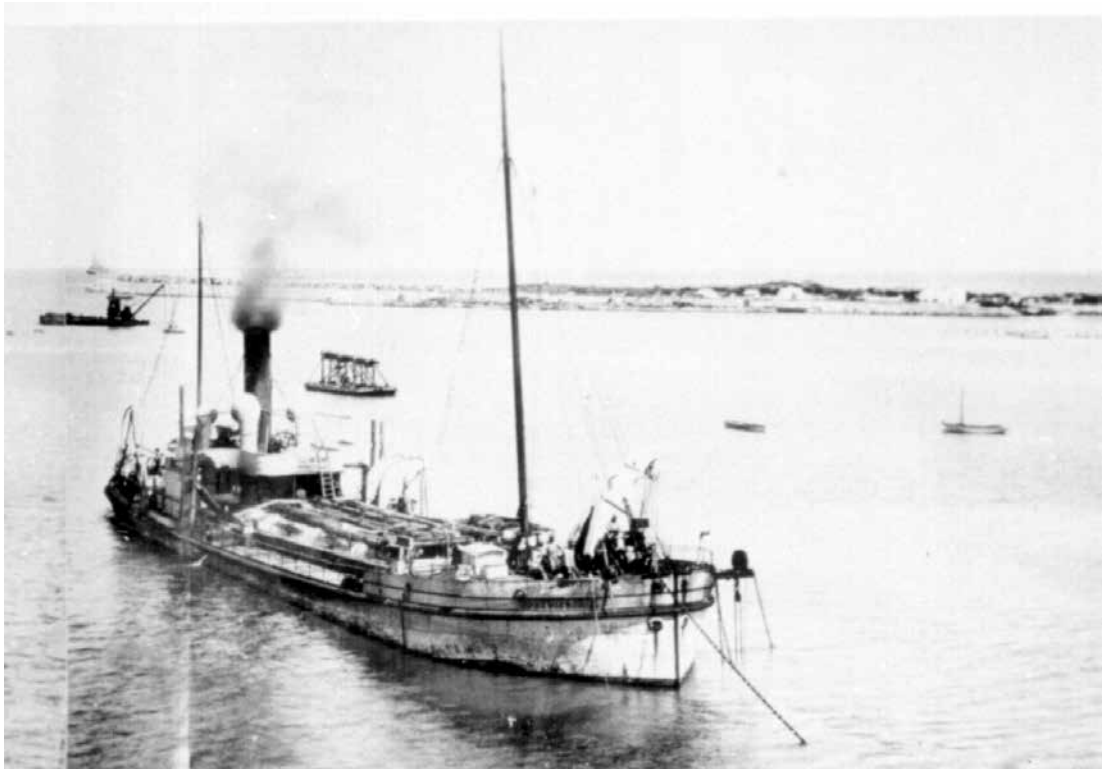
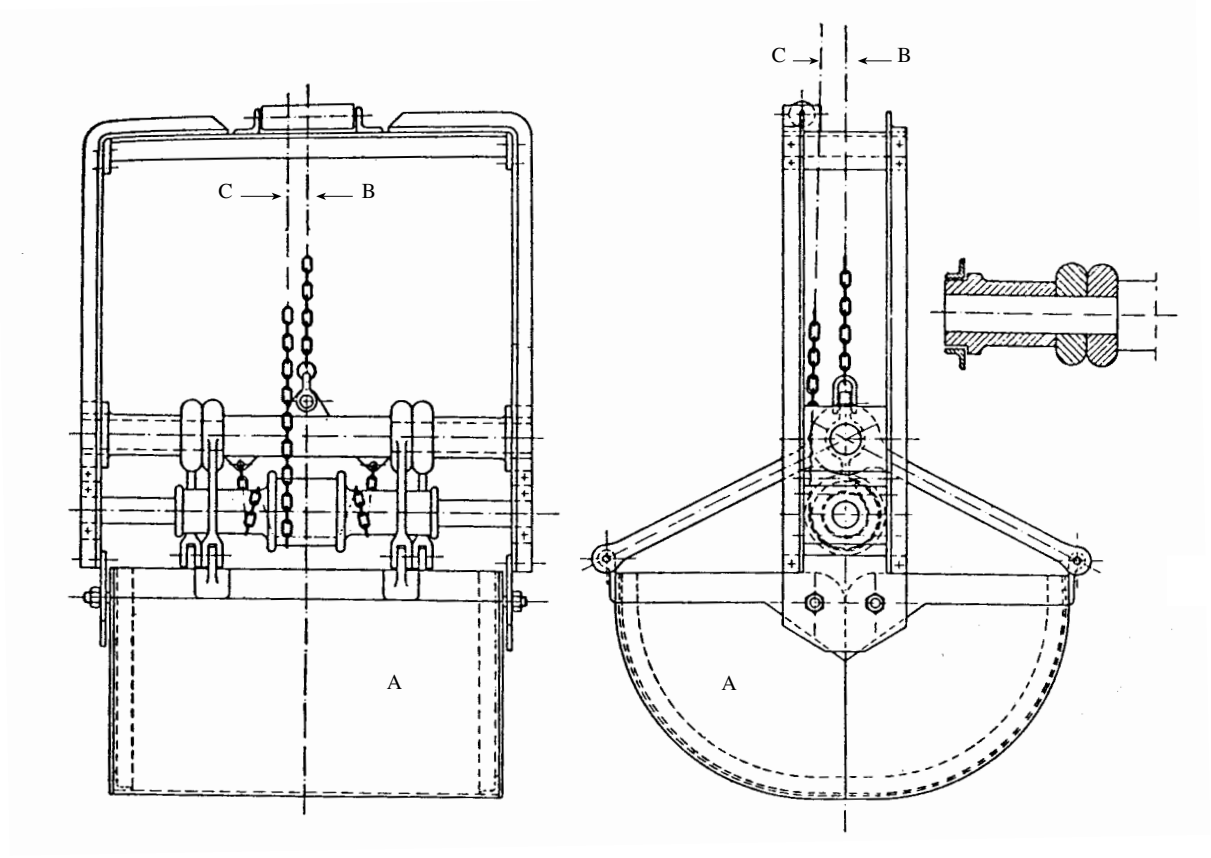


Figure 71
The Priestman dredge (far left) during construction of Fremantle Harbour in 1897 (MA 4530)



Priestman grab, original type

A. plate steel bucket
B. opening and lowering chain
C. hoisting and closing chain

Figure 72
Diagram illustrating the components of a Priestman dredge bucket grab (MA file no. 191/79)

James (1812–1830)

Figure 73
A carronade on the James *prior to recovery (JZ 26)*

Figure 74
Removing the concretion from the James *carronade (JZ 81 5)*

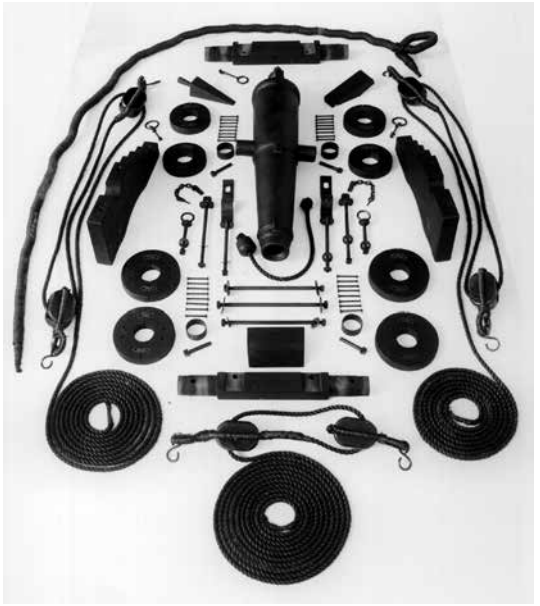


Figure 75
The pieces of the James *carronade display (MA 860)*

Figure 76
Transit photographs for the wreck site of James *(MA 4705)*

Where built:	America
Rig type:	second class brig
Hull:	wood
Tonnage:	195
Length:	
Breadth:	
Depth:	3.6 metres (12 feet)
Port from:	Liverpool
Port to:	Fremantle
Date lost:	21 May 1830
Location:	adjacent to South Fremantle Power Station
Chart number:	DMH 001
GPS position:	provisional
•	Latitude 32° 05.8562' S
•	Longitude 115° 45.4643' E
Finder:	M. Pollard (1975)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 1:101–5
MA file number: 133/76
ASD number: WA 187
Significance criteria: 1, 2, 4, 5, 6

The vessel

James was an American-built vessel owned by Chapman and Company. The vessel was sheathed in copper (1828), carried two chain and one hempen cable, and was armed with three cannon. It had a single deck with beams, a raised new deck and new upperworks in 1828. The vessel was involved in the passenger trade from Europe. Captain Ellis met the vessel at Kingstown, Ireland, on 18 December 1829 and described the conditions aboard:

> I found her crowded with passengers [of] the class of labourers, men, women and children, whom with passengers taken in at Kingstown, made the ship's crew 84 persons, and a quantity of sheep, pigs and geese... There was no place for goods, provisions etc.… part of our accommodation was filled up with stores and luggage belonging to the ship. .There was scarcely enough room for 24 persons to eat and sleep... We therefore suffered great inconvenience and want of air particularly as the height between the decks in the greater part of our cabins is but 4'6" between the beams and 4' to the beams instead of 5'6" as required by Act of Parliament (Particulars of the Voyage from Kingstown Ireland (to Swan River in 1828 [sic] per brig *James)* of Capt. Ellis *et al*., quoted in Henderson 1980:101–2).

The journey was very difficult for all on board the vessel and Ellis demanded that a survey be made of the vessel once they had reached Bahia (Salvador). The captain of *James*, Goldsfield, refused the request, and conditions continued to deteriorate. Five people died before 4 March 1830. *James* finally reached Swan River on 8 May, with twelve crew and 74 passengers and moored at Owen Anchorage.

The wreck event

On 21 May *James* was blown ashore along with the brig *Emily Taylor*. Captain Goldsfield refused to deliver passengers their goods until ordered to do so by the colonial secretary. Several incidents occurred involving injury to a man using explosives on the vessel, and another drowned during the transfer of goods by boat from the wreck to Fremantle.

Plans were made for the wreckage of the vessel to be incorporated into the building of a jetty but this never eventuated. There are no records to indicate *James* was ever refloated.

Site location
The site is adjacent to the South Fremantle Power Station, close to James Rocks, about 50 metres from shore. It is 81 metres south-east of the cooling water outlet pipe and the shore end is about 3.1 metres from the rocky sea-wall in front of the power station.

Site description
The wreckage lies on a sandy and rock bottom in 4 metres of water. It is significantly affected by sand movement in the area and regularly gets completely covered. Various artefacts have been removed from the vicinity of the site.

Carronade recovered
In 1976, K. Farthing reported the discovery of a carronade about 600 metres from the *James* wreck site. This heavily concreted iron gun was removed from the site by Museum staff and after conservation treatment an excellently preserved 6–pounder trunnion carronade was revealed (Green *et al*., 1981:101). A gun carriage was later built for its display at the Museum.

A second gun, this time a small iron signal cannon which had been spiked, was found in the grounds of the abattoir some 20 kilometres from the wreck site. Research revealed it had been removed from the vicinity of the wreck and was probably the second of the three guns known to have been aboard. A third gun remains on the site.

Statement of significance
TECHNICAL AND SCIENTIFIC
Analysis of the design of the carronade from the *James* wreck site may help in understanding the manufacturing process of these ordinances. Conservation of *James*'s carronade has resulted in new methods of treating salt impregnated iron artefacts. The *in situ* analysis of the third remaining gun can also provide useful information.

References
Green, J., Henderson, G. & North, N., 1981, 'The carronade from the brig *James*: its history, conservation and gun carriage reconstruction', *International Journal of Nautical Archaeology,* 10.2:101–8.

Figure 77
The reassembled James *carronade (MA 860)*

Diana (1860–1878)

Official number:	28766
Where built:	Teignmouth, Devon
Registered:	Aberystwyth, Wales
Rig type:	barque (Lloyd's), schooner (Fremantle records)
Hull:	wood, iron bolts
Tonnage:	224 net, 223 gross, 214 underdeck
Length:	33.6 metres (110.2 feet)
Breadth:	7.2 metres (23.5 feet)
Depth:	5.5 metres (18.1 feet)
Port from:	Port Natal
Port to:	Fremantle
Date lost:	16 July 1878
Location:	Owen Anchorage, adjacent to South Fremantle Power Station
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 05.9000' S
•	Longitude 115° 45.4530' E
Finders:	M. Pollard and G. Green (1975)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:238–9

MA file number:	20/80
ASD number:	WA 111
Significance criteria:	1, 4, 5, 6

Figure 78
Transit photographs for the wreck site of Diana *(MA 4229)*

The vessel
The wooden hull of *Diana* was partly fastened with iron bolts and sheathed in felt in yellow metal, which was replaced in 1876. There was a raised quarter deck of 8.2 metres (27 feet). While first rigged as a barque, the vessel was later changed to a three-masted schooner. It was built by Owens and mastered early in 1878 by J. Davies, but at the time of wrecking by H. Humphery. The vessel was owned by Mrs Edwards.

Diana came into Fremantle with a load of ballast from Port Natal on 4 July 1878. The first record of the arrival was a telegram from the harbourmaster to the colonial secretary reporting that it had struck the Parmelia Bank while sailing into Gage Roads without a pilot. The vessel was safely got off and anchored at Owen Anchorage.

The wreck event
On the night of 15 July a severe storm drove four vessels (*Clarence Packet*, *Argo*, *Will Watch*, and *Myth*) ashore at Fremantle and *James Service* was lost with all hands on Murray Reefs. Captain Humphery had *Diana*'s royal yards taken down and two anchors layed out.

> I had about 97 1/2 fathoms (177 metres) chain on the starboard anchor and about 38 (69 metres) on port - in a heavy squall about 3 p.m. of 16th she parted both cables and went on the beach and has become a total wreck and been sold as such. I produce a certificate of the testing of the chain (starboard) which was a new one. The port one was the same link (*Inquirer*, 10 July 1878)

From the inquiry it was considered that no blame could be layed with the captain or crew. *Diana*, full of water and with its back broken was condemned as a wreck and sold at auction by Messrs L. A. Manning. The hull was bought by Mr McCleery for £85.

A description of the wreck written in 1973 recalls that

> …there were two old ships at Owens Anchorage: the *Juno* [presumably the *James*] and the *Diana* - I think they were whalers. The *Juno* was cannibalised (Lucius Manning, notes, Western Australian Museum, quoted in Henderson & Henderson, 1988:238).

This implies that the wreck of *Diana* had not in fact been destroyed and that its remains were visible above the water-line (Henderson & Henderson, 1988:238).

Site location
This site lies adjacent to the South Fremantle Power Station and the water outlet pipes. It is about 100 metres from the shore.

Site description
The wreck site lies partially exposed on sand bottom, with the frames of the vessel coming off the sea-bed to just below the surface. The site is in shallow water of about 3 metres. Iron bolts, timber planks and frames are evident. It is subject to reburial by sand and at times the adjacent site of the *James* is completely buried. The best time to view the site is in winter when the storms can scour out the sand. There are not sufficient remains visible to make a site plan.

References
Inquirer and Commercial News, 10 July, 1878.

Omeo (1858–1905)

Figure 79
The wreck site plan for Omeo

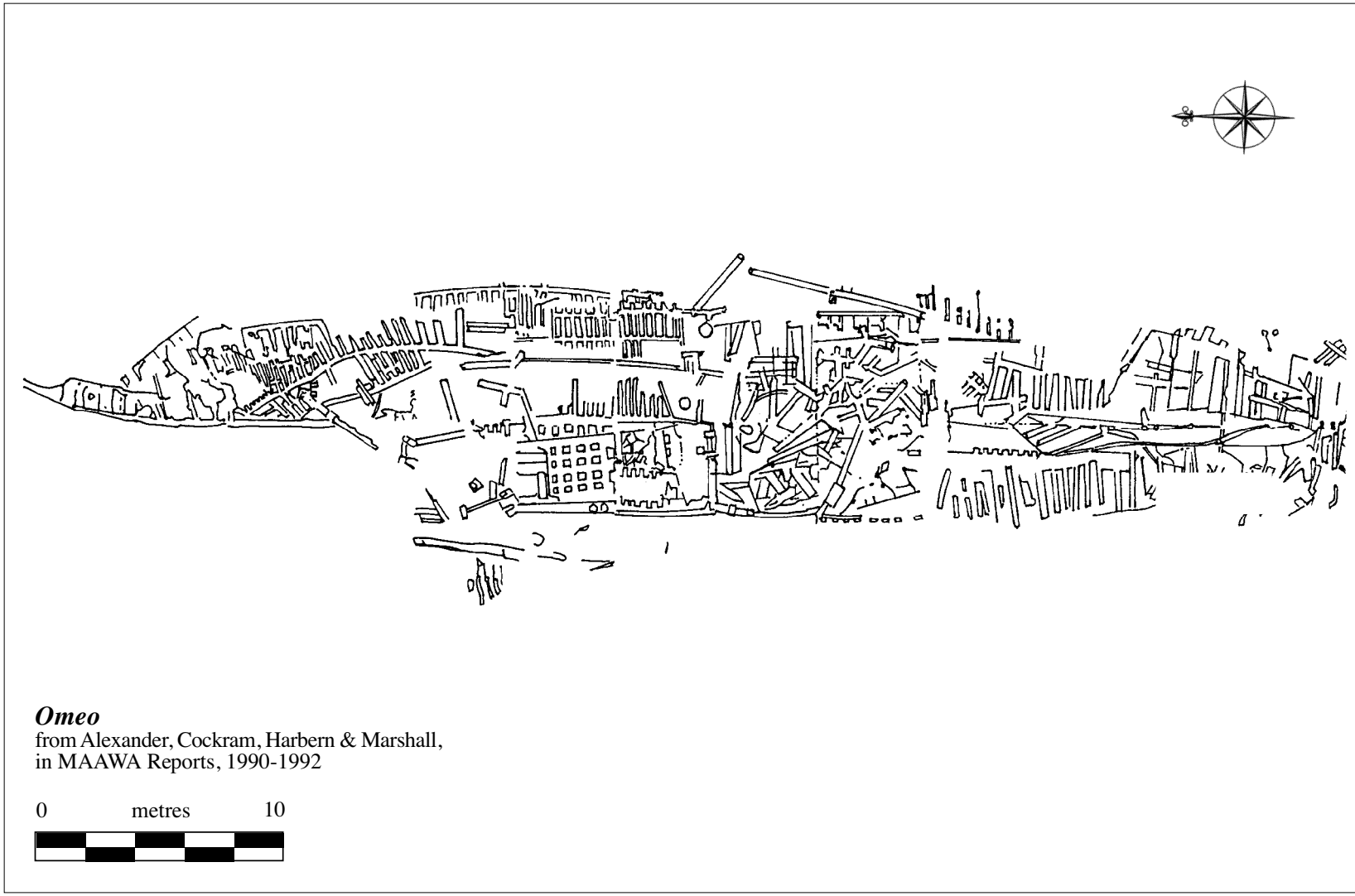


Figure 80
Transit photographs for the wreck site of Omeo *(MA 4269)*

Official number:	40338	
Where built:	Newcastle, England	
Registered:	Melbourne	
Rig type:	barque	
Hull:	iron	
Tonnage:	789	
Length:	64.9 metres (213 feet)	
Breadth:	9.3 metres (30.5 feet)	
Depth:	5.1 metres (16.7 feet)	
Port from:	at anchor, Cockburn Sound	
Port to:	at anchor, Cockburn Sound	
Date lost:	11 September 1905	
Location:	Coogee Beach	
Chart number:	DMH 001	
GPS position:		
Stern		
•	Latitude	32° 06.3800' S
•	Longitude	115° 45.6800' E
Bow		
•	Latitude	32° 06.3200' S
•	Longitude	115° 45.6700' E
Finders:	site location always known	
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)	

Unfinished Voyages, volume 3:235
MA file number: 19/80
ASD number: WA
Significance criteria: 1, 4, 5, 6

The vessel

Omeo was a clinker-built barque with one deck, four masts, a square stern, a woman bust figurehead, and was iron framed. Originally the vessel was built as a three-masted barque-rigged steamship with auxiliary power from a 120 hp engine. In 1882, the registered quarterdeck length was 27.4 metres, the forecastle, 7.62 metres, and the bar keel had a measurement of 0.18 metres. It had three water tanks as ballast and a gross underdeck tonnage of 710 tons. The auxiliary engine was removed and it was rigged as a four-masted jackass barque. The vessel's owners were W. H. Smith and Sons.

Omeo was a popular general trading vessel in the international trade and intercolonial passenger networks. Its original voyage was from England with a cargo of telegraphic cable for Tasmania, and immediately after that it was used on the run to New Zealand, transporting miners to the goldfields at Hokitika.

Omeo had an interesting series of near wreckings and close encounters before it finally came to rest on Coogee Beach in 1905. In September 1881, after completing a voyage from Newcastle, New South Wales with a cargo of coal *Omeo* was involved in a serious accident. Forced to anchor off Queenscliff, Victoria, overnight due to the weather, the vessel was trying to enter the west channel the following morning on the flood tide when it missed stays, lost steerage, and collided broadside with the Swanspit Light, completely destroying the latter. In early October 1895, *Omeo* sailed from Melbourne *en route* to Hamelin Bay under the command of Captain Campbell. The vessel encountered severe weather off Cape Leeuwin and a lot of cargo was washed overboard.

At Hamelin Bay the vessel loaded a cargo of jarrah. With 500 tons aboard the vessel bumped against the jetty in a severe storm, and finally broke its moorings to run headlong ashore, to the south side of the jetty (Cairns & Henderson, 1995:235).

Omeo had not been badly holed but there was doubt that it could be refloated. The owners sold the vessel to the North Queensland Insurance Company and a contractor undertook to refloat it. It was connected to the jetty by a trestle bridge and 200 loads of timber were discharged. This sufficiently lightened the hull by 17 March for the barque to be hauled off by means of a steam winch on the jetty. After survey the vessel was sold to Connor and Doherty who had the vessel towed to Fremantle, where it was converted to a coal hulk for use by the Blue Star Line.

The wreck event

On 11 September 1905 *Omeo* was at anchor in

Figure 81 Contemporary illustration from 1881 of Omeo *colliding with Swanspit Light at Queenscliff, Victoria (MA 1025)*

Cockburn Sound. At 5,30pm the vessel broke its moorings in a gale and was swept ashore opposite Ocean Street where it was finally abandoned. There the vessel remained on Coogee Beach behind the local abattoirs. In September 1972, a plan was mooted to move the vessel to the Northern Territory to serve as a permanent memorial to the Overland Telegraph. Inspection of the vessel showed that the wreck had deteriorated to such an extent that this was not feasible.

Site location

The site lies in the semi-submerged intertidal zone south of the Cockburn Power Station. The transit photographs show views of the site as it extends above the water's surface.

Site description

The *Omeo* wreck site has always been partially visible and photographic documentation shows the process of deterioration over the last 90 years. A photograph taken in 1915 shows the vessel with the hull intact and with four masts still in place, and some form of deck housing structure. Later the masts had gone, with most of the superstructure collapsing. The hull has remained largely intact, although holes have begun to appear in the cladding as deterioration takes place.

Two of the vessel's anchors were located on the site. They were raised in 1993 and are under conservation. Both chains from the two large anchors remain *in situ*. Artefacts are also found in the bilge hold. The bow and stern sections are above the water while the rest of the site remains submerged.

Statement of significance

Historical

The vessel had a noteable association with the development of the Overland Telegraph.

Archaeological

Through the examination of the wreck site information on the construction of the iron plate clinker hull and rare hybrid rig type, the jackass barque can be obtained. Ship's fittings that remain could also give evidence in the development of shipbuilding techniques.

Scientific

The site has been the subject of a conservation assessment and has the potential to yield data on the deterioration and preservation of iron hulls situated in intertidal zones subject to surge and tidal movement, and particularly at the air–water interface.

References

Halls, C., 1979, 'Saga of the *Omeo'*, *Port of Fremantle Quarterly,* Winter, 1979:18–19.

Maritime Archaeological Association of Western Australia Reports, 1990–1992:6–11.

Figure 82 Photograph of Omeo *(left) alongside a wharf on the Roper River, Northern Territory (MA 1025)*

Figure 83 Photograph of Omeo *c. 1970s (MA 1025)*

James Matthews (unknown—1841)

Figure 84
The wreck site plan for James Matthews

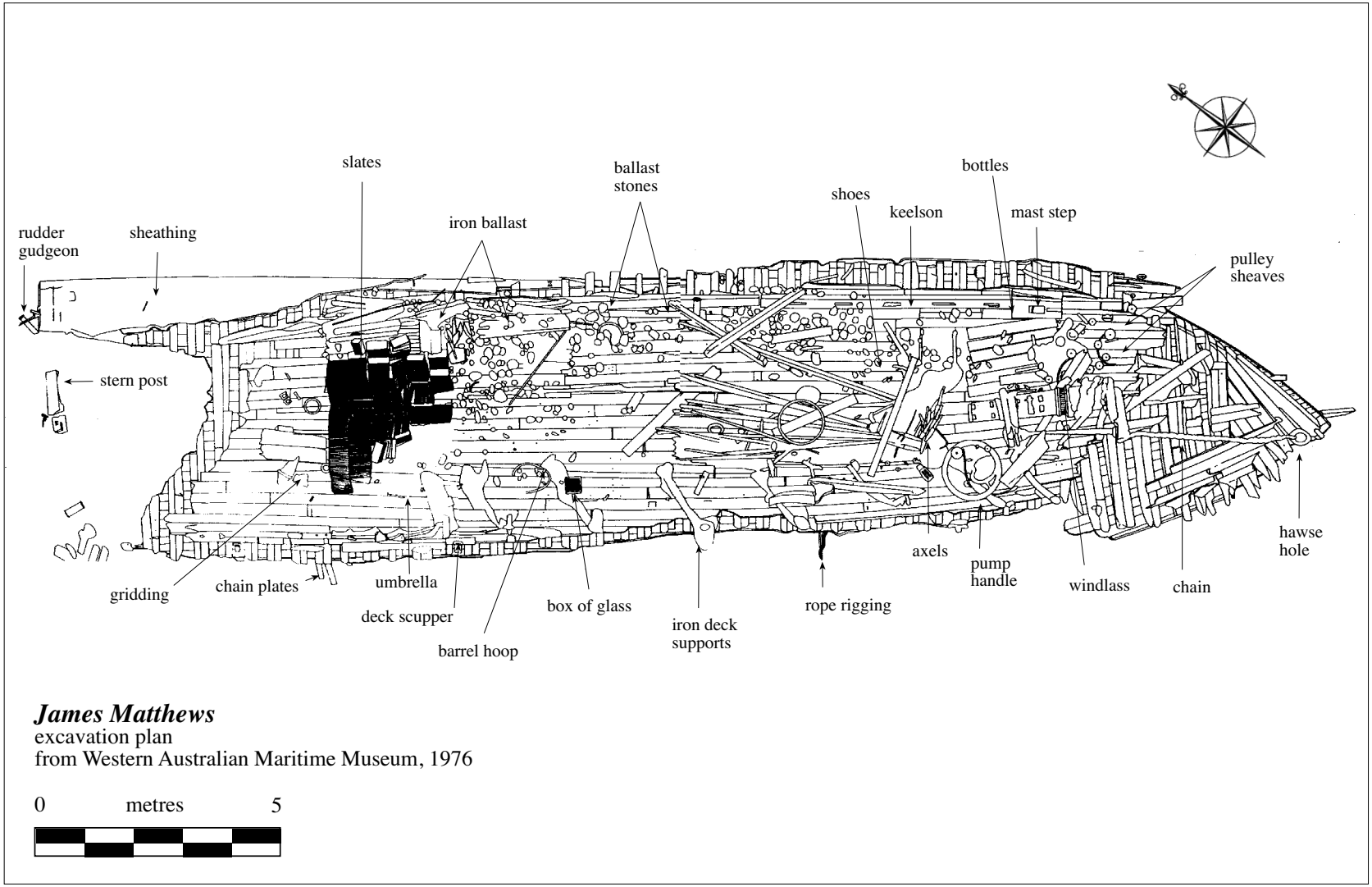


Figure 85
Transit photographs for the wreck site of James Matthews
(MA 3841)

Official number:
Where built: possibly France
Registered: London
Rig type: snow brig
Hull: wood, sheathed in copper (1838)
Tonnage: 167 gross, 107 nett
Length: 24.5 metres (80.5 feet)
Breadth: 6.5 metres (21.4 feet)
Depth: 3.5 metres (11.6 feet)
Port from: London
Port to: Fremantle
Date lost: 22 July 1841
Location: Woodman Point
Chart number: DMH 001
GPS position:
- Latitude 32° 07.9300' S
- Longitude 115° 44.6200' E

Finders: M. Pollard and the Underwater Explorers Club (22 July 1973)
Protection: *Historic Shipwrecks Act 1976* (gazetted 1977)
Unfinished Voyages, volume 1:182–4
MA file number: 434/71/1, 2 & 3
ASD number: WA 188
Significance criteria: 1, 4, 5, 6

The vessel

A Lloyd's survey of *James Matthews* survives and this records it as having one deck, two masts, a square stern, male bust figure-head and no galleries. The snow brig may be distinguished from other brigs by a small trymast, located just abaft of the mainsail, used to support a gaff-sail (Henderson, 1978:73). The vessel was listed as being a 'prize', and it is known that it was formerly a slaving vessel captured during the suppression of slavery.

In 1836 the vessel was sold to a Portuguese owner and became known as *Don Francisco*, after the well-known slave dealer of Whydah. In 1836 it left Whydah on a voyage to Havana with 433 slaves aboard. After a chase lasting seven hours *Don Francisco* was captured by H M brigantine *Griffon*. The vessel was found to be in near sinking state, was condemned but later re-registered as *James Matthews*.

James Matthews left London for Fremantle on 28 March 1841 with a cargo of 7 000 stone roofing slates, farm implements, general goods, three passengers, and fifteen crew. It arrived safely on 21 July 1841 and was moored at Owen Anchorage.

The wreck event

The following day a series of heavy squalls caused *James Matthews* to part its cables and to be blown southwards onto Woodman Point. The hatches were opened in preparation to land the cargo. The spare anchor was let go, but the vessel began to drag. It grounded on some rocks and cargo including ploughs, guns and rifles, and a box containing two hundred gold sovereigns was jettisoned.

At daybreak on 23 July the scene was described as follows:

> Land was visible through the dim light at a distance of less than a mile, with breakers in every direction around us. Spars, casks, planks etc. were floating away with the wind...We perceived we were on a narrow ledge of rock with deep water on either side (on MA File No. 434/71–1).

The masts were cut down but one pierced the bottom of the brig and the hull soon filled with water. A whale-boat from Fremantle rescued all hands. A fisherman who was sheltering aboard the vessel was the only casualty (Henderson, 1978:74).

Salvage

The vessel was sold to Anthony Curtis, a local

Figure 86
A diver recording a stack of slates on the wreck site of James Matthews *(JM A)*

shipowner, who was unable to make a profit out of the salvaged items. The wreck completely broke up during a storm in June 1846.

One passenger, Henry de Burgh, part-owner of the vessel, suffered heavy personal loss including a case of guns and rifles, and the chest containing sovereigns. His diary of the voyage out to Australia survives today.

Site location

The site lies on the north side of Woodman Point in Cockburn Sound, adjacent to the Cockburn Cement Jetty, about 100 metres from shore.

Site description

The wreck lies buried in sand in 2 to 3 metres of water. Prior to excavation in the 1970s the highest section of the wreck consisted of a mound of slates and bundles of long iron lengths that were part of the paying ballast. Underneath the ballast stones were the ceiling timbers. Sea grass covered the site, and visibility was poor due to a fine suspended sediment produced by the cement works development. The site is protected from swell and winds except the north-westerlies.

Excavation and artefacts

Four seasons of excavation were carried out on the site between 1973 and 1977. Full plans and a photomosaic of the site were made. The roofing slates formed the bulk of the material that was raised numbering over 3 500 intact and a quantity of broken ones. Some of the slates were used to restore the roof of the Strawberry Hill Farm at Albany. Other construction items to be recovered included several cases of glass window panes, a large number of heavy door hinges, and the iron ballast. Artefacts such as carpenter's tools, domestic items (including the chess set shown) and ship's fitting including iron grids, pulley blocks, sheaves, deadeyes, glass skylights, 100 metres of rope and deck structures etc. were also recovered (Henderson, 1978:79).

Figure 87
An illustration showing how slaves were possibly stowed aboard James Matthews *when it operated as a slave trader (JM D 33)*

Statement of significance

HISTORICAL

Following the stipulation of the 1831 Bill presented to the British Parliament, all slaving vessels were broken up following their capture. The site of the *James Matthews* is of historical significance as the unique remains of a vessel involved in the slave trade. It is the only known slaver to have survived. It was carrying a cargo of goods for the development of the De Burgh property near Moore River. The vessel's contents are of significance in as much as they reflect the types of goods imported by the early colonists. Also, the wreck site represents the hazards associated with the approaches to the Port of Fremantle and the use of Owen Anchorage, especially during adverse weather conditions.

ARCHAEOLOGICAL

The hull timbers of *James Matthews* are in a good state of preservation. Vessels built for the slave trade needed to meet special constructional requirements, such as shallow draft, fine lines for speed, and various internal fittings for containment of the slaves. Existing plans of slave ships are extremely scarce and the *James Matthews*' hull offers the only detailed source of information on this type of vessel.

The comparative analysis of artefacts from the site with other colonial collections of cargo goods, ship's fittings and personal items could provide a reinterpretation of early settlement through examination of the origin, nature, value, quantity and quality of material.

References

Henderson, G., 1975a, *'James Matthews* excavation summer 1974–1975'___ *Australian Archaeology*, 3:40–5.

1975b, 'Post settlement sites: *James Matthews* excavation', *International Journal of N___utical Archaeology,* 4.2:371.

1976, *'James Matthews* excavation, summer 1974, interim report', *International Journal of Nauti___cal Archaeology*, 5.3:245–51.

1978, Four seasons of excavation on the *James Matthews* wreck, in J. N. Green (ed.), *Papers from the First Southern Hemisphere Conference on Maritime Archaeology*, Oceans Society, Melbourne, pp. 73–9.

Henderson, G. & Baker, P., 1979, *'James Matthews* excavation, a second interim report', *International Journal of Nautical Archaeology*, 8.3:225–44.

Figure 88
Chess pieces recovered from the wreck site of James Matthews
(JM 41 6)

Amur (1862–1887)

Figure 89
The wreck site plan for Amur

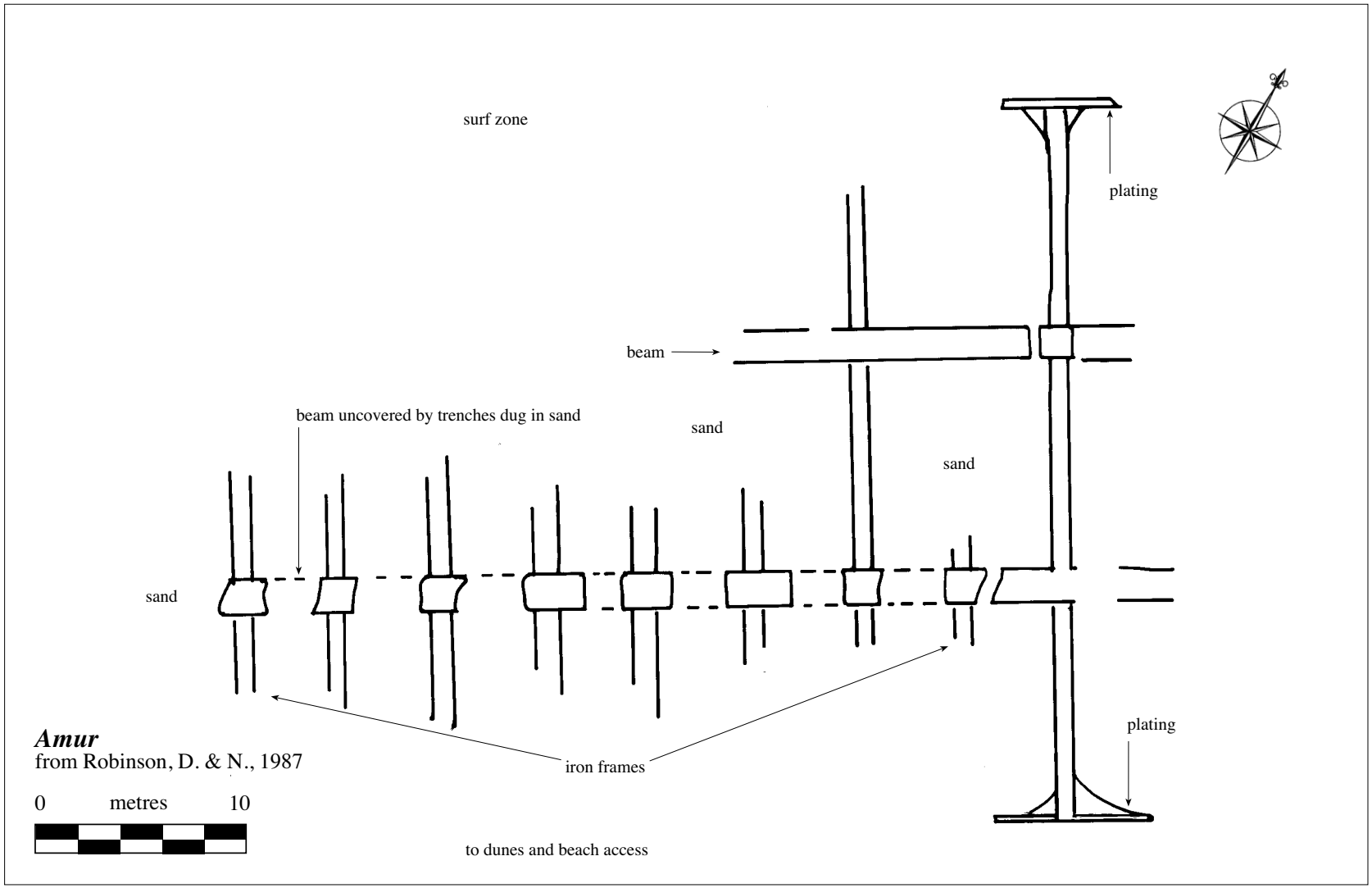


Figure 90
Transit photographs for the wreck site of Amur *(MA 4268)*

Official number:	44509
Where built:	Sunderland, England
Registered:	
Rig type:	barque
Hull:	composite
Tonnage:	236
Length:	33.5 metres (112.9 feet)
Breadth:	7.4 metres (24.3 feet)
Depth:	3.6 metres (11.9 feet)
Port from:	laid up at Careening Bay
Port to:	laid up at Careening Bay
Date lost:	17 March 1887
Location:	North Rockingham Beach
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 15.8340' S
•	Longitude 115° 44.6230' E
Finder:	D. Robinson (10 June 1987)
Protection:	*Maritime Archaeology Act 1973* (gazetted 1988)

Unfinished Voyages, volume 3:94
MA file number: 10/87
ASD number: WA 22
Significance criteria: 1, 4, 5, 6

The vessel

Amur was built in Sunderland, England in 1862 as *Agnes Holt*, a 236-ton carvel-built composite barque with one deck, three masts and a round stern. It was owned initially by W. Marmion and W. and G. Pearce of Western Australia. The vessel was part iron framed, with iron beams, wooden planking and yellow metal fastenings. A section of the flat area of the floor was tree-nailed. The keel was English and American elm, the stem and stern-post were English oak.

The vessel's construction was representative of a transitional period of shipbuilding in the evolution from wooden to composite vessels. An unusual feature were the fourteen pairs of iron straps riveted diagonally onto the outside of the frame. Lloyd's classified the vessel as 'experimental'.

Originally *Amur* was purchased to help establish a whaling enterprise in Western Australia. In 1883 *Amur* transported the Kimberely Survey Party to the North-West after the loss of the SS *Macedon*. The vessel played a major role in the settlement of the region (Cairns & Henderson, 1995:94). Having arrived in Carnarvon after a difficult voyage in March 1885 it was suggested in the press that if the 'wretched vessel' could make it to Fremantle, it should be put to use in the harbour and not dispatched any further.

The wreck event

The vessel was laid up in Careening Bay, Garden Island until 17 June 1887, when Fremantle experienced some strong gales. *Amur* drifted ashore at Rockingham but appears in the listed vessels for Fremantle Harbour until February 1888. In 1890 the derelict vessel's register was closed.

Salvage

Following the vessel's abandonment it is likely that *Amur* was salvaged for the valuable yellow metal fastenings and ship's fittings, leaving the iron work.

Site location

The site lies between Weld and Roe streets, south of Kwinana Grain Jetty, North Rockingham Beach. It is approximately 50 metres south of where Weld Street connects with the beach front between the high and low water marks. Transit photographs show the vessel as it appeared in the surf zone in 1994.

Site description

Last inspection (1 February 1994) of the site identified the vessel in the surf zone, 10 metres out from the dune line almost completely covered in sand. The bow of *Amur* was pointing to the north-east and the wreck site was lying parallel to the shore line.

Only the outline of the iron ribs and frames were visible just above the sand level. Approximately half of the length of the vessel was discernible.

Previous descriptions of the site report up to 28.72 metres (94.25 feet) in length and 6.9 metres (22.75 feet) in breadth of iron work have been revealed. The frames and deck beams form a rectangular pattern as shown in the site plan. During winter storms the structure is subject to scouring and is best viewed at these times.

Statement of significance

HISTORICAL

This site is of historical significance as the remains of a vessel that was important in the development of the whaling industry and the opening up of the North-West of Western Australia.

ARCHAEOLOGICAL

The site offers archaeological information that can reveal aspects of a transitional period in shipbuilding and the change from all wood to composite built vessels. The rules regarding the building of composites were not issued until 1867 and *Amur* has several unusual features including the iron straps (McCarthy & Robinson, 1989:76).

References

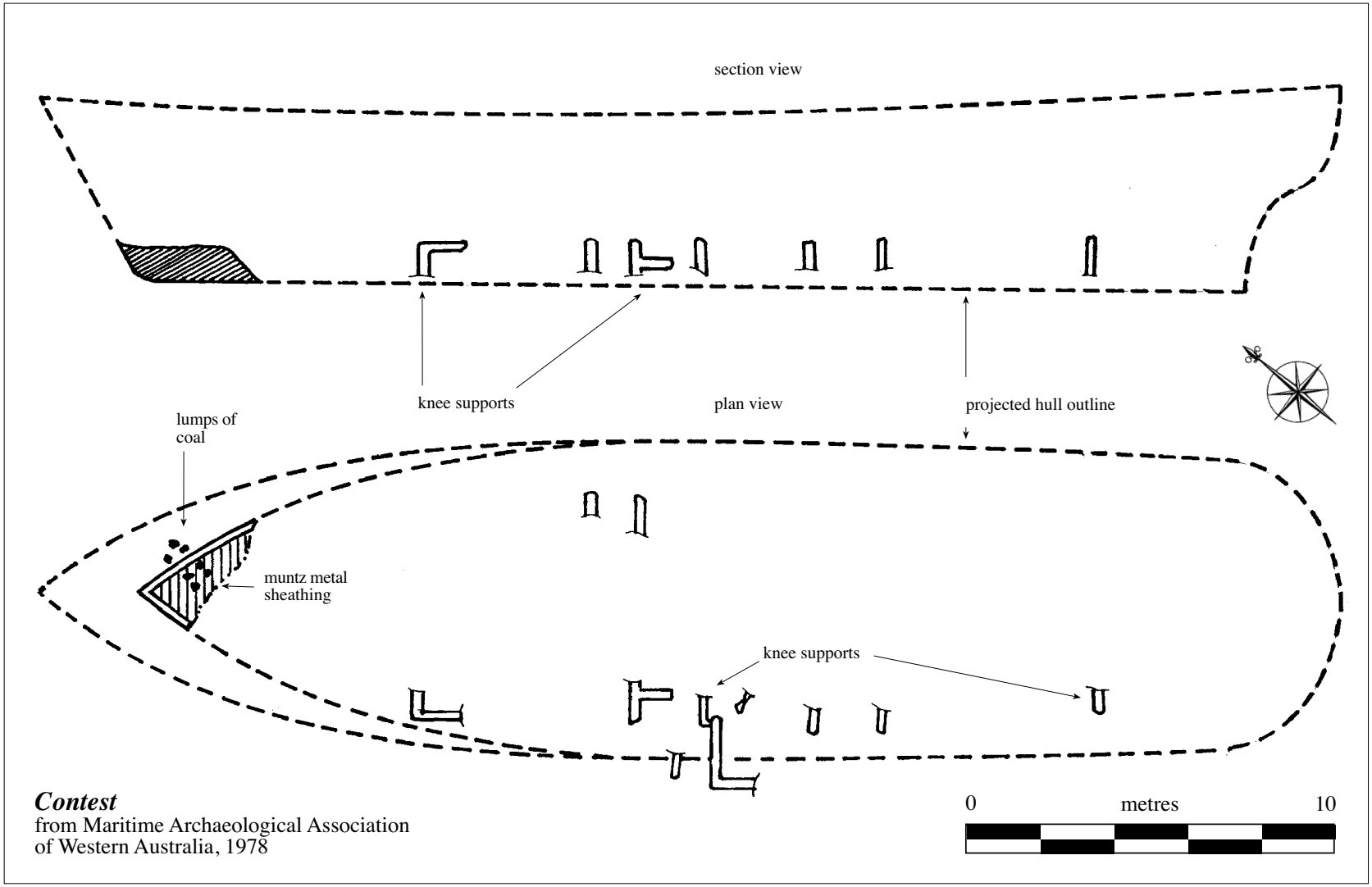
McCarthy, M. & Robinson, D., 1987, *Amur* notes, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. MA 10/87.

Robinson, D. & N., 1987, notes & photographs, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. MA 10/87.

Figure 91
Photograph showing the remains of Amur *in the surf zone (Robinson, D., 1987, MA file no. 10/87)*

Contest (1860–1874)

Figure 92
The wreck site plan for Contest



Contest
from Maritime Archaeological Association of Western Australia, 1978

Figure 93
Provisional transit photographs for the wreck site of Contest *(MA 4268)*

Official number:	37166
Where built:	Nova Scotia, Canada
Registered:	Liverpool, Port Adelaide
Rig type:	barque
Hull:	wood
Tonnage:	322
Length:	36.6 metres (120 feet)
Breadth:	8.6 metres (28.1 feet)
Depth:	3.9 metres (12.8 feet)
Port from:	Rockingham
Port to:	Lacepede Islands
Date lost:	14 July 1874
Location:	Rockingham, Mangles Bay
Chart number:	DMH 001
GPS position:	An approximate position is:
•	Latitude 32° 16.6000' E
•	Longitude 115° 43.4900' S
Finders:	D. Bathgate, K. Cormac, D Robinson and C. Scrimshaw (1978)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1982)

Unfinished Voyages, volume 2:147–8
MA file number: 5/79
ASD number: WA 96
Significance criteria: 1, 4, 5, 6

The vessel

Contest was built in Wilmont, Nova Scotia in 1860. It was a wooden-framed barque with a square stern, and was half-pooped with a female figure-head. The vessel was registered to and built for the Black Diamond Line of Liverpool's fleet. It was later registered at Port Adelaide, bought by H. Simpson in 1868 and used in the intercolonial trade.

On 3 June 1874, *Contest* arrived in Fremantle from Darwin and was taken down to anchorage at Rockingham three days later. The vessel discharged a cargo including 50 tons of coal, 75 bags of copper ore, eight mail bags and ballast. Two cabin and sixteen steerage passengers also disembarked. The master was Captain Thomas Allen and there were twelve crew aboard. Ballast was discharged and the vessel returned to anchorage. The intended return voyage was to transport railway sleepers to the Lacepede Islands (Bathgate 1979:1).

The wreck event

On 16 June 1874 a north-west gale blew up and *Contest* dragged its anchor going ashore on Rockingham Beach, adjacent to the timber station. On 14 July the harbour master reported:

> …she is now lying with her head to the N. W., with her bows in 12 feet and her stern in about 2 feet, with the water as high inside her as out. She is very seriously hogged on her port side and strained greatly about the covering boards and deck...Nothing is being done to her at present as the master expects instructions from the owners in the next mail (Report of L. Black, Gingin, 27 June 1874, Police Records quoted in Henderson & Henderson, 1988:146–8).

The preliminary inquiry into the wrecking exonerated the master and crew of any blame.

Salvage

An auction was held by Messrs L. Samson and Son on 6 August 1874. The condemned hull and a portion of the coal cargo was bought by Mr Tapper who was ordered to remove the wreck from the timber company's jetty within ten days. Attempts to refloat the vessel were abandoned, although there are reports that some of the wreck was taken away (Henderson & Henderson, 1988:148).

Site location

This site is presently buried and its location needs confirmation. The wreck site is located approximately 50 metres offshore from the western boat launching ramp, Palm Beach, Rockingham.

Site description

In 1994 an inspection of the site was not possible because the wreck was completely buried by sand. However, an earlier report had recorded the extent of the structure. The site lies in a depth of 1.3 metres on a bottom that consists of sand and sea grass which also covers the wreckage. It is exposed to the storm surf from the north-west to north-east but is sheltered from other winds especially the prevalent south-west breeze.

A number of iron deck support knees lie partially exposed with iron and yellow metal bolts protruding. The regular spacing of these indicate the possible outline of the hull amidships. Iron knees are also visible on the southern side of the site. The bow section is also visible and consists of wooden frames and planking sheathed in yellow metal. Large lumps of coal are scattered around and between the frames. (Sledge, 1978:1). The overall length of the site remains observed on the sea-bed is 26.8 metres.

Statement of significance

Historical

This site is of historical significance as the remains of a vessel important in the development of Western Australia and the intercolonial trade. The vessel's subsequent engagement in delivery of railway sleepers for the guano workings at the Lacepede Islands demonstrate this. Its involvement with the Black Diamond Line of Liverpool also gives the vessel historical significance.

Archaeological

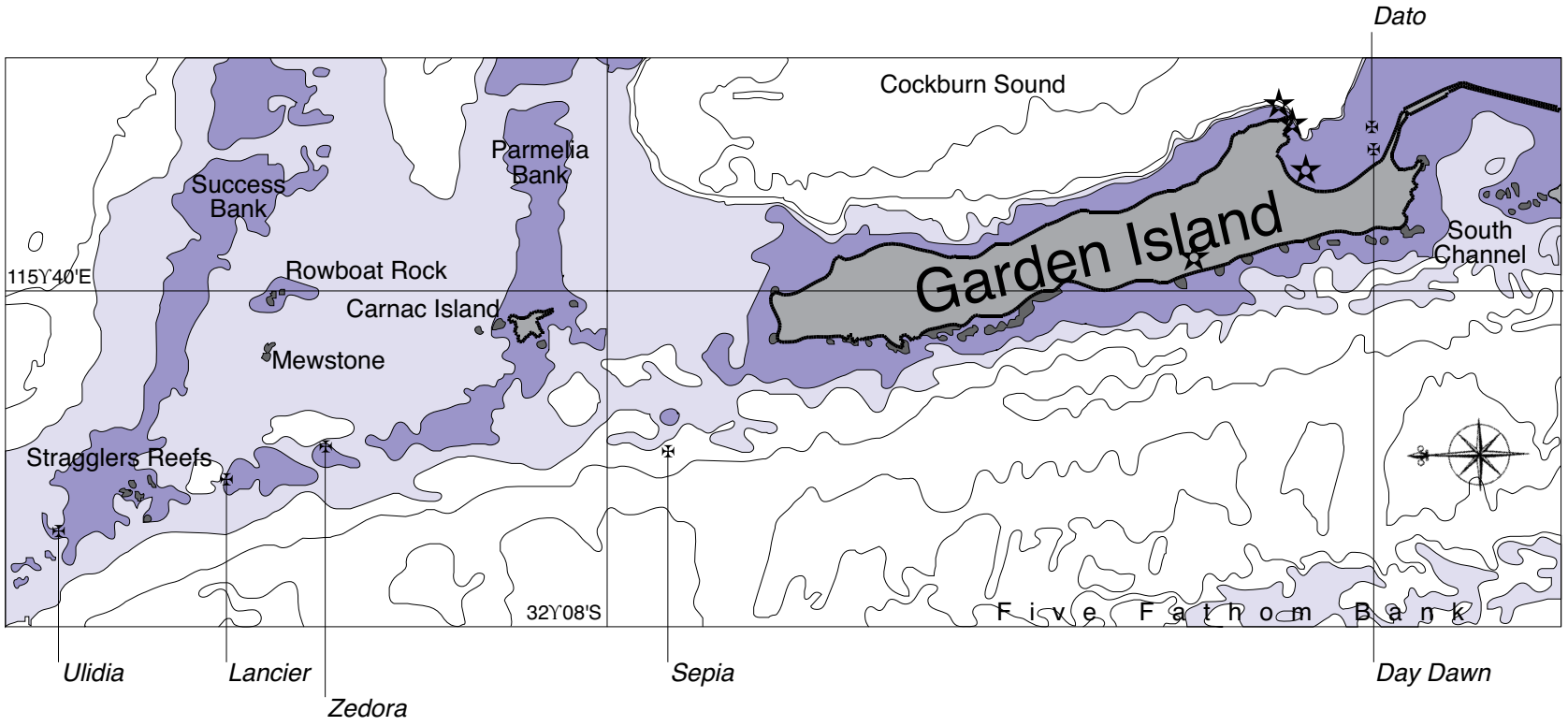
Through the investigation of the hull remains, the site has the potential to reveal elements in the design and shipbuilding techniques of wooden vessels built in Canada during the colonial period. It is an example of a deep-water, fast-sailing merchant vessel of the nineteenth century.

References

Bathgate, D., 1979, Site survey of the barque *Contest*, unpub. MAAWA Report, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. MA 5/79.

Sledge, S., 1978a, *Contest*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 32.

Map 4. Fremantle to Pt Peron (offshore)



Wreck sites on Map 4

Ulidia (1889–1893)

Figure 94
An isometric view of the bow of the wreck site of Ulidia

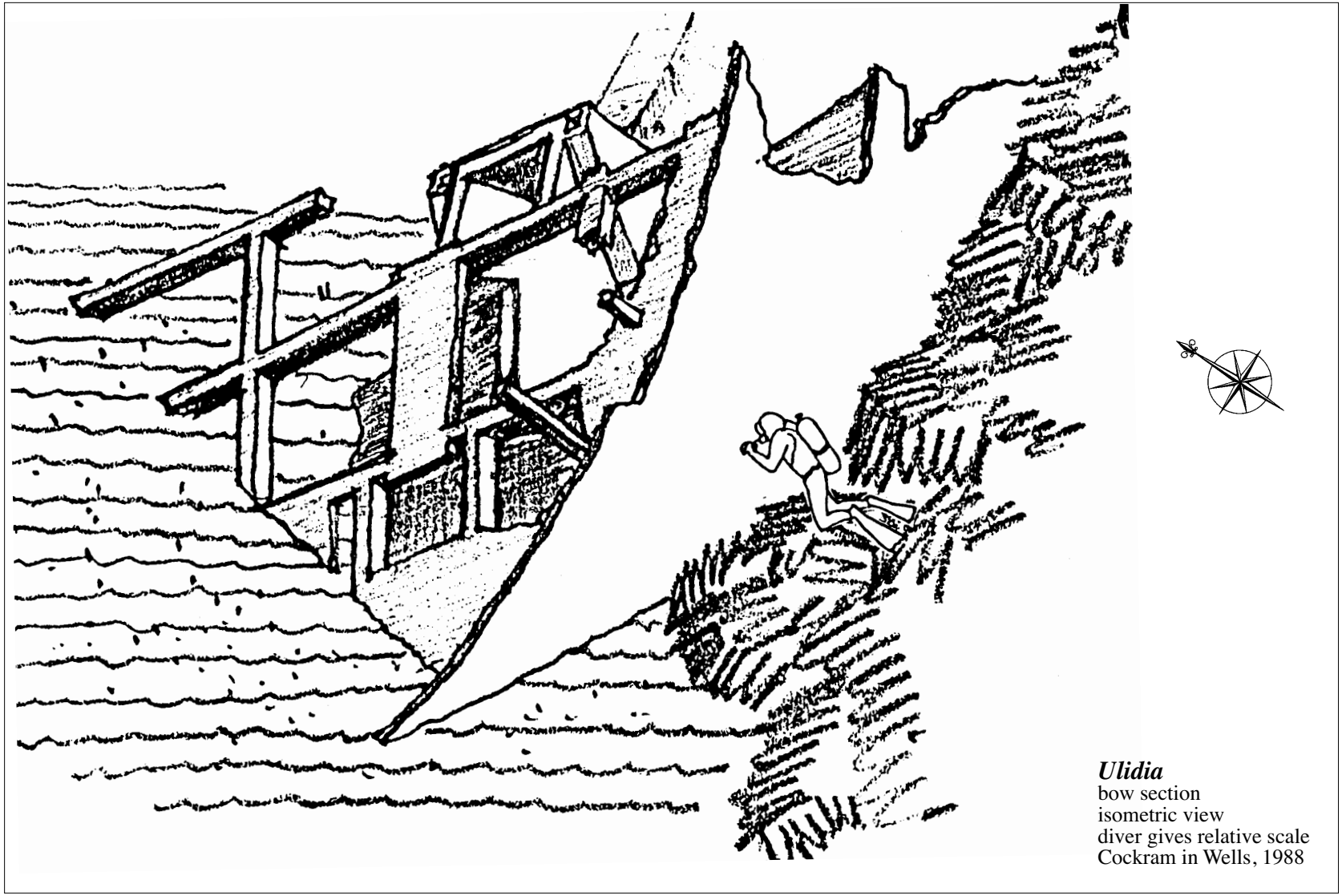


Figure 95
Transit photographs for the wreck site of Ulidia *(MA 2081)*

Official number:	76257
Where built:	Stockton-on-Tees, Durham, Scotland
Registered:	Belfast, Ireland
Rig type:	ship
Hull:	iron
Tonnage:	2 405
Length:	91.4 metres (300 feet)
Breadth:	12.8 metres (42 feet)
Depth:	7.4 metres (24.4 feet)
Port from:	Fremantle
Port to:	Newcastle
Date lost:	18 May 1893
Location:	Stragglers Rocks
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 03.4600' S
•	Longitude 115° 37.7300' E
Finders:	Olley and the Underwater Explorers Club (1950s)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:208–10
MA file number: 187/76
ASD number: WA 340
Significance criteria: 1, 4, 5, 6

The vessel

Ulidia was given an A1 classification at Lloyd's and was a fully rigged ship built by Richard Duck and Company, with one bulkhead and two decks. The forecastle measured 10.3 metres and the poop 11.6 metres. The underdeck tonnage was 2 263 tons and the net tonnage was 2 378. It was owned by P. Ireland and Porter.

The vessel was engaged in the Cape Horn trade route visiting ports in Europe, Australia and South America. This trading network involved the shipment of general goods from Europe to the colonies and then the export of coal or other primary produce to South America where fertiliser and goods for the industrial and agricultural needs of Europe were obtained.

Ulidia had arrived in Bunbury on 13 February 1893 after a fast voyage of 87 days from Newport, Monmouthshire, with a full cargo of railway iron, rails and fittings. The next day the vessel was grounded at the jetty and although it was refloated the captain lost his ticket for one year. Under Captain Abbot the vessel anchored at Careening Bay to unload the rest of the cargo. It then took 1 000 tons of sand ballast on, was cleared for Sydney on 15 May and made ready for sail under the command of Captain McAdam.

Owing to contrary winds the vessel did not leave until the morning of 18 May. On a close haul, starboard tack, with all sails set *Ulidia* made for Rottnest Island. A wind change to the north about thirty minutes later forced the captain to tack, but the vessel missed stays and hung in the chains owing to a lack of way and a heavy swell. A tack was attempted but the vessel remained four points from the wind and would not come round any further.

The wreck event

The starboard anchor was let go but after 192 metres had been paid out it snapped at the hawse-pipe. Before the anchor could be cleared *Ulidia* was on a reef 550 metres north-north-west of Stragglers Rocks. Although the vessel initially struck gently the moderate breeze and heavy seas together with the 1.5 knot tide flowing south forced the vessel on more heavily. The crew hoisted flags for assistance. The pumps were used and it was some time before there was leakage, but later the hull rapidly filled with water.

Dolphin and *Rescue* were sent out from Fremantle to render assistance. By 11.00 a.m. there was nearly 12 feet (3.6 metres) of water in the hold and all hands were ordered off. Four crew stayed aboard the vessel to protect it from unlawful salvage. Bin-

nacles, compasses, sails, two boats and the personal effects of the crew were removed. However, the chronometers were not saved (Pollard, n.d.).

The vessel was declared a total wreck when it was found impossible to tow off. It lay in a crevice with a pinnacle of rock through the bottom. The soundings over the site were port bow 1.5 fathoms (2.8 metres), aft 3 fathoms (5.5 metres) and with the quarter and starboard bow rock awash.

At the inquiry it was suggested that one of the reasons that the vessel did not respond to the helm was that in ballast it drew only 3.7 metres instead of the fully laden 6.6 metres. This left 2.7 metres of rudder out of the water and this in conjunction with the mild breeze stopped it from coming around. However, the captain's certificate was suspended for six months.

Salvage

The hull of *Ulidia* was sold at auction for £425 in early June. Operations were commenced to refloat the vessel and about twenty men were employed to remove the sand ballast. This proved an unsuccessful venture. With a large quantity of the sand removed, the vessel was lighter and more unstable, the action of the waves causing further damage. A number of investors in the wreck soon fought in court over the £1 500 that had been spent in the attempt. It was then sold to the Fremantle Stevedoring Company who intended to break up the vessel. By February 1894 the topgallant masts had been removed and *Ulidia* was in the process of being dismantled (Cairns & Henderson, 1995:210).

Site location

The vessel is 600 metres north-north-west of the northern-most point of the Stragglers Rocks on the eastern side of a breaking reef.

Site description

The wreckage lies on an east-west axis with the stem on the reef rising nearly to the surface in 3 metres of water and the stem on a sand bottom in approximately 6 metres. The vessel seems to have struck upright with the sides and stern section subsequently falling out. Large iron I-beam ribs lie in neat rows on the iron plating. The overall wreckage is spread over 99 metres. The stem is particularly interesting in that it is almost complete but lying backwards propped up by the iron strokes of the bow section. It measures 6 metres. A heavy iron hatch coaming can be seen aft amidships. There are three spar sections visible, together with cables and dead eyes. At the time of survey the site was covered in extensive weed growth and marine organisms. The location of the site means that it is subject to heavy swell conditions.

Statement of significance

HISTORICAL

This site is of historical significance as one of the largest sailing vessels to be wrecked on the Western Australian coast, and for its association with the Cape Horn trade route.

References

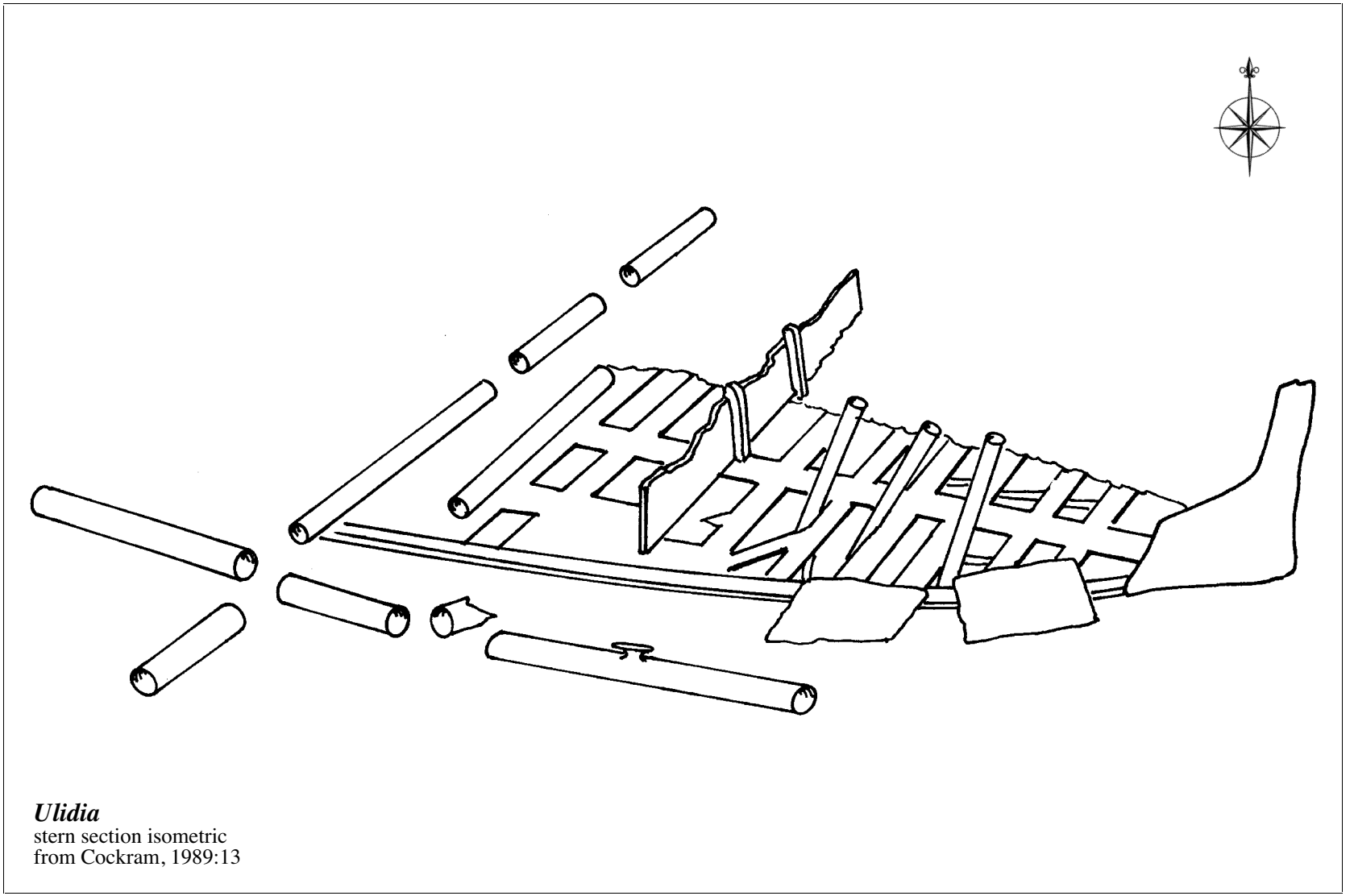
Cockram, C.,____1988, in Wells, S., 1988a.

1989b, The *Ulidia*: more detail added to earlier drawing, Maritime Archaeological Association of Western Australia Reports, Vol. 3, December 1988–June 1989:13.

Pollard, M., n.d., *Ulidia*, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. MA 187/76.

Wells, S., 1988a, The *Ulidia*: a picture emerges, Maritime Archaeological Association of Western Australia Reports, Vol. 2____ July–December 1988:10–12.

1989, The *Ulidia*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990:12–17.

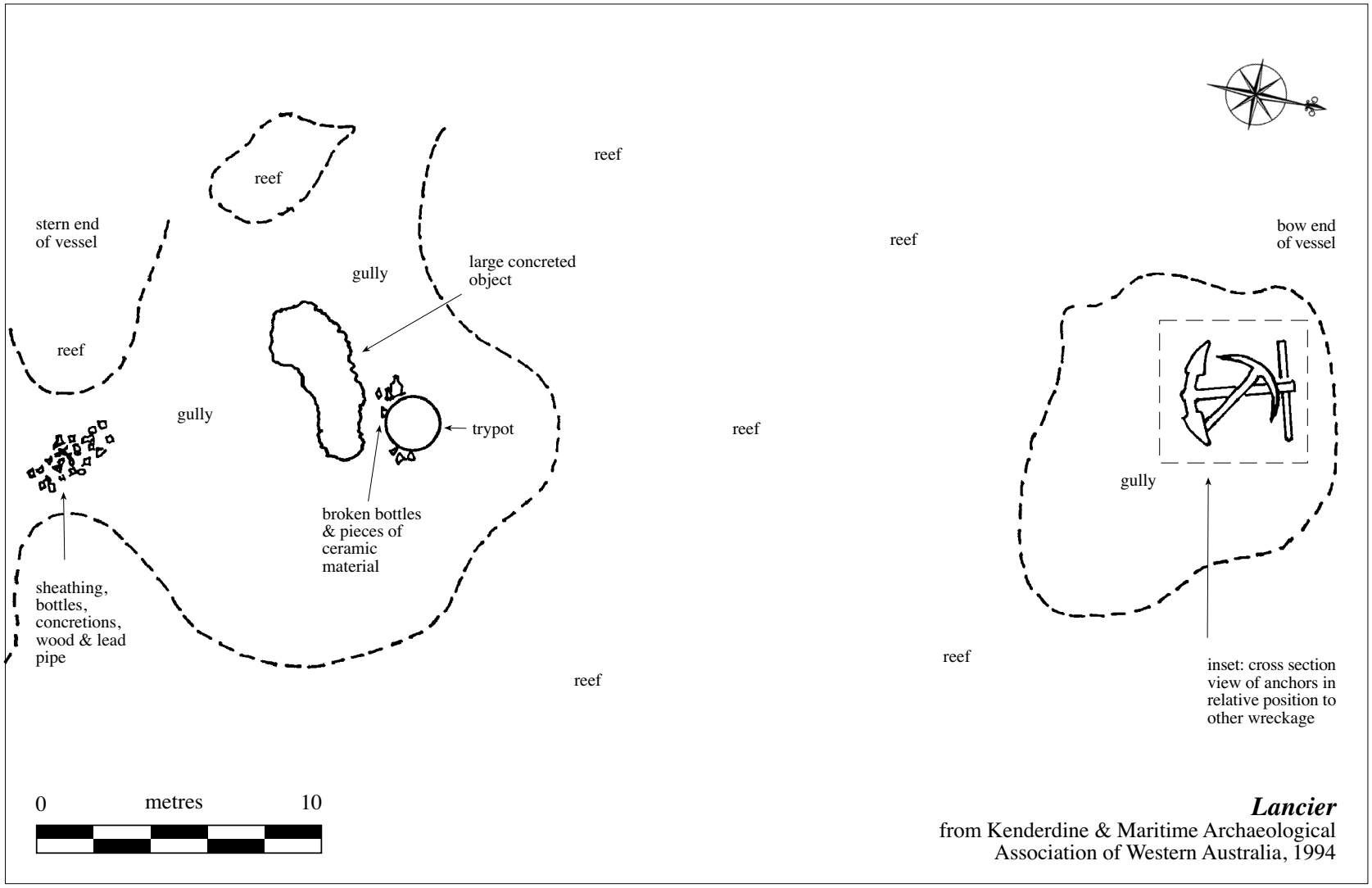


Ulidia
stern section isometric
from Cockram, 1989:13

Figure 96
An isometric view of the stern of Ulidia

Lancier (1834–1839)

Figure 97
The wreck site plan for Lancier



Lancier
from Kenderdine & Maritime Archaeological Association of Western Australia, 1994

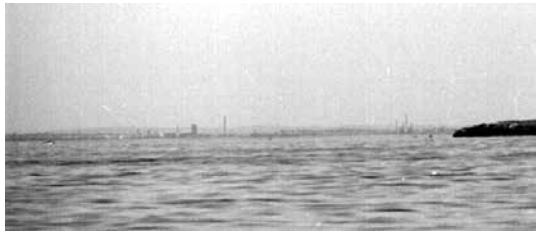


Figure 98
Transit photographs for the wreck site of Lancier (MA 4271)

Official number:
Where built: Seychelles, Indian Ocean
Registered: Port Louis, Mauritius
Rig type: barque
Hull: wood
Tonnage: 285
Length: 29.6 metres (97.2 feet)
Breadth: 7.3 metres (24 feet)
Depth:
Port from: Mauritius
Port to: Hobart
Date lost: 28 September 1839
Location: Mewstone Reef
Chart number: DMH 001
GPS position:
- Latitude 32° 04.7905' S
- Longitude 115° 38.0115' E

Finders: G. Henderson, K. Lewis, E. Karabanovs and P. Martinson (1970)
Protection: *Historic Shipwrecks Act 1976* (gazetted 1977)
Unfinished Voyages, volume 1:161–8
MA file number: 449/71
ASD number: WA 202
Significance criteria: 1, 4, 5, 6

The vessel

Lancier does not appear in Lloyd's Register; however, it is recorded by the Port Louis Controller of Customs in the Register of Ships. It was built by Messrs Crook and Naz in 1834 for Mr Charles Fourette.

Under Captain Durocher, *Lancier* left Port Louis in Mauritius and set sail for Hobart, intending to call at Fremantle. The vessel made the land off Fremantle on 28 September and signalled to both Garden Island and Carnac Island. The Captain was unfamiliar with the passage and, since no buoys were laid down, was hesitant to make the approach. At approximately 12.9 kilometres to the northward, the vessel entered the passage between Carnac Island and Rottnest Island. On the chart there were two rocks known to be located in this area.

The wreck event

Once opposite the passage, the signal was made for the pilot. When none appeared the vessel ventured forth with a lead hove and good look-out. The first rock was passed on the port side; however, the second rock was struck (Henderson, 1980:162).

The vessel's stern sank immediately and the bow stuck fast on the rock. There was 1.2 metres of water in the hold, a substantial wind, and the sea was running strong. The captain entertained the idea of forcing the vessel higher up on the rock to prevent damage from the waves, but the sails did not produce the force required and the aft hold filled further with water. Waves began to come over the poop deck.

With no option, the yawl was launched but due to the conditions the two whale-boats could not be let go. The former was too small to take all passengers and crew, and it only had one oar. Observers of the scene conveyed the predicament of the vessel to the harbour-master. He first had to be convinced that it was flying the flag of a merchant ship and was not in fact a Man-of-War making nautical observations (Henderson, 1981:161).

The harbour-master and another vessel under Captain Dempster of Fremantle arrived at the wreck to find little in the way of wreckage material. Only two chests remained floating alongside. At this stage the bow of the vessel was still out of the water but the water in the hold had risen to the foremast and the stern had sunk so far in the sea that the mast was almost perpendicular to the surface.

Back in Fremantle the crew were housed in the jail and much hospitality was offered by Dempster, while the actions of the harbour-master were a source of complaint. The *South Australian Register*

reported:

> …there were no buoys laid down in the dangerous entrance to the harbour, nor pilots to take people in. Unless the people of Swan River take means to render their harbour safe, they will get few persons to go near them, for no person will send his vessel to a port where it is almost certain she will be cast away (Extract from *Le Mauricien* article, *SAR*, 8 February 1840, quoted in Henderson, 1980:164).

In 1946 a publication by Frank Goldsmith referred to the log of Captain Dempster who had tried to receive in his vessel a chest of 7 000 specie when he was rescuing the last four crew members. The chest was lost overboard but Captain Dempster was said to have taken note of its location. There is, however, no mention of the specie in official correspondence. The vessel and its cargo were sold at auction for £6. 10 and £7. 10 respectively. There are few references to the vessel after this time and the extent of the salvage has not been determined. The possible presence of specie on board certainly led to numerous expeditions to relocate the vessel in more recent times, and in the 1950s the wreck was confused with that of *Zedora* located just several hundred metres further south.

Site location

The site is located at the northern end of Hugél Passage, south of Stragglers Rocks, on Mewstone Reef.

Site description

Little remains of the structure of the vessel as a result of prevalent weather conditions which expose the reef to swell and surge. The depths over the site range between 7 and 8 metres, with the remains of the wreck being situated on a sandy bottom in holes in the reef. The wreckage is spread over 25 metres length. Two anchors together with pieces of concretion lie at the northern part of the site in a hole in the reef. The bow and stern lie along an axis of 032°. Toward the mid section of the wreckage there is a trypot standing proud of the sea-bed and in places broken bottles and Willow Pattern china fragments are visible. About 8 metres further toward the stern of the vessel from the trypot there is copper sheathing, bottles and concretions, wood and a small lead piece, in the sand. Protection of the remains is offered by the surrounding reef and ledges of rock (Kenderdine, 1994c:4–6).

Artefacts

In 1971, a carronade was recovered from the site and at the time of publication is being treated at the Department of Materials Conservation at the Western Australian Museum. Although desalination has been completed, extensive exfoliation occurred on the iron surface due to partial drying of the object before treatment was commenced.

Statement of significance

Historical and social

This site is of historical significance as the remains of a vessel involved in the intercolonial and overseas trades, and whaling. The shipwreck soon after the establishment of the colony led to identification of the problems of negotiating the approaches to Fremantle. The loss of this vessel together with *Elizabeth* in the same period would have amounted to a value exceeding the total produce of the colony in that year, and was a bitter blow to the fledgling economy. Subsequent speculation about the specie has become enshrined in the lore of the local community.

References

Kenderdine, S., 1994c, *Lancier*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 111.

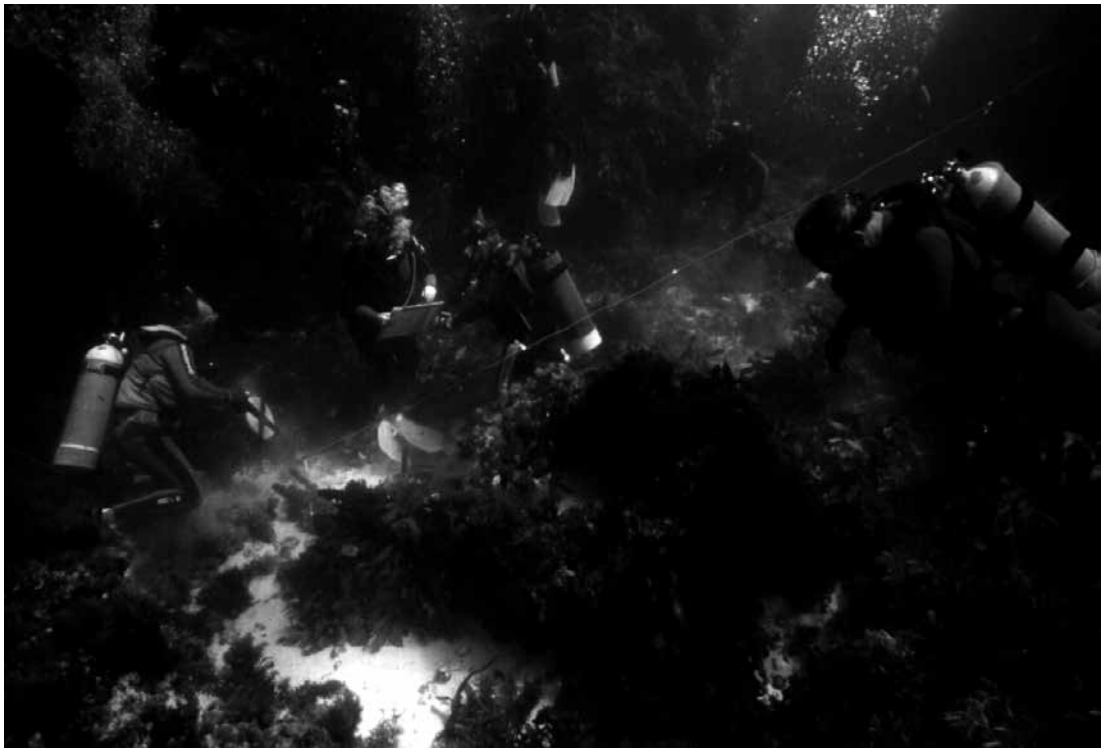


Figure 99
Maritime Archaeological Association of WA visit to Lancier *wreck site (LAN 41)*

Zedora (1869–1875)

Figure 100
The wreck site plan for Zedora

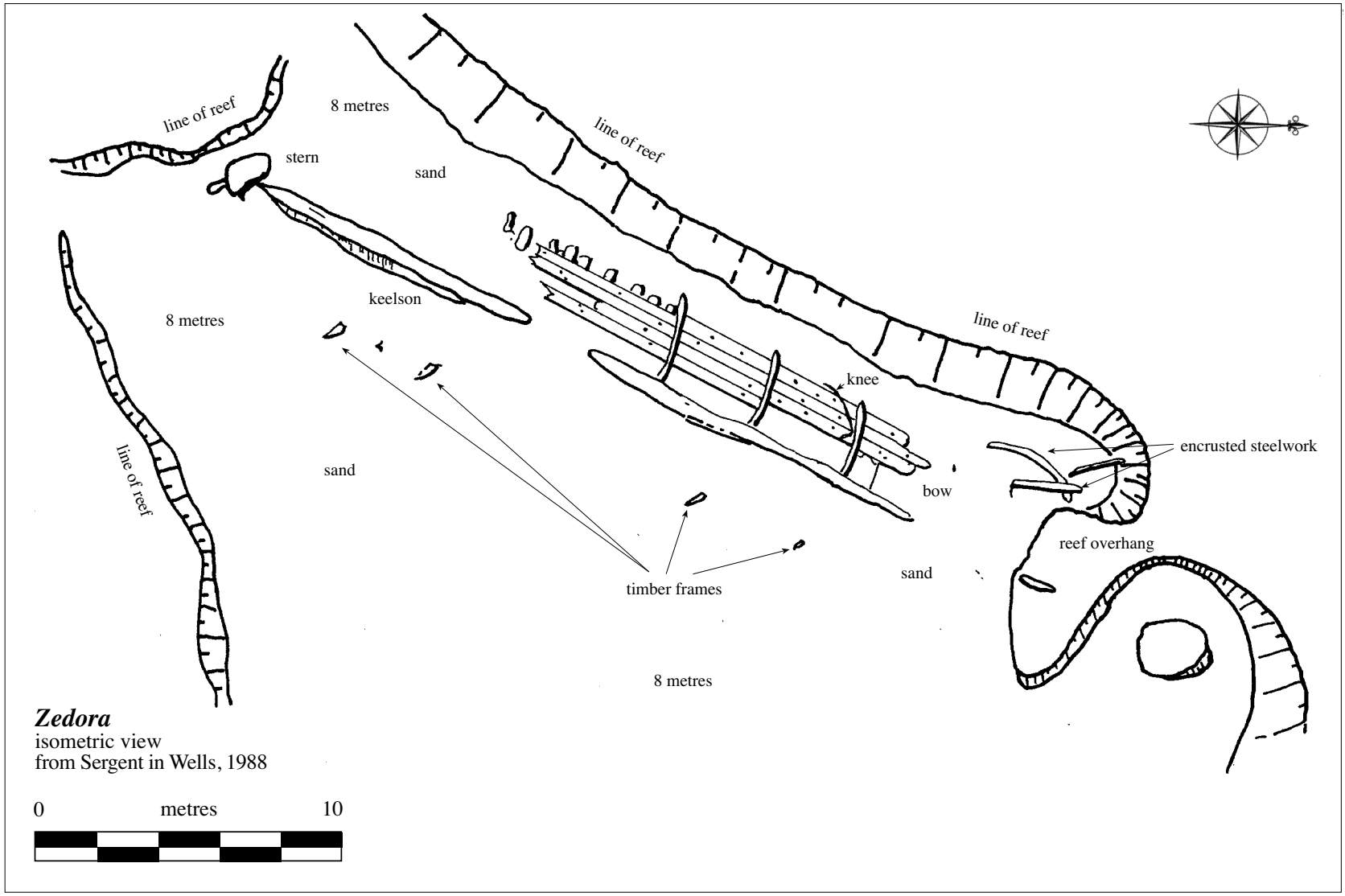


Figure 101
Transit photographs for the wreck site of Zedora *(2081)*

Official number:	62891
Where built:	Bideford, north Devon, England
Registered:	England
Rig type:	barque
Hull:	wood
Tonnage:	269
Length:	35.9 metres (117.7 feet)
Breadth:	7.6 metres (25 feet)
Depth:	4.5 metres (14.8 feet)
Port from:	Mauritius
Port to:	Fremantle
Date lost:	11 February 1875
Location:	Mewstone Reef
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 05.0638' S
•	Longitude 115° 38.2205' E
Finders:	J. Sue *et al*. (1957)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:158–60
MA file number: 435/71
ASD number: WA 400
Significance criteria: 1, 4, 5, 6

The vessel

On 10 January 1875, *Zedora* (owned by J. Mill), under the command of Captain Hodges and with a crew of ten, left Mauritius bound for Adelaide with a sand ballast. By 7 February the vessel had reached latitude 37° south. A strong squall struck the barque, shifting the ballast and throwing the vessel on its beam ends. The crew worked for two hours to shift the sand back into position. The next morning it was found that the pumps were clogged and that water was washing about in the hold (Henderson & Henderson 1988:158–9).

Captain Hodges decided to make for Fremantle to try and pick up a charter. At midday on 10 February the ship's position was fixed as being 143.9 kilometres (90 miles) west of Rottnest Island heading on a course approximately east by north, and later it hauled further to the south, travelling at 8.5 knots (Wells, 1988:13). At 8 p.m. the upper fore, main topsails and fore staysails were reefed and speed was reduced to between 3.5 and 4 knots.

The wreck event

Sharp look-out was kept but no light was sighted. At 11 p.m. the mate reported land under the lee; the lead was cast to give a reading of 25 fathoms. A revolving light was sighted on the starboard quarter bearing north-east. At the same time, however, broken water was seen ahead and soon the vessel had struck a reef.

The ensuing chaos was described by the captain:

> I ordered the mate to cast the lead and in doing so the lead was carried away and immediately the vessel struck aft carrying away the rudder and the wheel (which I was at at the time) and began to bump very heavily. I ordered the gig to be again lowered at once, the man on the long-boat singing out that she was sinking on the rock astern. The vessel then went over on her side, and settled down at once (John Hodges, evidence at Inquiry into the stranding of the *Zedora*, Fremantle, 13 February 1875, C. S. R. 813, fol. 12, quoted in Henderson & Henderson 1988:159).

After a short time Captain Hodges 'deemed it prudent for the safety of the lives of the crew to leave the ship which they did about 2 a.m.'. Nothing was saved from the vessel and Fremantle was reached about 8 a.m. the next morning.

Inquiry

The captain was not charged and the preliminary inquiry stated:

> We attribute the accident entirely to the Rottnest Light having not been seen from the vessel, when she must have been in the usual range of that light for two hours prior to the casualty, though a proper lookout was kept (Preliminary Inquiry, 13 February 1875, C. S. R. 813, folder 12, quoted in Henderson & Henderson, 1988:160).

The colony's governor was not satisfied with the court findings, seeing them as an indictment of the lighthouse keeper at Rottnest. The case went back to court but Hodges was able to call witnesses that supported his own testimony about the absence of the light.

Salvage

Zedora became a total wreck and was sold at auction for £160. Numerous cargo items and ship's fittings from the vessel were sold, including forty-three sails. Notices were issued indicating that anybody found removing material washed up on the beaches would be prosecuted. The captain's report on the vessel suggested that the wreck was probably in a very vulnerable condition and breaking up on the reef. A year later a piece of timber with the letters 'ZE' printed on it was found at Jurien Bay, 100 kilometres north.

Site location

The wreck site is located at the very edge of Hugél Passage, on the northern end of Mewstone Reef. Although marked on the charts as one continuous piece of reef it is in fact several inter-connected pieces.

Site description

The wreckage lies in about 8 metres of water at the base of a 3 to 4 metre rock wall which has a predominant overhang to the northern part of the wreck. It is parallel to the reef face with the bow facing north-east, the stern south-west. The exposed site covers 20 metres by 25 metres, lying in part on a sand and weed bottom. Little of the wreck protrudes further than 1 metre above the sea-bed (Wells, 1988b:15).

The remains of the keelson are clearly visible for 15 metres. This consists of a heavy timber, 1 metre wide, with scarf joints evident, and several securing bolts. Frames extend up on both the starboard and port sides up to 2 metres, although sand covers all but the tops of the starboard frames. Outer planking is evident on the port framing and covers a length of 9 to 10 metres, four planks thick each 0.25 metres wide. At the bow end an iron knee is clearly visible (Wells, 1988b:17).

Separate from the wooden structure, 2 metres west, is located some heavily concreted steelwork, possibly part of the bowsprit. Since the original colonial secretary's report two things appear to have happened to the wreckage. Firstly, the bow of the vessel and probably the whole structure have slid backwards off the reef into deeper water. Secondly, the vessel has shifted, rotating about 120° south (Wells, 1988b:17).

Wreck inspection reports indicate that the site is prone to swells in any weather, visibility is often poor and winter scouring of the site occurs. The site was subject to diver interference in the 1960s as it was thought to be that of *Lancier*, several hundred metres north.

References

Wells, S., 1988b, The *Zedora*: a history and photographic study, Maritime Archaeological Association of Western Australia Reports, Vol. 2, July–December 1988.

Figure 102
Hull structure of the Zedora
(ZD 7)

Sepia (1864–1898)

Figure 103
The wreck site plan for Sepia

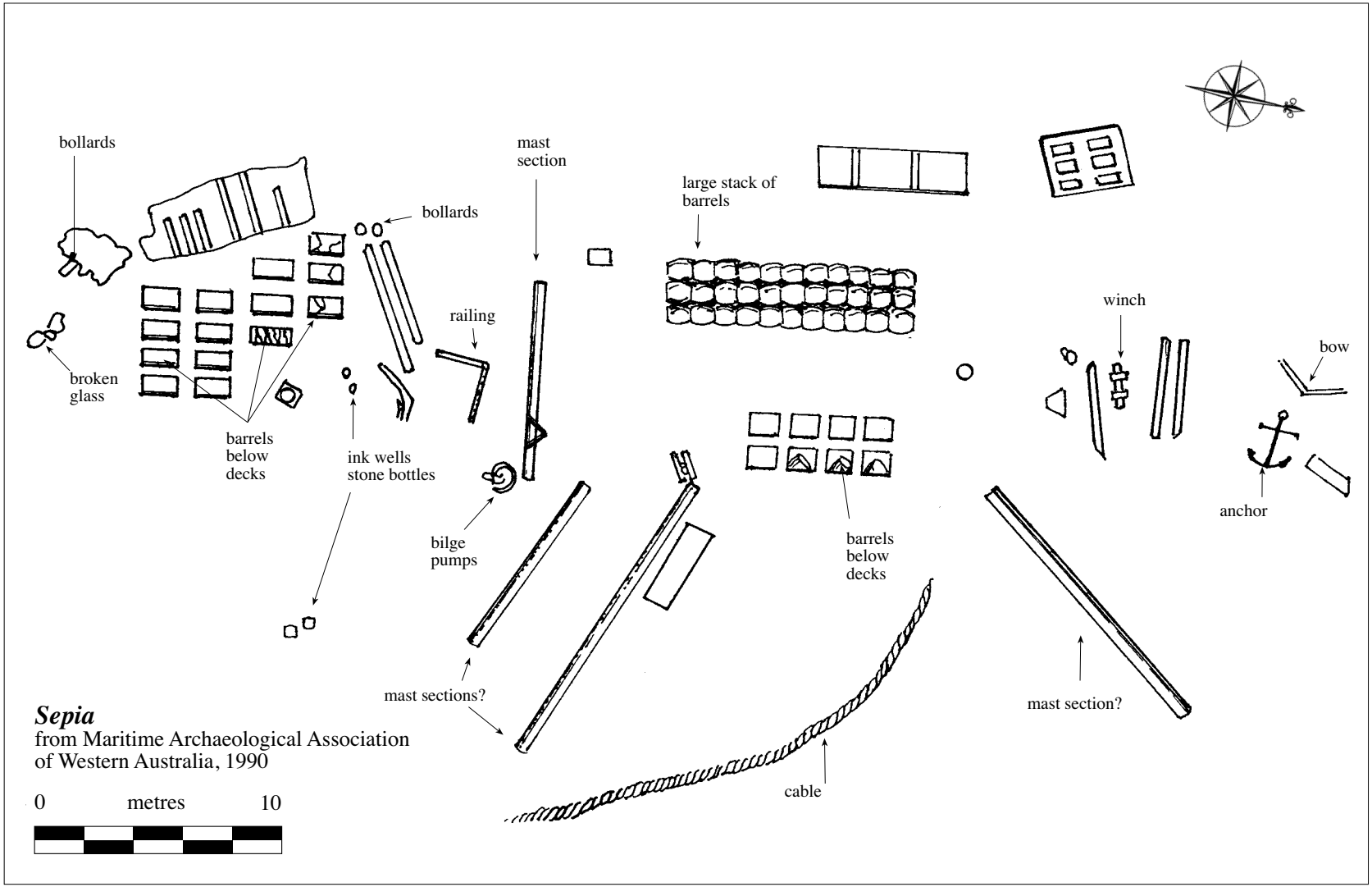


Figure 104
Transit photographs for the wreck site of Sepia *(MA 2081)*

Official number:	18814
Where built:	Hartlepool, England
Registered:	London
Rig type:	barque
Hull:	iron
Tonnage:	715
Length:	53.9 metres (177.4 feet)
Breadth:	8.8 metres (29.3 feet)
Depth:	5.8 metres (19 feet)
Port from:	London
Port to:	Fremantle
Date lost:	28 December 1898
Location:	2.9 kilometres offshore, between Carnac and Garden Islands
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 08.0600' S
•	Longitude 115° 38.3400' E
Finders:	D. Cougran and D. Nobel
Protection:	*Historic Shipwrecks Act 1976* (gazetted)

Unfinished Voyages, volume 3:280–1
MA file number: 447/71
ASD number: WA 308
Significance criteria: 1, 4, 5, 6

The vessel

Sepia, a three-masted barque was built by Denton, Grey and Company of Hartlepool and was owned by Bethell, Gwyn and Company, London. The vessel, well-known as a trader on the Fremantle run, left London on 14 September 1898. Aboard were twelve crew and a mixed cargo of 1 200 tons valued at £20 000. The hull had an estimated value of between £1 200 and £1 400.

Travelling at 10 knots on the evening of 28 December *Sepia* ran before a strong southerly wind under the main and topgallant sails. Shipping was seen ahead of the vessel and this was presumed to be activity at the port of Fremantle. Captain Hugh Thomas was not new to navigation along this coast.

The wreck event

Although no danger was anticipated, as the order was given to haul up, the barque struck a submerged rock without warning at the outer edge of Five Fathom Bank. The vessel sank in less than ten minutes. The speed with which *Sepia* sank made the task of rescuing the crew difficult (Cairns & Henderson, 1995:280). Heavy seas were breaking over the vessel and the cargo had begun to burst through the hatches.

The lifeboat and gig were launched and most crew including the captain left the stricken vessel just as it began to slip off the rock. Four crew remaining made their way up the rigging where they were unable to be rescued as the barque sank further. Thomas decided to make for the port and reached Fremantle at 8.00 p.m. that evening. The Government steamer *Penguin* was dispatched to the wreck and it was after midnight before the four remaining crew were got off.

Sepia was later visited by the harbour-master, collector of customs, manager for Dalgety's and the surveyor for the underwriters. The vessel was found to be lying in 13 metres of water 2.4 kilometres west of Carnac Island. The pilot jack still flew from the foremast and the lower topsails were set. The mainmast had broken loose and was hanging over the starboard side. To minimise the effect of the sea on the wreckage the sails were removed from the rigging. It was hoped that successful salvage could be carried out as the weather and the vessel's position were favourable (Cairns & Henderson, 1995:280).

Salvage

The WA Lighterage Company successfully tendered for the salvage of *Sepia*'s cargo valued at

Figure 105 Contemporary photographs showing the wrecking of Sepia *(SP 12)*

£30 000. It was reported on 12 January 1899 that the masts had been removed and the divers were commencing salvage on the vessel. A large portion of cargo must have been removed as work was still being carried out in May.

Inquiry

At the preliminary inquiry Captain Thomas refuted that he had mistaken shipping activity at Rockingham as that at Fremantle. After sighting it he had changed course to the north to go inside Five Fathom Bank to South Passage. After passing Garden Island, and in view of Carnac Island, he was on the look-out for Rottnest Island when the vessel struck. No soundings had been taken. Charges of gross carelessness in not altering course to clear possible obstruction, carelessness in not taking soundings or having kept sufficient look-out and neglect to using ordinary precautions as indicated in the Admiralty sailing directions, were investigated. The court upheld these charges and the captain's certificate was suspended for nine months.

Site location

South of Flat Rock and Carnac Island, approximately 2.4 kilometres on a bearing of 225° from Flat Rock and 900 metres from Challenger Rock, bearing 325°.

Site description

The position of the *Sepia* remained common knowledge after the shipwreck, and after the introduction of sport diving it became exposed to the activities of souvenir hunters. There are reports of divers being able to swim along the passageways and look into rooms during the 1940s and 1950s but today the decks have collapsed leaving no indication of where the passageways and rooms may have been located (Buhagiar & Murphy, 1990:2).

The overall length of the site is 56.6 metres. The structure that remains on the sea-bed is well defined. It is located in 12 to 15 metres of water on an undulating sand bottom with protruding reef structure (Gauntlett & Punchard, 1990:4).

The most prominent features of the *Sepia* wreck site are the sternpost standing up about 3 metres, clearly identifiable deck framing, masts sections, a deck winch, an anchor, and a prominent bow section. During the winter months when storms scour out the site and the weed growth dies off it is possible to see pieces of wreckage over a much wider area including ink wells, the remains of clay pipes, ceramics and glass items.

Wine bottles can be found throughout the wreckage and beneath the deck they are stacked one up one down as they would originally have been stowed in their crates (Buhagiar & Murphy, 1990:2). Most of these have lost their corks and are empty. Some cargo items such as barrels of cement and bottles have been located off the main wreckage area.

Hardened cement in the original barrel shapes can be found largely concentrated on the port side of the wreck approximately amidships. The location of the barrels can possibly indicate the process of wrecking and the reader is referred to PART 3, 3.3.3. for further discussion of this wrecking process.

Artefacts

A number of cement barrels, bottles, ink wells and ship's fittings have been removed from the site and these are now displayed at the Maritime Museum.

Statement of significance

Archaeological

Examination of the hull remains could lead to further information on shipbuilding techniques and the evolution and design of riveted iron sailing ships built in the mid-1800s.

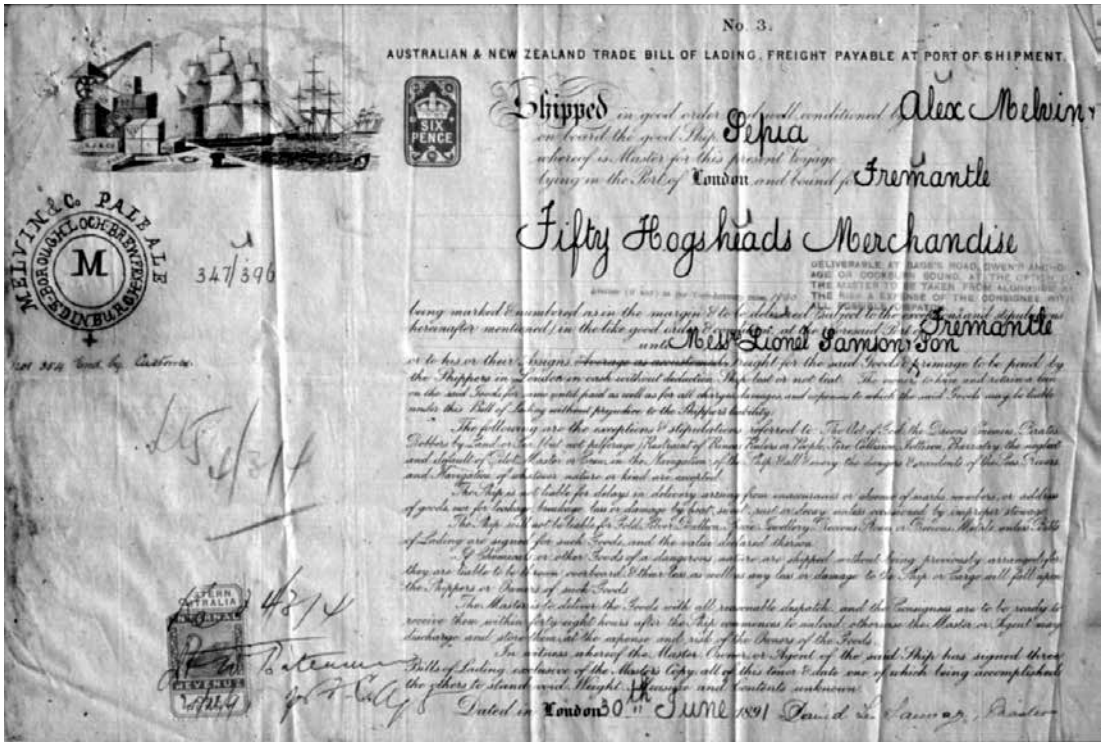
Recreational and educational

This site is a good example of an iron shipwreck. The substantial remains make it an excellent site for diving although it is subject to strong currents. Interpretation of the wreck site and artefacts from the vessel can demonstrate the nature of colonial Western Australia's reliance on imported goods, the hazards associated with the navigational approaches to Fremantle, and the importance of wreck site protection.

References

Buhagiar, C. & Murphy, M., 1990, The *Sepia*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990:2–11.

Gauntlett, M. & Punchard, E., 1990, *Sepia*, Wreck Inspection report, Graduate Diploma Course in Maritime Archaeology Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 4.


No. 3.

AUSTRALIAN & NEW ZEALAND TRADE BILL OF LADING. FREIGHT PAYABLE AT PORT OF SHIPMENT.

SIX PENCE

Shipped in good order and well conditioned by Alex Melvin on board the good Ship Sepia whereof is Master for this present voyage lying in the Port of London and bound for Fremantle

Fifty Hogsheads Merchandise

MELVIN & C. PALE ALE EDINBURGH M

347/396

Fremantle

Messrs Lionel Samson & Son

Dated in London 30th June 1891

Figure 106
A bill of lading for Sepia
(MA IL 285)

Dato (1879—c. 1893)

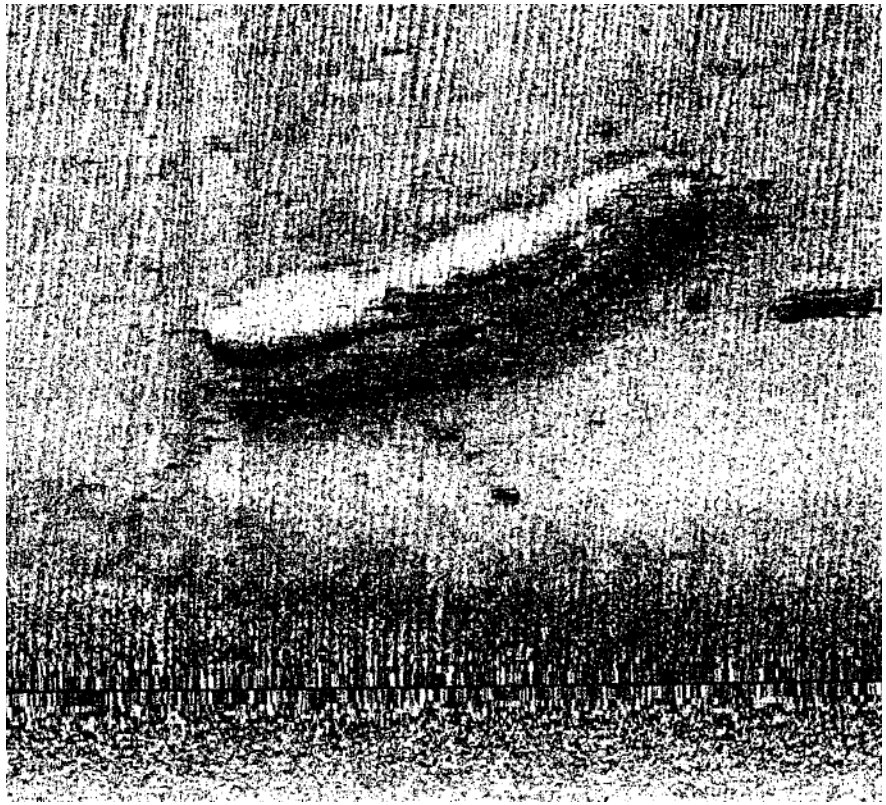


Figure 107
A side scan sonar image of the wreck site of Dato, *1995. Side scan sonar produces an image of the seabed similar to radar, the shadow effect shows the elevation of the hull. Small rocks and objects can be seen around the site.*

Figure 108
Transit photographs for the wreck site of Dato *(MA 4275)*

Where built:	Ekenas, Finland
Registered:	Laurvig, Finland
Rig type:	two-masted brigantine
Hull:	wood
Tonnage:	498
Length:	40.6 metres (133.2 feet)
Breadth:	9.6 metres (31.7 feet)
Depth:	5.1 metres (16.8 feet)
Port from:	at anchor, Careening Bay
Port to:	at anchor, Careening Bay
Date lost:	c. 1893
Location:	Careening Bay, Garden Island
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 14.2495' S
•	Longitude 115° 41.4830' E
Finders:	Underwater Explorers Club
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:205–6
MA file number: 196/72
ASD number: WA 105
Significance criteria: 1, 4, 5, 6

The vessel

As a brigantine, *Dato* had two masts. The foremast had a square rig and the mainmast was rigged fore and aft.

Dato arrived in Fremantle in 1893 with 600 tons of coal from Newcastle, New South Wales, on consignment to the Fremantle Gas Company. Under charter to W. D. Moore and Company, the vessel left for Quindalup to load jarrah for London. While waiting to clear Quindalup port on 27 February 1893 a storm from the north-east drove the brig ashore at the old jetty.

The vessel lost its mainmast and was lying over a kilometre offshore between Quindalup and Dunsborough. It was soon condemned as a total wreck. *Dato* had, however, sustained little permanent damage and was bought by the timber merchant H. J. Yelverton in partnership with Captain Reid, a local master mariner (Cairns & Henderson, 1995:205). After the damaged hull was repaired, the cargo of timber paving blocks was unloaded. Thorough examination of the hull revealed that several of the planks were smashed. These were replaced and the vessel was ready to be sold as a hulk.

Dato was resold to W. D. Moore and Company and towed to Fremantle by the tug *Dolphin*. Little is known of the hulk's subsequent history. There was some discussion between the government and owners with reference to using it to store explosives. The government was to consider purchasing the vessel to replace *Laughing Wave* which was used for the storage of dynamite at the time. Fremantle harbour-master, Captain Russell expressed the opinion that though *Dato* was suitable for such a purpose its ownership was not a viable proposition for the government. This suggests perhaps that the vessel was damaged in some way and could not easily be repaired. It was recommended that the hulk be used as a temporary storage until Moore and Company could arrange for the sale of the explosives (Cairns & Henderson, 1995:205).

Process of wrecking

There is no record of the sinking of the *Dato* hulk. It has been concluded that the vessel capsized and sank at its moorings in Careening Bay. During the latter half of the last century the bay was used to moor ships that were no longer sound enough to go to sea.

Site location

The site is located at the southern end of Careening Bay, Garden Island.

Site description

The remains of *Dato* lie upside down in 14.5 me-

tres of water on a sea-bed of soft calcareous mud. It is approximately 45 metres long and 7.8 metres wide with the bow facing north-west on a bearing of 340°. In profile, the site rises over 1 metre off the bottom, although the stern section is buried in mud and there is a large hole in the starboard side of the bow.

Muntz metal and copper sheathing have been observed on the seaward side of the vessel. It appears that the keel and stern-post have fallen toward the sea. The extent of wreckage below the mud has yet to be ascertained.

Visibility on the wreck is often very poor. The planking of the hull is covered in tube worms and marine borers.

Artefacts

Artefacts removed from the site aided in the identification of the wreck as that of *Dato*. An anchor has also been removed from the site and is now on display at Rockingham. The presence of Muntz metal on the wreck has been recorded on a limited part of the vessel suggesting perhaps that it was only used in repairs. The absence of this material (universally in use after 1846) could indicate that the wreck in Careening Bay was built prior to this period. However, length and breadth measurements correspond closely to those registered for *Dato*.

Statement of significance

Recreational and educational

This site lies in Controlled Naval Waters under the administration of the HMAS *Stirling* Naval Base on Garden Island and recreational diving is not possible here. Permission to dive on the site is restricted to projects that involve scientific or archaeological investigation. Written permission from the Commanding officer, HMAS *Stirling*, is required and access is limited to professional maritime scientists on an 'as needs' basis.

The site often has low visibility and therefore an overall impression of the site is not easily gained. Interpretation of the site and dissemination of information on the wreck can reveal aspects of scantily documented aspects of colonial ship use. It could also foster an appreciation of the importance of wreck protection.

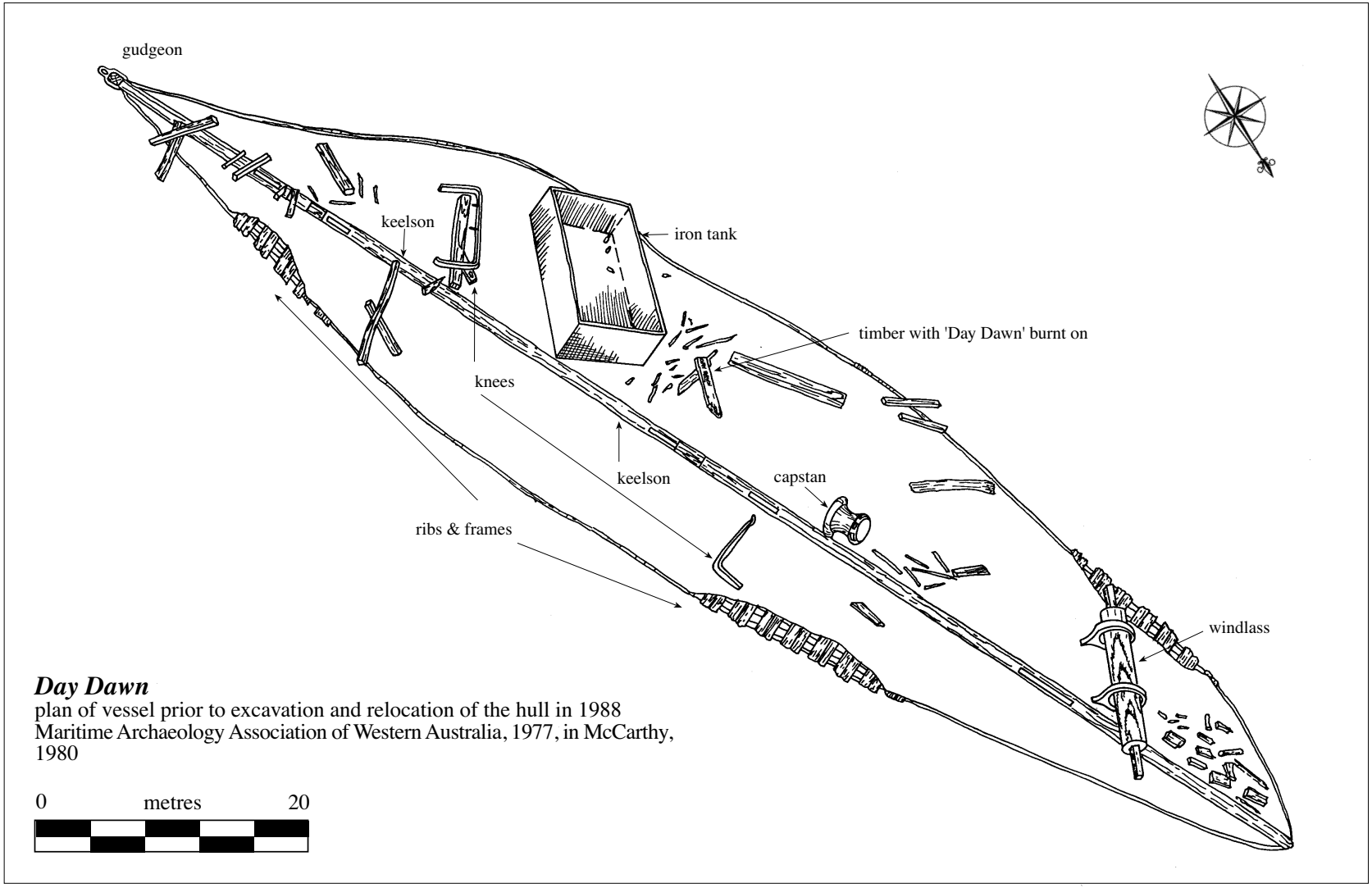
References

Wolfe, A., 1988, Management of the historic shipwrecks *Day Dawn* and *Dato* at Careening Bay, Garden Island, Western Australia, unpub. Consultant's Report, HMAS *Stirling* Environmental Working Paper No. 6.

Figure 109
A rare view of the hull planking on Dato. *The wreck site is often covered in weed and tube worms (DTO 13)*

Day Dawn (1851–1886)

Figure 110
The wreck site plan for Day Dawn *prior to relocation*



Day Dawn
plan of vessel prior to excavation and relocation of the hull in 1988
Maritime Archaeology Association of Western Australia, 1977, in McCarthy, 1980

Figure 111
Transit photographs for the wreck site of Day Dawn*(MA 4075)*

Official number:	46469
Where built:	Fairhaven, Massachusetts, USA
Registered:	Sydney (1872), Adelaide (1878)
Rig type:	barque
Hull:	wood
Tonnage:	355
Length:	36.9 metres (117.7 feet)
Breadth:	8.5 metres (27.1)
Depth:	4.4 metres (14.3 feet)
Port from:	at anchor, Careening Bay
Port to:	at anchor, Careening Bay
Date lost:	1886
Location:	Careening Bay, Garden Island
Chart number:	DMH 001
GPS position:	
•	Latitude 32° 14.5157' S
•	Longitude 115° 41.5855' E
Finders:	Navy dredgers (1970s)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3: 82–3
MA file number: 6/78/1, 2 & 3
ASD number: WA 108
Significance criteria: 1, 4, 5, 6

The vessel

Day Dawn was originally built as *Thomas Nye* in 1851. It was a ship-rigged vessel of the New Bedford whaler design. The tonnage was 461 tons but this was later reduced to 355 tons when the vessel was cut down to a barque.

As a whaler, *Thomas Nye* completed three successful voyages after being launched in June 1851. In 1862 the vessel was sold to H. A. Pierce, a prominent Boston ship merchant. It then reappears in Lloyd's Register for 1867 under the new name of *Day Dawn*, registered to the Port of Sydney and owned by P. Jones. In 1872, ownership changed to H. Barne, and by 1877 the ship had been re-registered in South Australia to a master mariner.

In 1885 *Day Dawn* is mentioned in the Bureau Veritas as having been converted to one deck with two sets of deck beams, but by 1887 the Lloyd's entry noted the vessel as 'wrecked'. Construction details indicate a square stern, no galleries, billet head and carvel build. The construction materials included timbers of oak, pitch pine and fir. Copper and iron fastenings were used, with yellow metal sheathing.

The wreck event

The career of *Day Dawn* is well documented from 1884 onwards. It made a number of trips to Western Australia including one to Quindalup. On 14 August 1886 the vessel was wrecked in South Australia while loading sleepers for the Silverton Railway. According to the *Adelaide Observer* it was 'the best vessel in the colonies' (quoted in McCarthy, 1980:30). It had gone ashore on a long shelving rocky bottom and was last reported 'lying on her bilge, hogged with 40 feet of her keel gone and full of water' (quoted in McCarthy, 1980:30). The crew were paid off and returned to Fremantle.

The vessel was condemned as a wreck although the hull was in good condition and was sold as a hulk for over £1 000. Archaeological evidence from the excavation of the site in Careening Bay suggests that the hulk was taken to Garden Island, to an area used at the time for mooring coal hulks and for ship repairs.

Identification and excavation

In the 1970s a wreck was uncovered in Careening Bay following dredging work in the area for development of a new naval facility. The wreck was moved to deeper water and was later excavated. The hull appeared to have been stripped and burnt, but among the excavated material were four jarrah planks bearing the name 'Day Dawn'

burnt into them. Also a capstan with the words 'D. A. Taylor, Boston', helped to confirm the identity of the wreck.

Continuing deterioration of the wreck led to various *in situ* wreck protection measures involving the dumping of sand to prevent further teredo worm damage. In 1988 the Navy planned to redevelop the small boat harbour which prompted the Museum to explore options for the removal of the wreck. It was once again lifted off the sea-bed and towed to deeper waters (Kimpton & Henderson, 1991).

Site location

The vessel lies at the southern end of Careening Bay.

Site description

The plan shows the shipwreck prior to its various relocations, with the major features *in situ*. However, recent wreck inspection reports suggest that the site requires further stabilisation work to prevent the movement of sand down the slope from crushing the hull flat. It currently lies in 1 to 4 metres of water.

Statement of significance

Recreational and educational

This site lies in Controlled Naval Waters, under the administration of the HMAS *Stirling* Naval Base on Garden Island and recreational diving is not possible here. Permission to dive on the site is restricted to projects that involve scientific or archaeological investigation. Written permission from the Commanding officer, HMAS *Stirling*, is required and access is limited to professional maritime scientists on an 'as needs' basis.

The site demonstrates an *in situ* attempt at wreck site stabilisation and protection methods. Interpretation of the site could demonstrate the importance of wreck site protection and scientific methods that allow this to take place. The vessel's history is a reminder of the importance of the timber industry to the development of Western Australia.

References

Kimpton, G. & Henderson, G., 1991, 'The last voyage of the *Day Dawn* wreck', *Bulletin of the Australian Institute of Maritime Archaeology*, 15.2:25–8.

McCarthy, M., 1980, *Excavation of the barque* Day Dawn, Western Australian Maritime Museum, Perth.

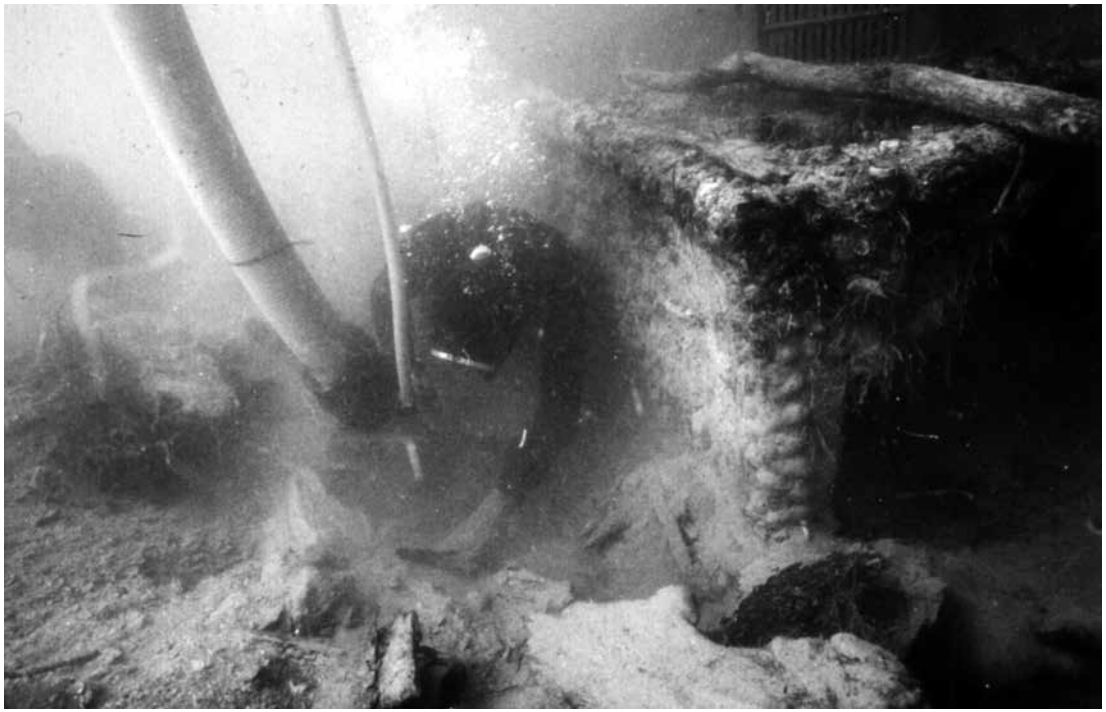
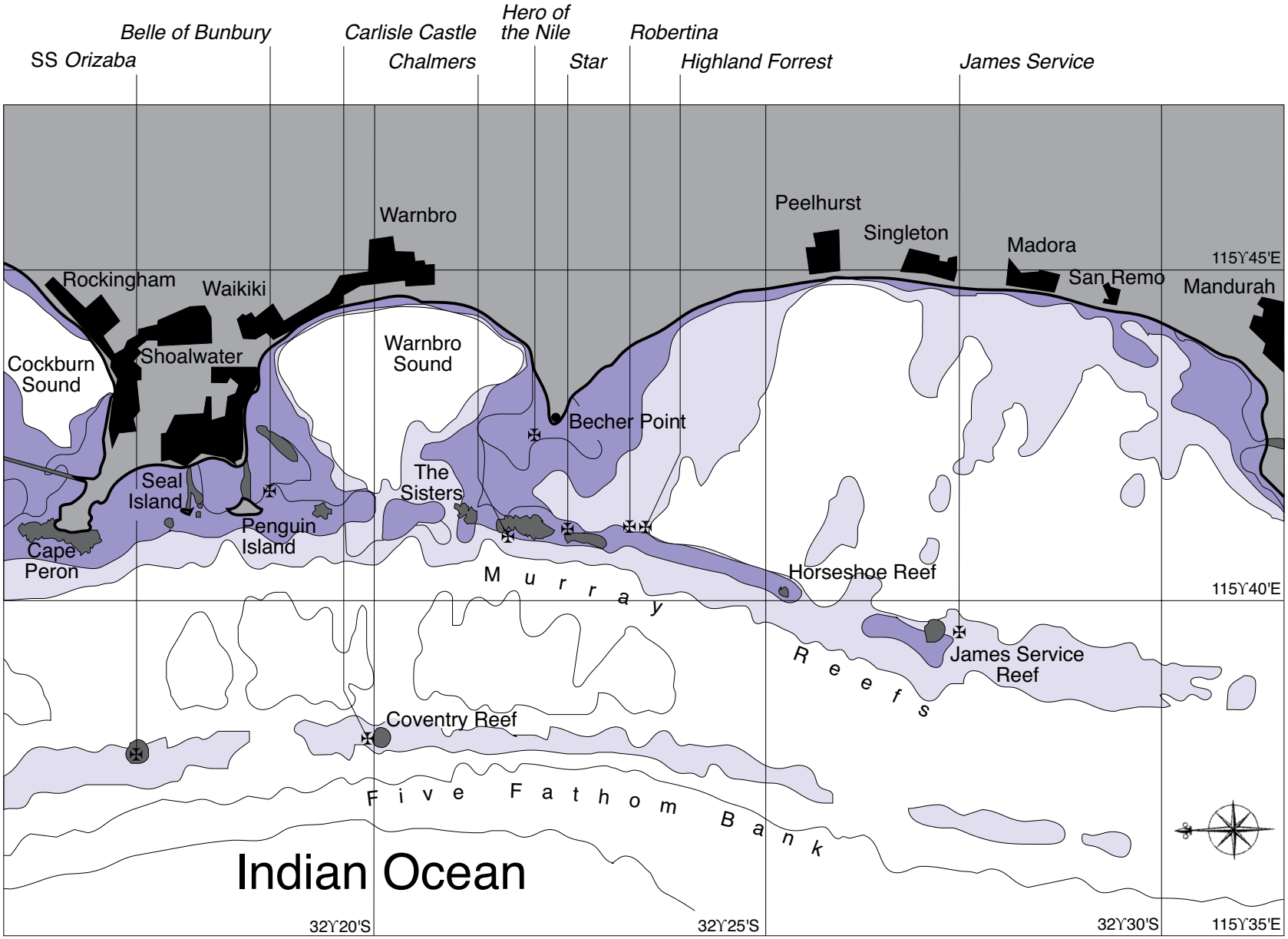


Figure 112
A diver excavating around the water-tank on the wreck site of Day Dawn *(DD A 190)*

Map 5. Pt Peron to Mandurah (north)



Wreck sites on Map 5

SS *Orizaba* (1886–1905)

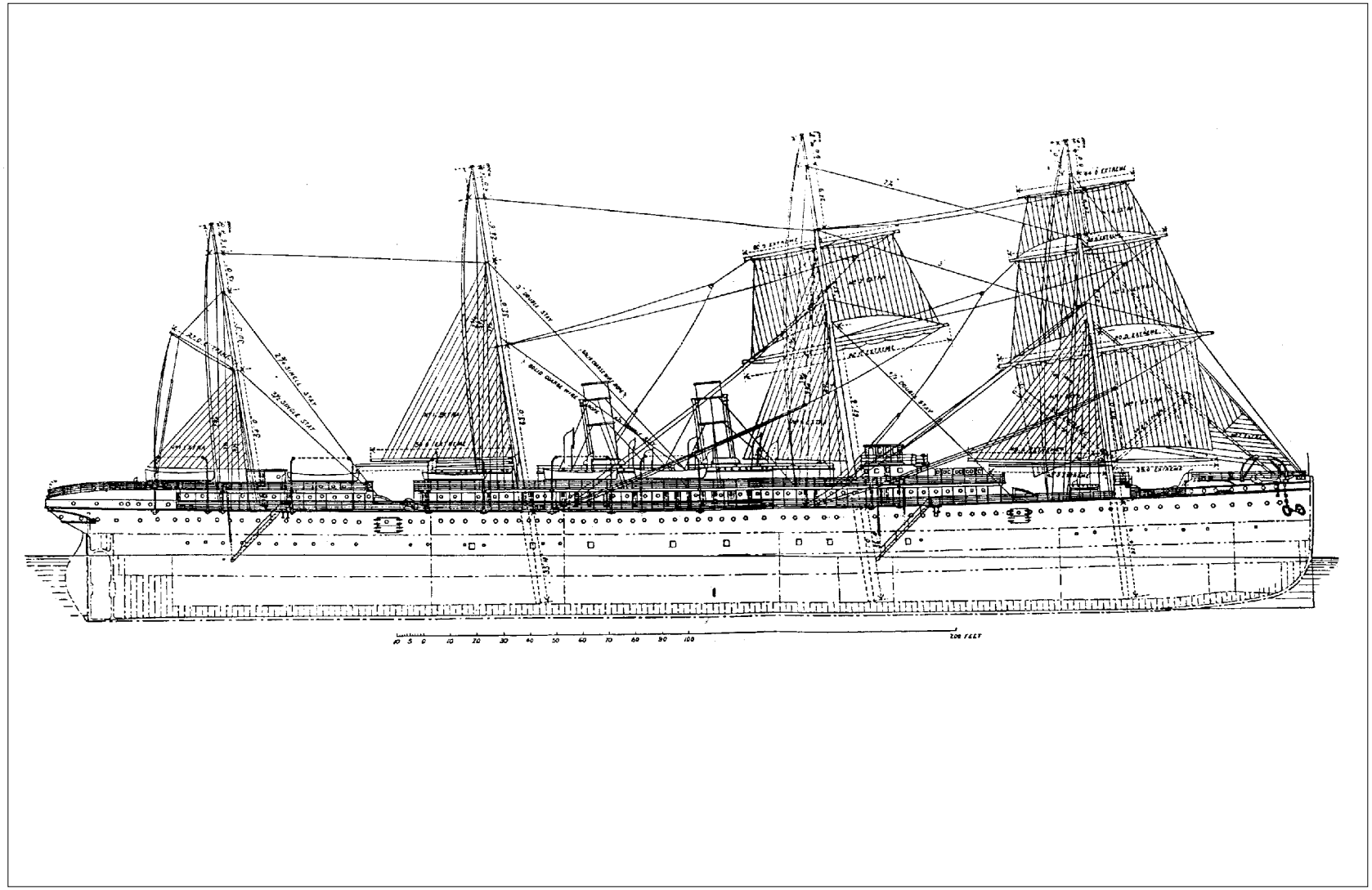


Figure 113
SS Orizaba*: elevation and plan views (*Engineering*, October 8, 1886).*

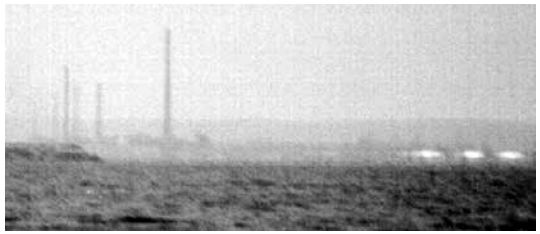


Figure 114
Transit photographs for the wreck site of SS Orizaba *(MA 2092)*

Where built:	Barrow, England
Rig type:	screw steamer
Hull:	iron
Tonnage:	6 077
Length:	140.2 metres (460 feet)
Breadth:	15 metres (49.3 feet)
Depth:	5.9 metres (19.4 feet)
Port from:	Schooner
Port to:	Sydney
Date lost:	17 February 1905
Location:	Five Fathom Bank between Point Peron and Garden Island
Chart number:	DMH 277
GPS position:	
•	Latitude 32° 16.9780' S
•	Longitude 115° 37.5950' E
Finder:	R. S. Barnett
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1994)
MA file number:	441/71
ASD number:	WA 819
Signficance criteria:	1, 4, 5, 6

The vessel

The SS *Orizaba* was built by the Barrow Ship Building Company for the Pacific Steam Navigation Company and was used for the Royal Mail service. Designed for the fast trade, the vessel was considered to be a great improvement on existing designs. It had three decks, was fitted with a triple-expansion engine of 7 000 hp and was capable of a speed of 14 knots. The vessel could carry 126 first-class, 154 second-class and 400 steerage-class passengers. It was one of a number of vessels that established the tradition of Orient Line ships on the Australia run and had names that began with 'O'. Detailed plans of the vessel are available and reprinted in *Engineering*, October 8, 1886.

On 15 February 1905 SS *Orizaba* was 529.1 kilometres (286 nautical miles) south of Rottnest Island, under the command of Captain Archer. The following day thick haze was hanging over a calm sea and the vessel was on a course toward Fremantle of south 70° east, at a speed of 14 knots. Aboard the vessel were 160 passengers and 2 500 tons of general cargo. By 9 a.m. on the 16th Rottnest Island had still not been sighted. When land was sighted through the haze it was taken to be Buckland Hill, lying to the north of Fremantle. At 11.20 a.m. breakers were seen off the starboard side and when the haze lifted land could be seen on both sides of the vessel, although Fremantle was nowhere in sight. The ship was stopped and soundings taken all around which indicated a depth of between 6 and 8 fathoms. A new course was steered as the vessel sought the open sea (Wolfe, 1986:2).

The wreck event

Just as the passengers were preparing for lunch SS *Orizaba* came to a sudden holt, grounding on Five Fathom Bank. The engines were immediately put full astern but the vessel stuck fast with its midship section resting on a sand and limestone outcrop. Message of the wreck reached the harbour-master and the tug *Gannett* arrived and took the passengers off, together with the luggage and mail. The remaining crew and Captain Archer were all off the vessel by 21 February.

Salvage

Salvage operations were begun immediately. The engine room had been flooded but the holds had remained dry. On Friday, 18 February, 875 tons of dry cargo had been removed from the wreck. On the following Monday, however, the watertight bulkheads gave way and further salvage had to be undertaken by divers.

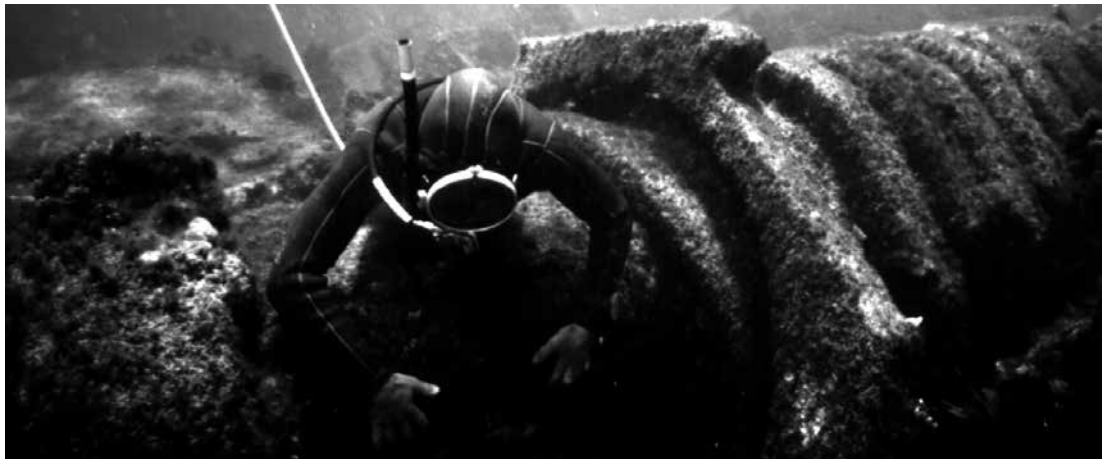


Figure 115
A wreck inspection on SS Orizaba *(0R 39)*

On 28 February an auction of the cargo was held. Items included 60 cases of drapery, one case of electrical goods, 9 cases of merchandise and one case of bicycles. Machinery, varnish, chemicals, glassware, books and tea were also sold. The goods fetched £1 600.

Examination of the hull revealed that it would be a difficult process to get the vessel off and the representative for the underwriters thought there were insufficient resources within Western Australia to attempt such a full salvage operation. In 1907 the remains of the hull were still visible on the reef top.

The remains of the vessel were sold at auction for £3 750 and the remaining cargo for £500. The present owner of the site is R. S. Barnett, who purchased the wreck in 1970. He recovered the ship's bell in the same year.

Figure 116
The bell from the SS Orizaba *(MA 4766)*

Inquiry

At the inquiry into the stranding Captain Archer was charged with having committed an error of judgement in attempting to take the vessel over Five Fathom Bank. He was censored and ordered to pay half the cost of the inquiry although the court noted that the haze and strong current had contributed to the wrecking.

Site location

The site is on Five Fathom Bank between Cape Peron and Garden Island.

Site description

The wreck lies with its bow out to sea on a north-west by south-west axis, in a depth of water ranging from 4 to 7 metres. Parts of the site come within 3 metres of the surface. The area is subject to heavy swell and diving conditions on the site can be hazardous. Three boilers are still intact although one is gradually losing its shell. The boilers are the most imposing feature on the site with the crank-shaft and conrods lying exposed on the reef top.

The vessel's floors are still evident although all plating upwards of the bilge has disintegrated. In the midship section the steering gear remains obvious (McCarthy, 1980c:1).

Statement of significance

HISTORICAL AND TECHNICAL

The wreck site is of historical significance as the remains of a vessel involved in the transference of mail from London to Albany, and it was owned and run by the Pacific Steam Navigation Company. It is representative of many general cargo and pas-

senger vessels operating in the trade to Australia during the last quarter of the nineteenth century. The vessel's design is of particular significance. At the time of its construction it incorporated several new features including the triple-expansion engine. A type of steel known as 'Siemens Steel' was used in the construction of the boilers.

ARCHAEOLOGICAL

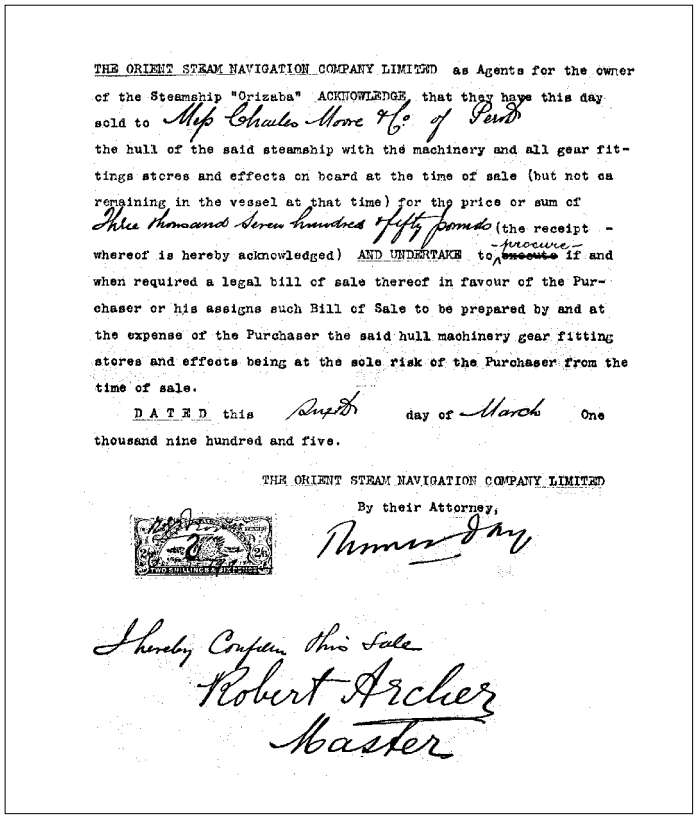
Detailed plans of the vessel were made at the time of its construction. However, examination of the remains could lead to a re-evaluation of the historical record. The site could also be viewed in comparison to the remains of wrecks of similar design found in other parts of Australia including *Gulf of Carpentaria*, which sank at Wilsons Promontory in 1885, *Catterthun* which sank in 1887 off Seal Rocks in New South Wales and *Riverina,* wrecked off Ram Head, Gabo Island in 1887.

References

Engineering, October 8, 1886.

McCarthy, M., 1980c, SS *Orizaba*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, no report number.

Wolfe, A. 1986, SS *Orizaba*, Graduate Diploma Course in Maritime Archaeology Report, Department of Maritime Archaeology, Western Australian Maritime Museum.



THE ORIENT STEAM NAVIGATION COMPANY LIMITED as Agents for the owner of the Steamship "Orizaba" ACKNOWLEDGE that they have this day sold to Mess Charles Morse & Co of Peru the hull of the said steamship with the machinery and all gear fittings stores and effects on board at the time of sale (but not as remaining in the vessel at that time) for the price or sum of Three thousand Seven hundred & fifty pounds (the receipt whereof is hereby acknowledged) AND UNDERTAKE to ~~execute~~ procure if and when required a legal bill of sale thereof in favour of the Purchaser or his assigns such Bill of Sale to be prepared by and at the expense of the Purchaser the said hull machinery gear fitting stores and effects being at the sole risk of the Purchaser from the time of sale.

DATED this Twenty day of March One thousand nine hundred and five.

THE ORIENT STEAM NAVIGATION COMPANY LIMITED

By their Attorney,

I hereby Confirm this Sale

Robert Archer

Master

Figure 117
A registration certificate for SS Orizaba *(MA file no. 447/71)*

Belle of Bunbury (1877–1886)

Figure 118
The wreck site plan for Belle of Bunbury

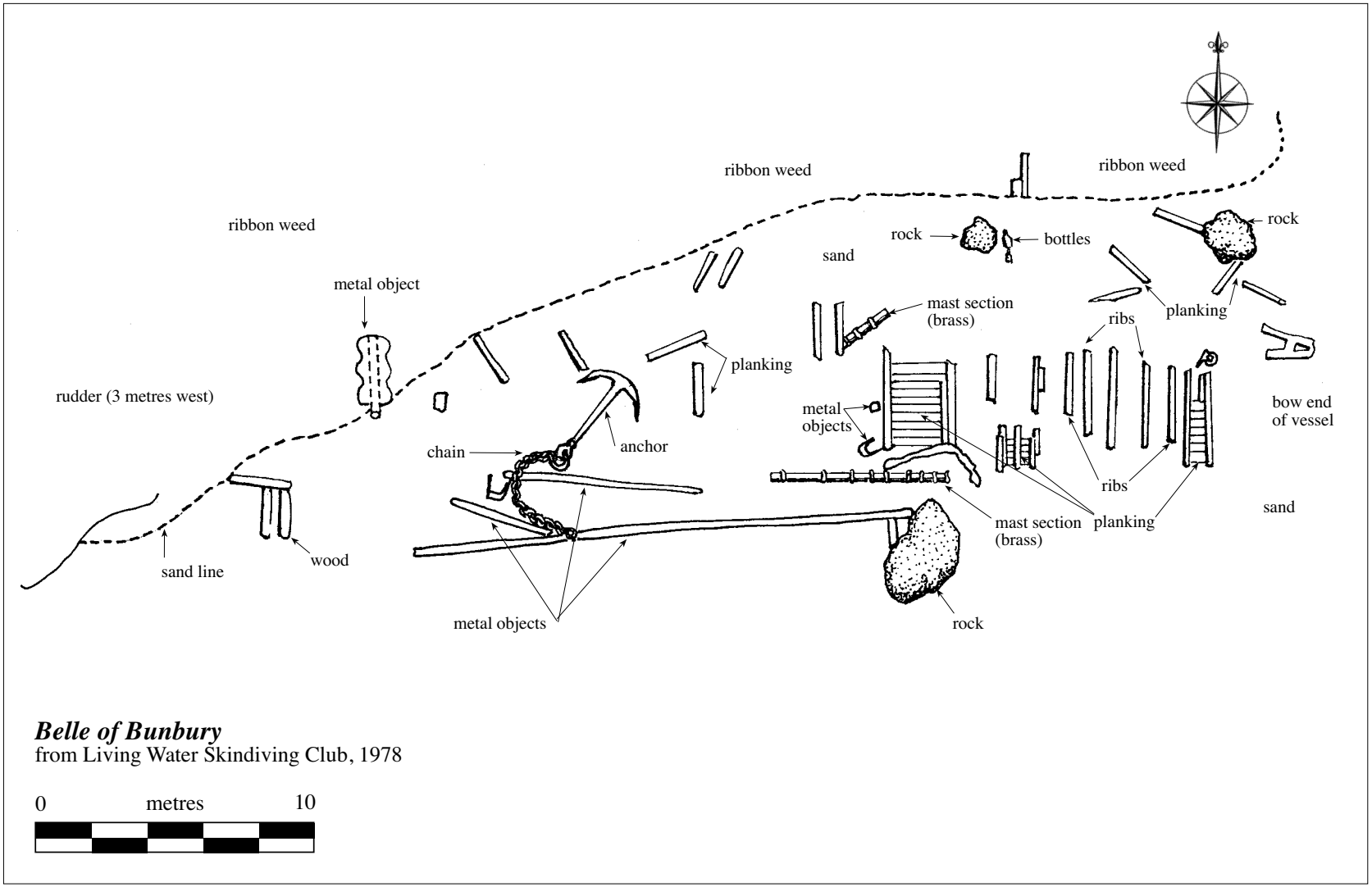


Figure 119
Transit photographs for the wreck site of Belle of Bunbury *(MA 4705)*

Official number:	75298
Where built:	Bunbury, Western Australia
Registered:	Fremantle
Rig type:	fore-and-aft schooner
Hull:	wood
Tonnage:	42
Length:	16.4 metres (53.8 feet)
Breadth:	4.9 metres (16.1 feet)
Depth:	2.1 metres (6.9 feet)
Port from:	Bunbury
Port to:	Fremantle
Date lost:	10 December 1886
Location:	Safety Bay, Pub Passage
Chart number:	DMH 277
GPS position:	
•	Latitude 32° 18.7386' S
•	Longitude 115° 41.4013' E
Finders:	G. Anderton and members of the Living Water Skindiving Club (1975)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:66
MA file number: 373/77
ASD number: WA 46
Significance criteria: 1, 4, 5, 6

The vessel

Belle of Bunbury was a coastal vessel trading between Bunbury, Fremantle and Geraldton during the 1880s. A fore-and-aft rigged schooner, the carvel-built vessel had one deck, two masts, a billet head and an oval stern. Built by James Gibbs it was owned by Hayward, Stewart and Reid.

The vessel carried mainly general agricultural produce along the coast. It was during one such voyage that *Belle of Bunbury* came to be wrecked. The schooner left Bunbury on 9 December 1886. On board the vessel were the master William Miller, the mate, the cook and two passengers, and a cargo of potatoes and seventy bales of wool (Cairns & Henderson, 1995:66). A southerly wind was blowing and the captain ordered the crew to keep the vessel close to the coast. The weather was fine with a light wind blowing in an easterly direction. The decision was made to run up the inside of Murray Reef, a common course for local vessels travelling the coast in these conditions.

The wreck event

Despite the mild conditions and the ten-year experience of the captain in these coastal waters, the vessel when running under free sail, struck a rock at 8.45 a.m. on 10 December. At the subsequent inquiry it was revealed that the lead had been on deck since 8.00 a.m. but Captain Miller saw no need to deploy it. The mate was stationed as look-out. The vessel struck a rock just off Penguin Island and sailed a further 80 metres before sinking in 6 metres of water. It was maintained throughout the inquiry that all the crew were sober, despite allegations to the contrary.

Site location

The site is located in Safety Bay, south of Penguin Island.

Site description

The wreck of *Belle of Bunbury,* which lies in 6 to 7 metres of water on a sand bottom, consists mainly of scattered timbers. Most of these timbers are half buried and the site is often subject to complete burial, especially during the summer months before the winter storms scour the site. A section of keelson, recorded during a site inspection in 1977, suggests that the vessel lies on a south-east by north-west axis. An anchor with an iron stock is located at the western end probably indicates the bow. The anchor measures 1.4 metres along the shank from ring to crown and the flukes are 1.6 metres across. The stock has a length of 1.8

metres. Although the hull is broken up it is likely that a significant proportion of the vessel remains buried in the sand. The predominant south-westerly swell can reduce visibility to zero and subject the site to bottom surge.

Artefacts

Several of the ship's fittings and cargoes have been removed from the site. Those from the initial site inspection of 1977 include a rib or frame with iron bolts, a sample of copper sheathing on wood, a wine bottle with contents and cork, an iron dead eye and a chain plate with wire rope attached. A rudder was raised in 1981, 30 metres south-west of the site. It is well preserved with copper-zinc alloy sheathing and wooden fastening bolts.

Statement of significance

Historical

This site is of historical significance as an example of a locally built vessel involved in the coastal trade of Western Australia. It is one of only three wrecks in the survey region to have been built in Western Australia.

Archaeological

Through the examination of hull remains this site could contribute to the knowledge of locally built coastal traders. The number of Western Australian vessels in the overall shipwreck resource of Western Australia is limited.

References

Sledge, S., 1975a, *Belle of Bunbury*, unpub. Wreck Inspection Report, Department of Maritime Archaeology Department, Western Australian Maritime Museum, No. 22.

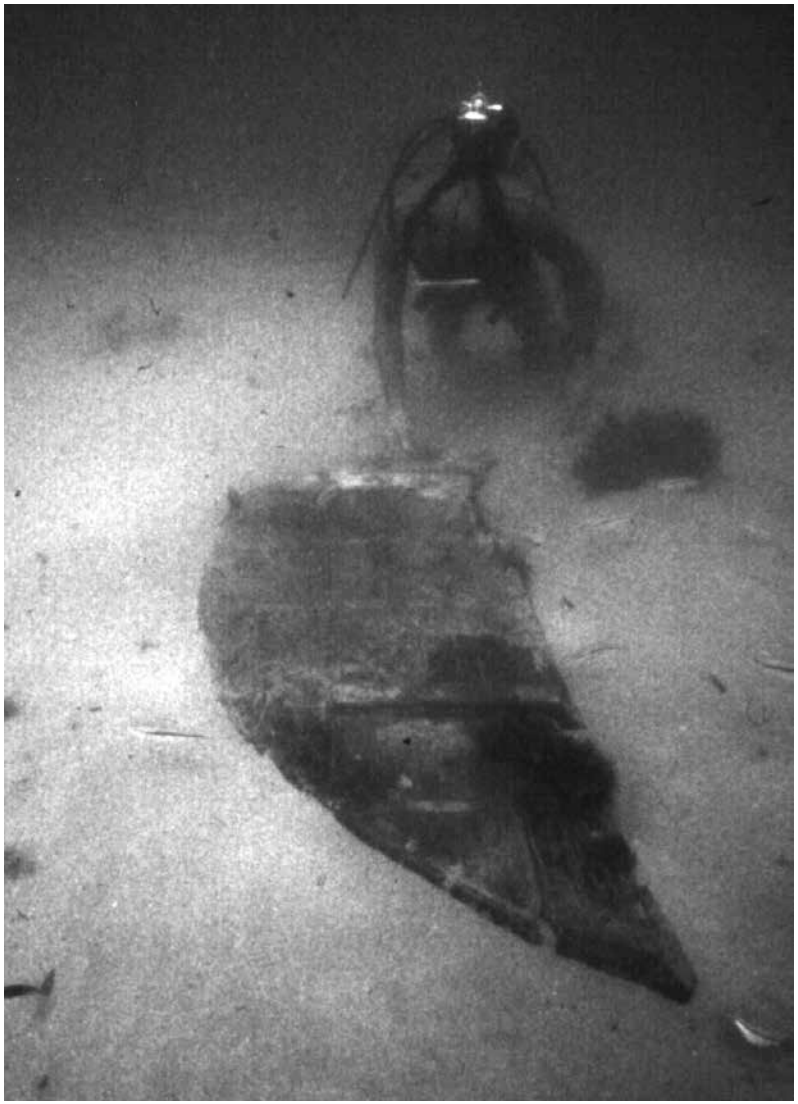
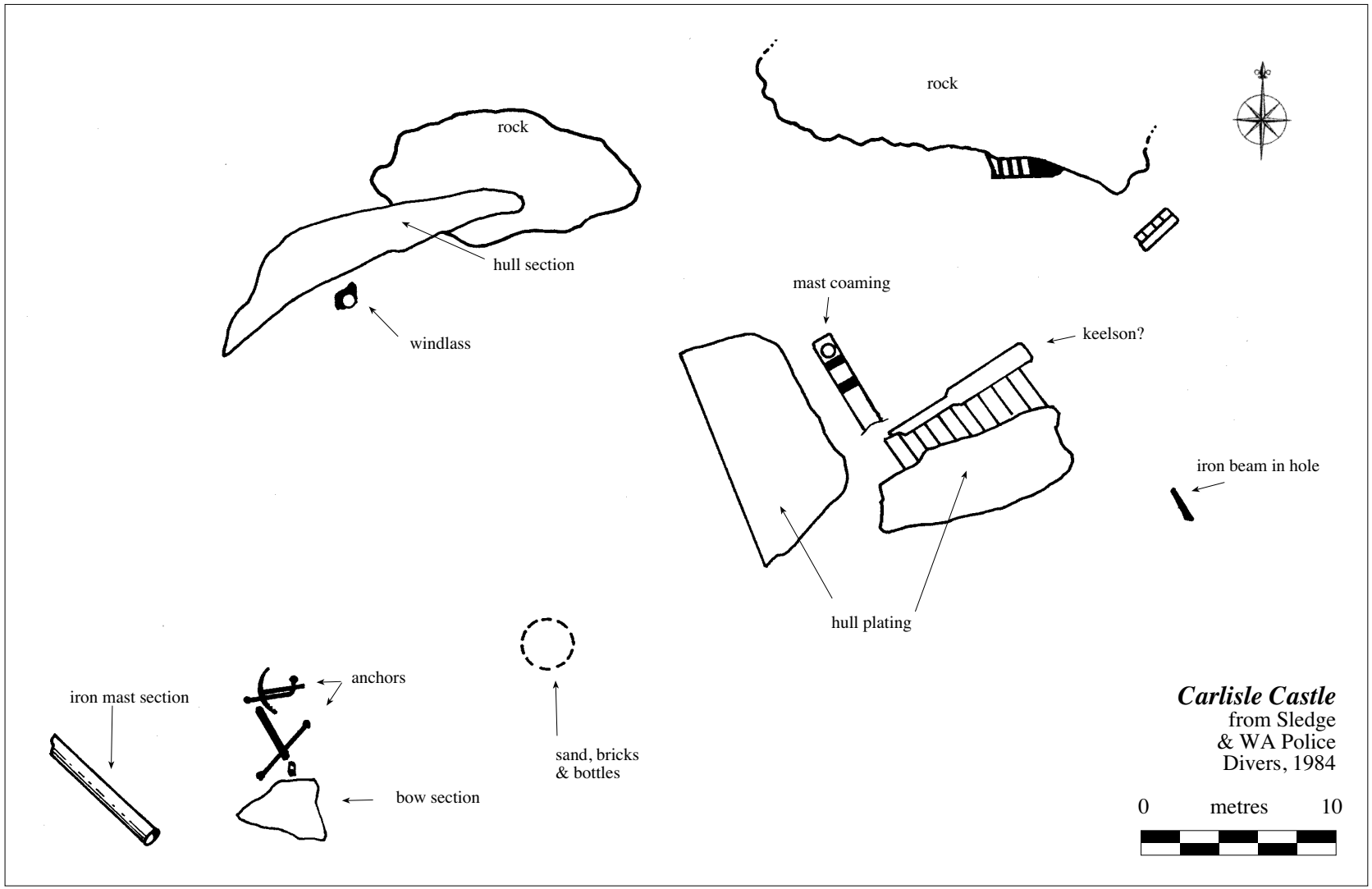


Figure 120
Rudder from the
Belle of Bunbury
(BB 4)

Carlisle Castle (1868–1899)

Figure 121
The wreck site plan
Carlisle Castle



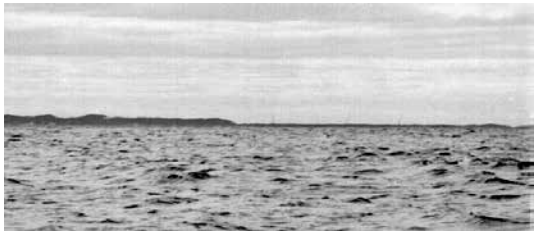


Figure 122
Transit photographs for the wreck site of Carlisle Castle *(MA 2518)*

Official number:	60871
Where built:	Blackwall, London
Registered:	London
Rig type:	barque
Hull:	iron
Tonnage:	1484 gross
Length:	70 metres (229.8 feet)
Breadth:	11.5 metres (37.8 feet)
Depth:	6.9 metres (22.8 feet)
Port from:	Glasgow
Port to:	Fremantle
Date lost:	11 July 1899
Location:	Coventry Reef (western side, northern end)
Chart number:	AUS 277
GPS position:	
•	Latitude 32° 20.1060' S
•	Longitude 115° 37.9860' E
Finders:	Underwater Explorers Club (1977)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 3:289–92

MA file number:	406/71
ASD number:	WA 510
Significance criteria:	1, 3, 4, 5, 6

The vessel

Carlisle Castle was built of iron to Lloyd's A1 specification. The vessel had two decks and one collision bulkhead. It was initially built as a fully-rigged ship with a forecastle of 12.8 metres and a bar keel of 23 metres. It was converted to a barque rig when sold to J. Robertson in 1893–4 (Sledge, 1984).

Carlisle Castle was among the ships expected to arrive in Fremantle in early July 1899. It was under the command of Captain Lindsay and carrying a cargo of railway irons, water-pipes, house bricks, cloth, wines, spirits, ale and various groceries. Also on board were 2 365 locking bars consigned to Messrs G. and C. Hoskins of Midland Junction, contractors of pipes required for the Goldfields Water Scheme. The estimated value of the cargo was between £40 000 and £50 000.

On 11 July, a force ten westerly storm swept Fremantle which resulted in the wreck of a number of small coastal craft, as well as *City of York*. The conditions at the time were described as treacherous. There were various reports from Rockingham that wreckage was washing ashore on Penguin Island. It became apparent that there were two wrecks, one of which had occurred closer to Rottnest Island (*City of York)*. After arranging for the survivors of this shipwreck to be picked up off the vessel, the harbour-master, Russell, set off to investigate the other vessel (Cairns & Henderson, 1995:290).

The wreck event

Russell could see no names on the spars and rigging that floated on Coventry Reef, but a number of masts and spars were visible above the water-line on the westward end of the reef.

Nothing is known precisely of the sequence of events that led to the wreck but it has been suggested that Captain Lindsay could not get a reliable sun or star fix on the Tuesday owing to the bad weather conditions. It is unlikely that he would have been able to take soundings for the same reason. Unable to see the Rottnest Island light he probably had the vessel lay-to on the port tack to wait for daybreak. The break of Coventry Reef was probably not noticed in the inclement conditions and *Carlisle Castle* may well have drifted and struck on its starboard side (Cairns & Henderson, 1995:290).

On inspection, Russell surmised that the vessel had sunk immediately and that all hands had gone down with the vessel. With such a heavy cargo of railway iron in the hold the vessel would probably

have gone down too quickly for the crew to escape. The exact number of casualties is not known, although the crew would have numbered between 24 and 26 given the size of the vessel (Cairns & Henderson, 1995:290). Only seven bodies were found.

Salvage

Salvage parties began collecting and selling the wreckage, including such items as soap and spirits. The hull and cargo were sold to Mr Bloom who represented a Perth syndicate. The hazards associated with the salvage of a vessel in such a location were reflected in the prices of £21 for the cargo and £5 for the hull. The purchasers were able to employ a diver, however, and he removed a large quantity of material from the wreck site. By April 1900 the Carlisle Castle Salvage Company had salvaged about £5 000 worth of goods although only £2 100 of it had been sold at this time.

Site location

The wreck site rests on the western side of Coventry Reef, at the northern end, 6.4 kilometres south-west of Rockingham and 3.2 kilometres west of Penguin Island.

Site description

The site lies in approximately 7.5 metres of water on an exposed rock bottom along a north-west to south-east axis, with the stern just below the water-line and the bow pointing out into deeper water. Iron railway lines are found at the aft end of the vessel, water pipes amidships and house bricks in the bow.

The wreckage is spread over an area of 50 metres by 50 metres, with large and small sections of hull plating on iron frames lying flattened against the sea-bed at all angles. In several places, sections of the hull lie broken on the reef top. There is an anchor with the flukes concealed under plating, but the shank and iron stock (in the set position) stand up from the sea-bed. A smaller anchor stands nearby, but this lies flat with its stock in the stowage position. No chain was attached to either anchor. This evidence may suggest that there was no time to deploy anchors during the wrecking.

A wreck site inspection in 1985 recorded that green bottles and cobalt blue bottles were freshly uncovered from between the frames, indicating that looting had recently taken place. The majority of the wreckage was covered in moderate to heavy marine growth.

Artefacts

An assortment of bottles was recovered from the site, inlcuding some which had contained beverages, wine (possibly 'moselle'), pickle, castor oil, sauce and coffee essence bottles. One porcelain cup, a brass bell together with wooden handle and iron clapper, a wooden toy, and a brick marked 'CRAITHCRAIG' have also been conserved for the Museum collection.

Two plaques have been placed at the site describing some of the vessel's history.

Statement of significance

SOCIAL

The wreck of this vessel, combined with the loss of *City of York*, created a double tragedy that impacted on the local community. Money was collected for the relief of shipwreck victims and a monument was erected at Fremantle cemetery.

References

Lubbock, B., 1922, *The Blackwall fr___gates*, Charles E. Lauriat, Boston.

1975, *The colonial clippers,* Brown, Son and Ferguson, Glasgow.

Sledge, S., 1984, *Carlisle Castle*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 81.

Figure 123
Divers examining glass bottles on the wreck site of Carlisle Castle *(CC A 2)*

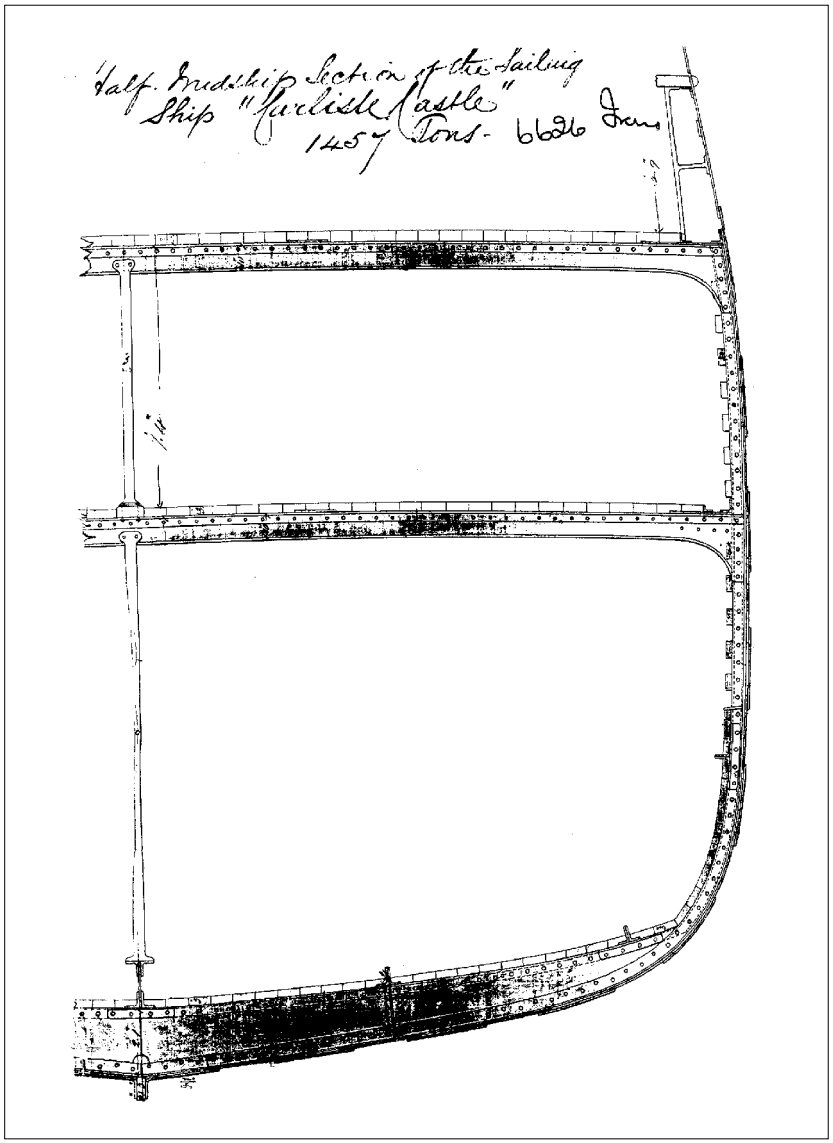
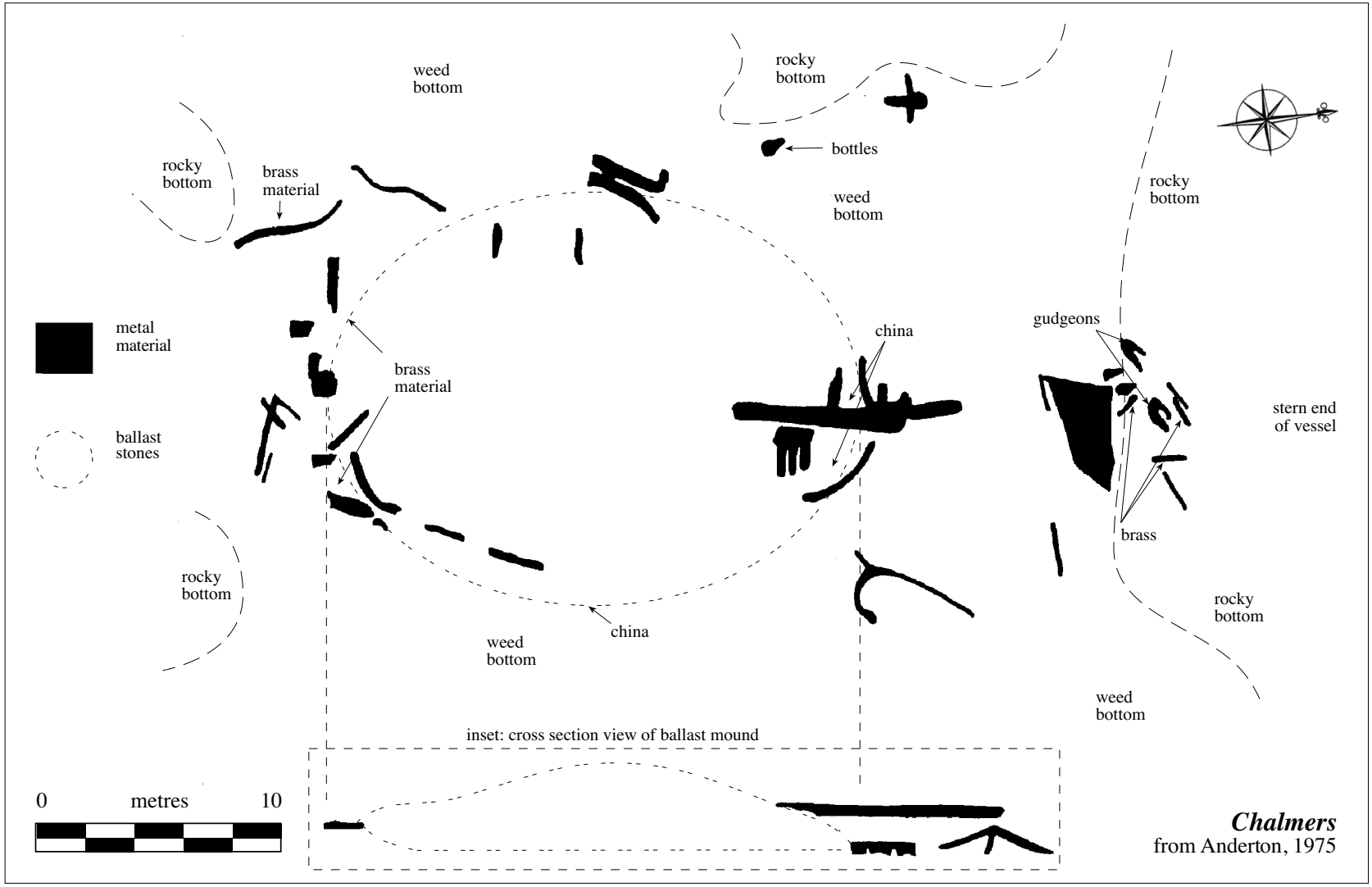


Figure 124
A half midship section of the sailing ship Carlisle Castle *(Lloyd's Register Office)*

Chalmers (1851–1874)

Figure 125
The wreck site plan for Chalmers



Official number:	12542
Where built:	Sunderland, England
Rig type:	barque
Hull:	wood
Tonnage:	594
Length:	40.1 metres (131.5 feet)
Breadth:	9.1 metres (29.8 feet)
Depth:	6.2 metres (20.2 feet)
Port from:	Mauritius
Port to:	Fremantle
Date Lost:	19 March 1874
Location:	Warnbro Sound, Sisters Reef
Chart number:	DMH 277
GPS position:	
•	Latitude 32° 22.1000' S
•	Longitude 115° 41.3600' E
Finders:	G. Anderton, J. Prince and L. Gillet (16 May 1975)
Protection:	*Historic Shipwreck Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:141–2
MA file number: 195/75
ASD number: WA 77
Significance criteria: 1, 4, 5, 6

The vessel

Chalmers was a three-masted wooden vessel of 594 tons, built in Sunderland, England, for James Laing in 1851. It maintained a Lloyd's A1 classification for the duration of the 23 years of survey, and had an English oak stem and stern-post, and nine pairs of iron hanging knees. The exterior, including the flat upper deck was fastened entirely with yellow metal (Henderson & Henderson, 1985:142).

The wreck event

The vessel was carrying a cargo of sugar from Mauritius to Fremantle under Captain Alexander, when it struck Murray Reef on 19 March 1874.

It first struck the reef between 11 p.m. and 12 p.m. but continued to sail. Although it was night time, no soundings were taken. The captain did not pull the helm down and the vessel continued on the same east by south course. After *Chalmers* struck a second time it got clear again into about 2.5 to 3 fathoms (4.6 to 5.8 metres) of water, but later struck fast on a sand bottom. Although the vessel was taking water at a rate of 1 inch (2.5 centimetres) per hour no effort was made to pump it out.

Inquiry

Captain Alexander was charged with negligence over the wrecking of *Chalmers*. At the inquiry he testified that he had seen a bush fire on the mainland and had steered for it believing it to be the Rottnest Island light. However, it was found that even after the vessel was initially hove afloat by the kedge, he neglected to anchor it or to use the boat to ascertain if a clear passage out was practicable, before the warp was cut. The captain had his certificate cancelled.

Salvage

The wreck of *Chalmers* was sold at auction to Messrs J. and W. Bateman for £19. Although most of the cargo had been destroyed much of the ship's equipment was saved. The Batemans employed three lighters to dismantle the wreck (Henderson & Henderson, 1985:141).

Site location

The wreck site of *Chalmers* is located in Warnbro Sound near the southern end of Sisters Reef, approximately 2.6 kilometres west of Becher Point and 1.4 kilometres south of Sisters Rocks. It is located on the inshore side of a breaking reef. Transit photographs are not yet available for this site.

Site description

The wreck lies in 4 to 7 metres of water on a bottom composed of coral and sand patches. It is orientated on a north to south axis with the stern facing to the north. When last surveyed in 1975 the site was predominantly obscured by seaweed and marine organisms.

The hull of the vessel is broken up, with only a few timbers showing above the sand. Two sections of keel were exposed and at the northern end large floor timbers were found to be attached to the keel. Several tons of ballast in the form of small stones still exist on site. In the sand patches a number of small artefacts were visible. Scattered across the wreck site were large yellow metal fastenings.

Several small artefacts were raised during the inspection, and these included some examples of the fastenings and ship's fittings.

References

Sledge, S., 1975b, *Chalmers,* unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 21.

Anderton, G., 1975, Department of Maritime Archaeology, Western Australian Maritime Museum File No. 1995/75.

Hero of the Nile (1852–1876)

Official number:	4668
Where built:	West Cowes, England
Registered:	London
Rig type:	barque
Hull:	wood
Tonnage:	356
Length:	38.4 metres (126.5 feet)
Breadth:	7.6 metres (25 feet)
Depth:	5.2 metres (17.2 feet)
Port from:	Melbourne
Port to:	Lacepede Island
Date lost:	20 October 1876
Location:	Warnbro Sound, Long Point
Chart number:	DMH 277
GPS position:	This site is presently buried and its location needs confirmation. An approximate position is:
•	Latitude 32° 21.8822' S
•	Longitude 115° 42.1517' E
Finders:	Mr Broz, H. Roberts and the Underwater Explorers Club (1966)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:202–3
MAD file number: 431/71
ASD number: WA 178
Significance criteria: 1, 4, 6

The vessel
The barque *Hero of the Nile* was owned by Thomas and Westmoreland, London. It was of wood construction and copper fastened. Under the command of Captain Dughall the vessel was in sand ballast when it set off from Melbourne bound for the Lacepede Islands to pick up a cargo of guano.

On 19 October 1876, the captain estimated the position of the vessel as 55 kilometres off Cape Bouvard. With the wind behind the vessel and full sails set, *Hero of the Nile* steered a course north-east towards the Rottnest Lighthouse. Early on the 20th the land on the lee prompted an alteration of the course to north-west. Expecting that this new course would take him clear of land Dughall did not take any soundings. A general chart of the area was aboard but it did not detail the hazardous currents in the region. The currents took the vessel onto the inside of Murray Reef.

The wreck event
Hero of the Nile struck Long Point at 2 p.m. on that day. Although Captain Dughall backed the sails it was to no avail and they were furled. The vessel grounded heavily on the reef all night and eventually filled with water after the pumps became choked with the sand ballast. At daybreak an anchor and warp was run out but they too were of little use (Henderson & Henderson, 1988:202).

The thirteen crew, two passengers and the master all made it safely to shore in the ship's boat. Captain Johnston passed the stricken vessel in the cutter *Eveline Mary* and provided Dughall and his wife with transport to Fremantle. When the harbour-master visited the wreck the next day it was estimated to lie 275 metres from Long Point, canted over on its port side and held down by sand ballast.

Salvage
Unsuccessful attempts were made to remove the vessel using warp and anchor to kedge it off. It was later condemned and sold as a wreck at public auction. The hull was sold to Messrs Higham and Sons for £100, and the gear and furniture were sold in small lots to a total sum of £500.

Inquiry
The captain was exempt from blame as the court of inquiry declared that the charts of the area were not good enough for coastal navigation. The wreck appears on the Warnbro Sound chart of 1879.

Site location
The wreck site lies about 300 metres north-east of Long Point.

Site description
The wreck lies on a north-east to south-west axis in a depth of 2 to 3 metres, on a sand bottom surrounded by shallow weed banks. The vessel was travelling in a northerly direction when the wrecking occurred. The bow and stern are not discernible.

The wreck site has two rows of heavily overgrown outcropping which, upon inspection in 1974, proved to be iron. Fanning revealed timber in good condition under the sand. No shards of pottery nor glassware were evident. The majority of the hull structure does not appear to be broken up and probably lies buried in the sand. Contemporary salvage work on the site probably means there are few

Figure 126
Transit photographs for the wreck site Hero of the Nile *(MA 4705)*

ship's fittings or the remains of cargo to be found.

Artefacts

A bell inscribed with the name and date of the vessel was presented to the Museum in 1990.

Statement of significance

HISTORICAL

The remains of *Hero of the Nile* are significant as a vessel that was involved in the international trade of guano from northern Western Australia. At the time this trade was mostly illegal. The wreck event demonstrates the difficulties associated with navigation of the coastline in this region, during the early colonial settlement of Western Australia.

References

Sledge, S., 1974a, *Hero of the Nile*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 9.

Star (1876–1880)

Figure 127
The wreck site plan for Star

Figure 128
Transit photographs for the wreck site of Star *(MA 2096)*

Official number:	72482
Where built:	Fremantle, Western Australia
Registered:	Fremantle
Rig type:	schooner
Hull:	wood
Tonnage:	70
Length:	24.1 metres (79.1 feet)
Breadth:	5.3 metres (17.5 feet)
Depth:	2.3 metres (7.7 feet)
Port from:	Geographe Bay
Port to:	Fremantle
Date lost:	20 October 1880
Location:	Sisters Reef
Chart number:	DMH 277
GPS position:	
•	Latitude 32° 22.5900' S
•	Longitude 115° 41.0300' E
Finders:	G. Anderton, B. Evans, R. Morgan and D. Grove (1973)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:280–4
MA file number: 19/73
ASD number: WA 314
Significance criteria: 1, 4, 5, 6

The vessel

Star was built for Messrs J. and W. Bateman by veteran Fremantle boat-builder Thomas Mews. The fore-and-aft rigged schooner was designed for fast sailing. It had one deck and an oval counter stern. Originally the owners were unsure where to employ the vessel and it was first sent to Batavia (Jakarta) with a cargo of jarrah, but by the latter half of 1877 it was employed in the whaling industry, initially at Rosemary Island, in the Dampier Archipelago. The venture was successful and *Star* returned to Fremantle with 147 casks of oil.

On 28 September 1880 *Star* was fitted out for a voyage in the hope of encountering whales sighted in Geographe Bay. The vessel was under the command of Captain Sheppard and the crew was all Malay. Two whale-boat crews and a whale hand were also aboard although they had nothing to do with the sailing of the schooner. John Bateman senior was also on the vessel. Although eight whales were sighted during the voyage these eluded capture, so at 3 p.m. on 19 October the course was set for Fremantle (Henderson & Henderson, 1988:281).

Under advice from Bateman as to the strong inshore currents, Captain Sheppard steered north-north-east for the Rottnest Island light. A fresh south-westerly breeze propelled the vessel speed forward. At 1 a.m. Cape Bouvard was seen bearing east at a distance of 11 or 12 kilometres (Henderson & Henderson, 1988:281). The vessel's course was altered two points to the east, the captain making for the north end of Garden Island.

The wreck event

In the early morning of 20 October the helmsman saw breakers on the starboard bow and put the helm up. The captain was alerted and in the confusion the vessel swung back onto the reef, striking so violently that the crew were thrown from their berths. The vessel had struck on the weather side of Murray Reef but it was nearly an hour before the hull was pierced and began to take water, suddenly sinking in 3.7 metres of water.

The crew managed to save their traps and all the sails, and in the ship's boats made for Point Becher and then onto Fremantle. It was soon evident that the whaling gear, including trypots and firing apparatus were lost. The vessel was uninsured and anchors, chains and running gear also went to the bottom.

Inquiry

At the preliminary inquiry Bateman maintained

Figure 129
Wreck finder G. Anderton recovering a stoneware jar during excavation of Star
(MA 2093)

that the captain was at fault because he had altered course. The court found him guilty of four charges and his certificate was suspended for eighteen months. The wrecking was the fifth in a succession of losses for the Bateman Company, others being *Favourite*, *Flying Foam*, *Twinkling Star* and *Bungaree*.

Site location

The wreck is located about 2 kilometres south of Sisters Rocks on the Murray Reef chain out from Becher Point.

Site description

The wooden hull is badly broken up lying in 2.7 metres of water. The various elements of the site are identified in the site plan. Limited excavation has been undertaken and the removal of timber samples helped to identify the remains as the of *Star* . These were analysed to indicate local jarrah, a sapwood, red mahogany and red gum, the latter two possibly of New South Wales origin.

Statement of significance

HISTORICAL

The wreck site is significant because of its association with the operations of a local merchant and shipowners, Batemans, and also for the role it had in the operation of whaling in Western Australia.

ARCHAEOLOGICAL

The remains of the vessel are of significance as an example of local shipbuilding.

References

Anderton, G., 1972, Department of Maritime Archaeology, Western Australian Maritime Museum File No. 19/73.

Figure 130
Measuring the keelson and inner planking of Star *(MA 2096)*

Robertina (1843–1859)

Figure 131
The wreck site plan for Robertina

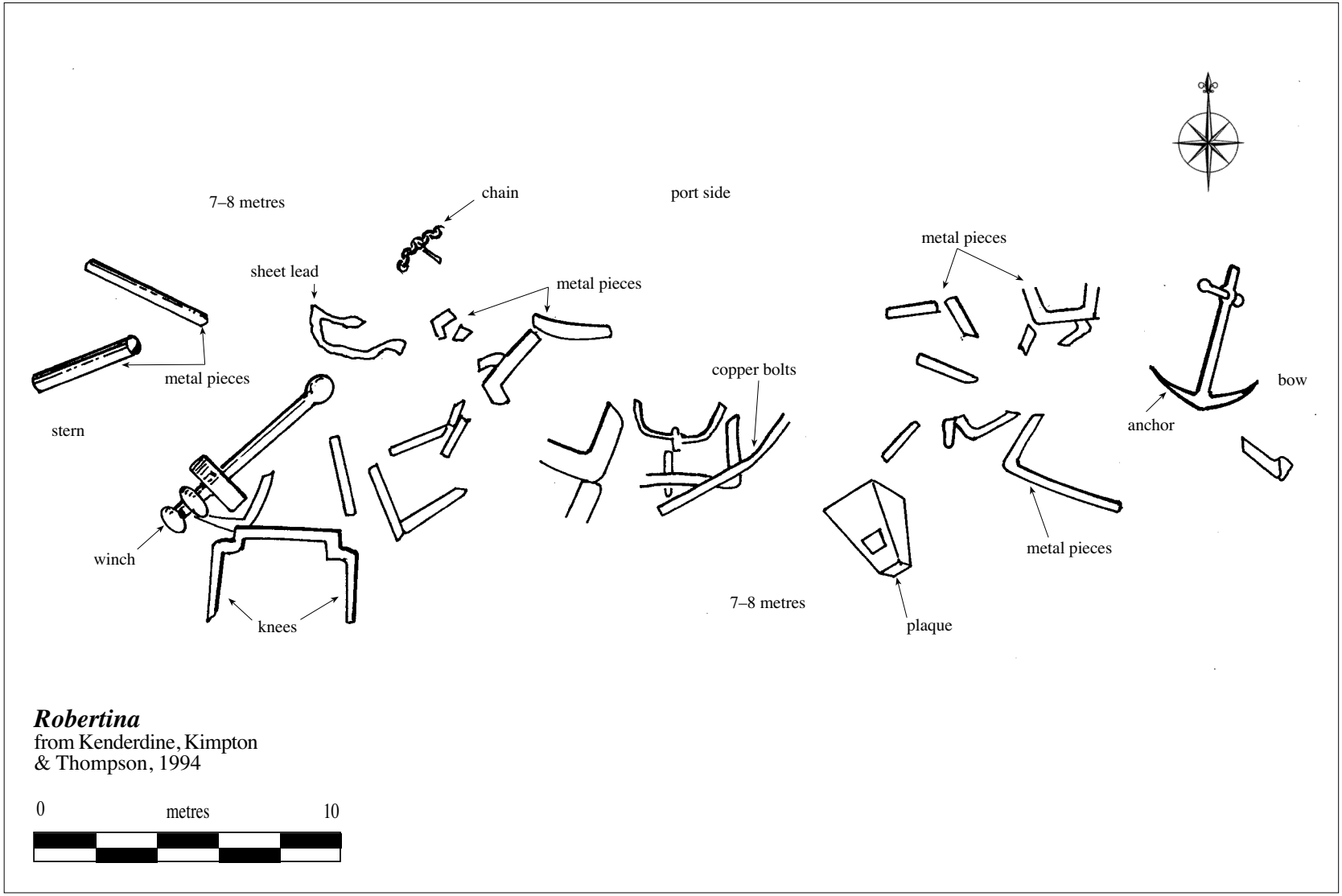


Figure 132
Transit photographs for the wreck site of Robertina
(MA 3747)

Official number:	31510
Where built:	Greenock, England
Registered:	Melbourne (1854)
Rig type:	brig
Hull:	wood
Tonnage:	213
Length:	26.3 metres (86.4 feet)
Breadth:	6.2 metres (20.5 feet)
Depth:	4.6 metres (15.1 feet)
Port from:	Fremantle
Port to:	Adelaide
Date lost:	2 November 1859
Location:	Murray Reef
Chart number:	DMH 277
GPS position:	
•	Latitude 32° 23.6737' S
•	Longitude 115° 40.7488' E
Finder:	G. Anderton (1987)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1987)

Unfinished Voyages, volume 2:41–2
MA file number: 52/88
ASD number: WA 288
Significance criteria: 1, 4, 5, 6

The vessel

Robertina was a carvel-built wooden vessel with one and a quarter decks. It had a square stern with a standing bowsprit and a busted female figure-head (Henderson & Henderson, 1988:42).

On 2 November 1859, *Robertina* left Fremantle under the command of Captain Davis, carrying a cargo of timber, flour and whale oil intended for the Adelaide market. The vessel was guided out by the pilot and then set a course back towards the land in a south-easterly direction, to make use of the evening breeze. At 6 p.m. the chief officer Joseph Mallison took bearings that placed Coventry Reef about 4.8 kilometres off the lee beam. The chart aboard the vessel did not indicate any reef in its path. The topgallant sails were taken in and orders were given for a sharp look-out to be kept. The weather was calm and clear.

The wreck event

At 6.50 p.m. the orders were given to go about but ten minutes later the vessel struck Murray Reef, at a distance 10 kilometres from Coventry Reef. No breakers were visible. The lead was hove and read 3.3 metres, same as the draft of *Robertina*. The vessel went down immediately, bow first, leaving only 1 metre of its stern above the water. The twelve crew and seven passengers only just made it to the ship's boats before it sank.

The subsequent inquiry into the wrecking charged the captain with neglect of duty, although he was found to be not guilty by the court. The wreck was sold at auction for £30 along with a fair portion of the cargo. Apparently some fittings, anchors, chain and fastenings were removed from the site.

Site location

The wreck site is located on Murray Reef approximately 1 kilometre from the Sisters Reef and 200 metres north-east of the *Highland Forest* wreck site.

Site description

The wreckage lies at a depth of 7 to 8 metres and is spread over an area of 25 metres by 8 metres, on a sand bottom with reef surrounding it. The iron structure is well concreted and there is no loose surface material to be seen. The whole site was covered in a prolific weed growth at the time of the last inspection (1994).

The bow of the vessel lies along a mound in the centre of the site indicating the keelson. Previous surveys of the site have recorded bolts, pump sections, sheathing timbers and iron knees. Most of the wreckage, including some chain, is on the

port side of the vessel possibly indicating the vessel leaned to port during the process of wrecking. Other remains include a single, 2 metres long, iron-stocked Admiralty pattern anchor, a fish pendant for raising anchors, a windlass barrel, sheathing and lead piping. The location of the iron knees possibly indicate a poop-deck. Pump sections and a deck winch barrel can also be observed in the stern end of the wreck site. Sheet lead and copper bolts also remain (Kenderdine, 1994d:6).

The anchor dimensions are 2.5 metres in length with a distance across the flukes of 1.5 metres. The iron cross piece does not appear in the plan view of the site as it extends vertically up from the wreckage (Kenderdine, 1994d:6).

Figure 133
A bell recovered from Robertina, *prior to full conservation treatment (ROB 22)*

Artefacts

In 1988, a bell was raised from the site bearing the inscription 'ROBERTINA 1843'. The main body of the bell together with the clapper has been conserved by the Department of Materials Conservation, Western Australian Museum. This item was originally used by the finders of the site to identify the wreck.

References

Kenderdine, S., 1994d, *Robertina*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 112.

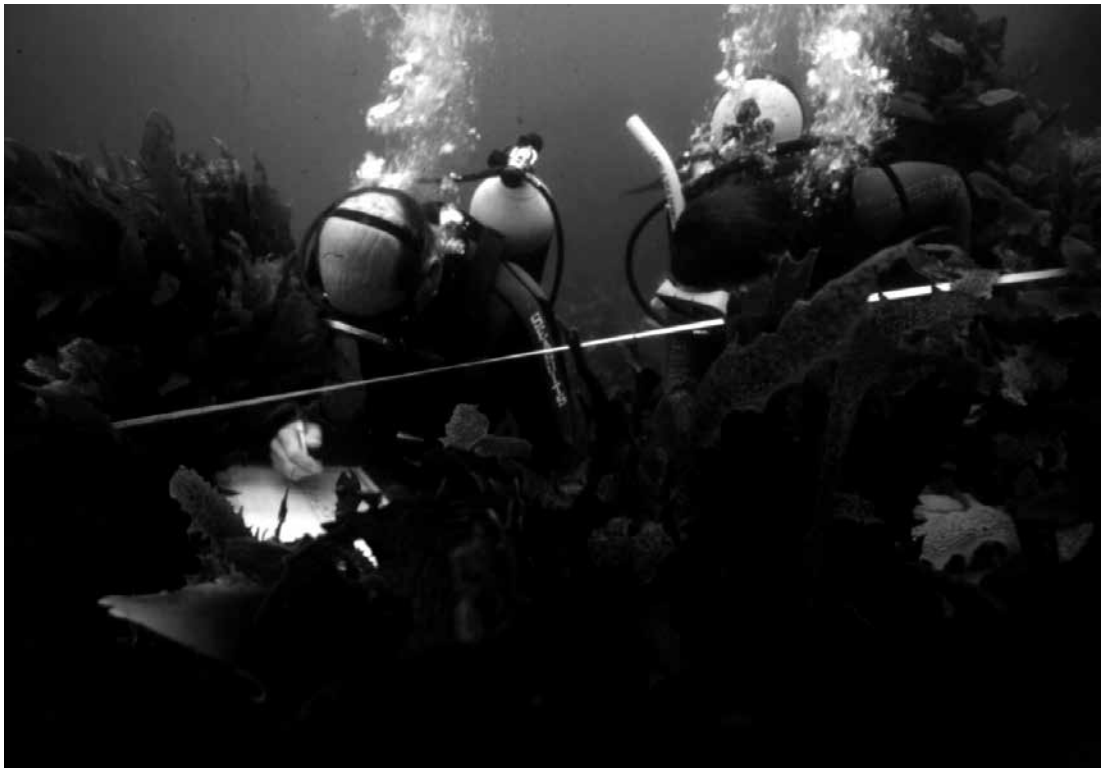


Figure 134
Surveying Robertina *site in dense eklonia kelp growth (ROB 33)*

Highland Forest (1884–1901)

Figure 135
The wreck site plan for Highland Forest

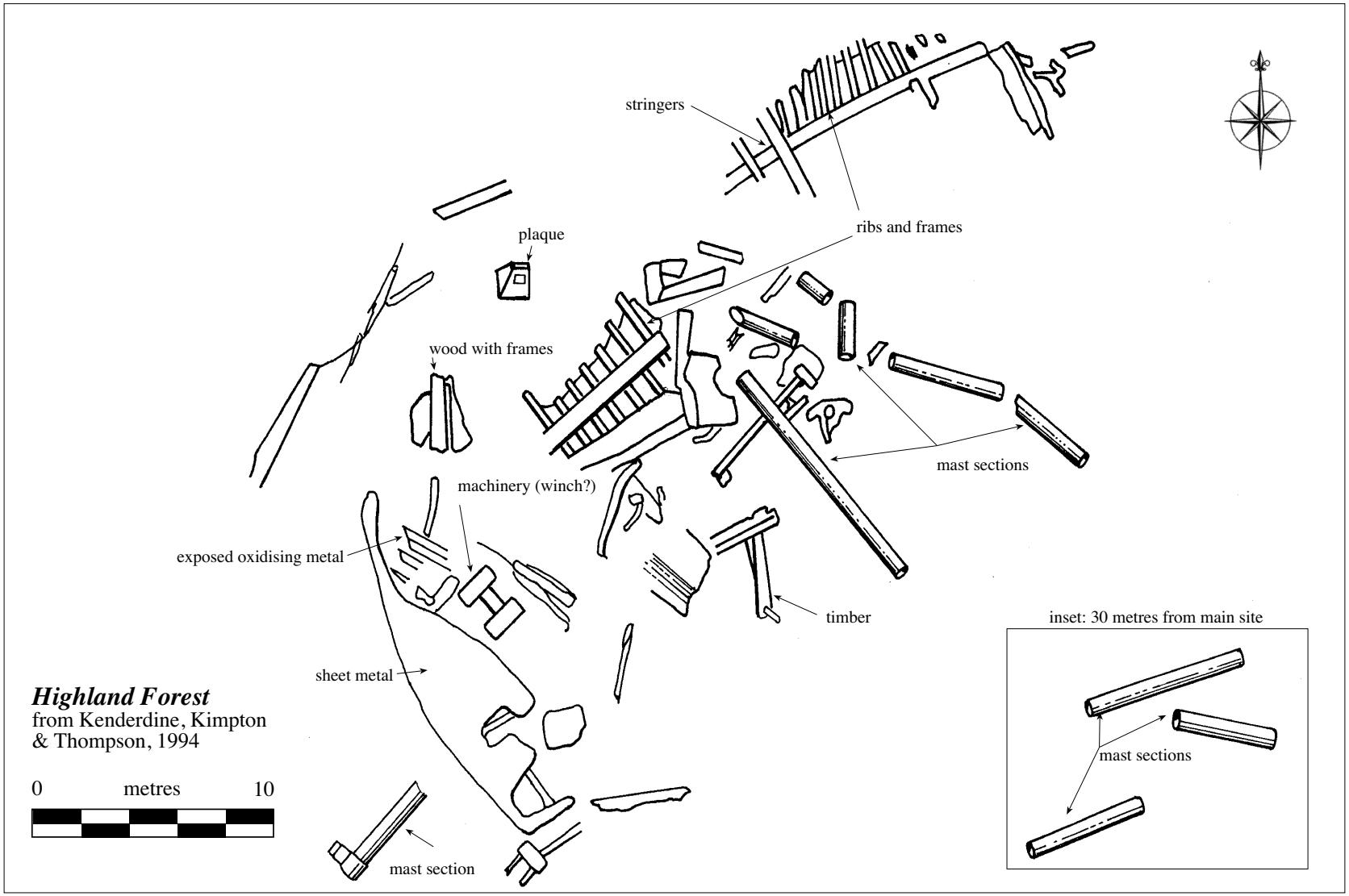


Figure 136
Transit photographs for the wreck site of Highland Forest *(MA 3748)*

Official number:	89909
Where built:	Leith, Scotland
Registered:	Glasgow
Rig type:	barque
Hull:	iron
Tonnage:	1040 gross, 938 under deck, 995 nett
Length:	73.9 metres (209.6 feet)
Breadth:	10.4 metres (34.2 feet)
Depth:	6 metres (19.7 feet)
Port from:	New York
Port to:	Fremantle
Date lost:	29 April 1901
Location:	Warnbro Sound, Murray Reef
Chart number:	DMH 277
GPS position:	
•	Latitude 32° 23.7821' S
•	Longitude 115° 40.7161' E
Finders:	R. Kreuzer and D. Wethrop (1968)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1986)
MA file number:	432/71
ASD number:	WA 179
Significance criteria:	1, 4, 5, 6

The vessel

Lloyd's Register records that *Highland Forest* was built by Ramage and Ferguson at Leith with three masts, one central bulkhead, one deck and two tiers of beams. The poop measured to 8.2 metres and the forecastle was to the same height.

The vessel left New York bound for Fremantle with a cargo on consignment to the Western Australian Shipping Association. The goods aboard included 1 646 steel plates, 8 250 cases of kerosene, 9 392 pieces of white pine shelving, 131 cases of chairs, 880 barrels of asphalt, cornflower, canned goods, printing paper, sheet iron nails, windmill apparatus and other sundries.

The vessel approached Fremantle in April 1901 in excellent weather conditions, under the command of Captain Alexander Chapman.

The wreck event

Highland Forest was laden to the plimsoll line when it struck Murray Reef heading north to Fremantle with all the sails set full. It struck heavily on 29 April, was unable to stand the shock and broke up quickly. All eighteen hands aboard were safely landed but few of their personal affects could be got off and only some of the ship's papers were saved. The cargo went to the bottom. Contemporary records have not yet been located that indicate if the vessel was sold or the extent to which salvage was undertaken (*Western Australian*, 1 May 1901, p. 5f).

Investigations into the conduct of the master were held at the Customs House of Fremantle. Master Chapman stated that he 'had sailing directions' (Findlay's Indian Ocean Directory). His certificate was suspended for twelve months (*Harbour and Lights,* file 81/16, Battye Library).

Site location

The site lies at the end of the Murray Reef group approximately 2.2 kilometres offshore.

Site description

The site rests in 7.5 metres of water on a shallow reef that is subject to swell, surge and the onshore (or lee) breeze. The wreckage covers an overall length of 30 metres with pieces found up to 15 metres to the port side of the main wreck concentrations. The bow of the vessel is in a sand hole. The iron floors are intact on the reef top with the vessel's iron sides collapsed outwards, and deck beams lying at random. Iron mast fragments occur throughout the whole site.

Together with the ribs, frames and mast sections large pieces of sheet metal are the most

predominant feature on the site. At the time of last inspection (1994), weed growth on the remains was minimal. The only timber on the site was found on the starboard side, amidships, and is 0.5 metres square. On the site there is no evidence of cargo remains, although there have been no historical records located that can confirm if salvage took place. Given the high energy dynamics of the marine environment along this reef it is likely that smaller items and ships fittings are either extensively buried or have been destroyed. No anchors are evident on the site (Kenderdine, 1994b:6). Freshly exposed metal suggests recent attempts at looting on the site (1994).

Artefacts

A bell bearing the inscription 'HIGHLAND FOREST' was removed from the site in 1968 by R. Kreuzer. It has been conserved by the Department of Materials Conservation, and is on display at the Museum.

Statement of significance

HISTORICAL

This wreck site has particular historical significance for its association with the author Joseph Conrad who centred one of his novels (*The Mirror of the Sea*) around the voyages of *Highland Forest* on which he served as first mate. It also has significance as a reflection of the overseas trade network and the development of the Western Australian economy.

References

Kenderdine, S., 1994b, *Highland Forest*, unpub. Wreck Inspection, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 114.

Harbour and Lights, file 81/16, Battye Library.

Western Australian, 1 May 1901, p. 5f.

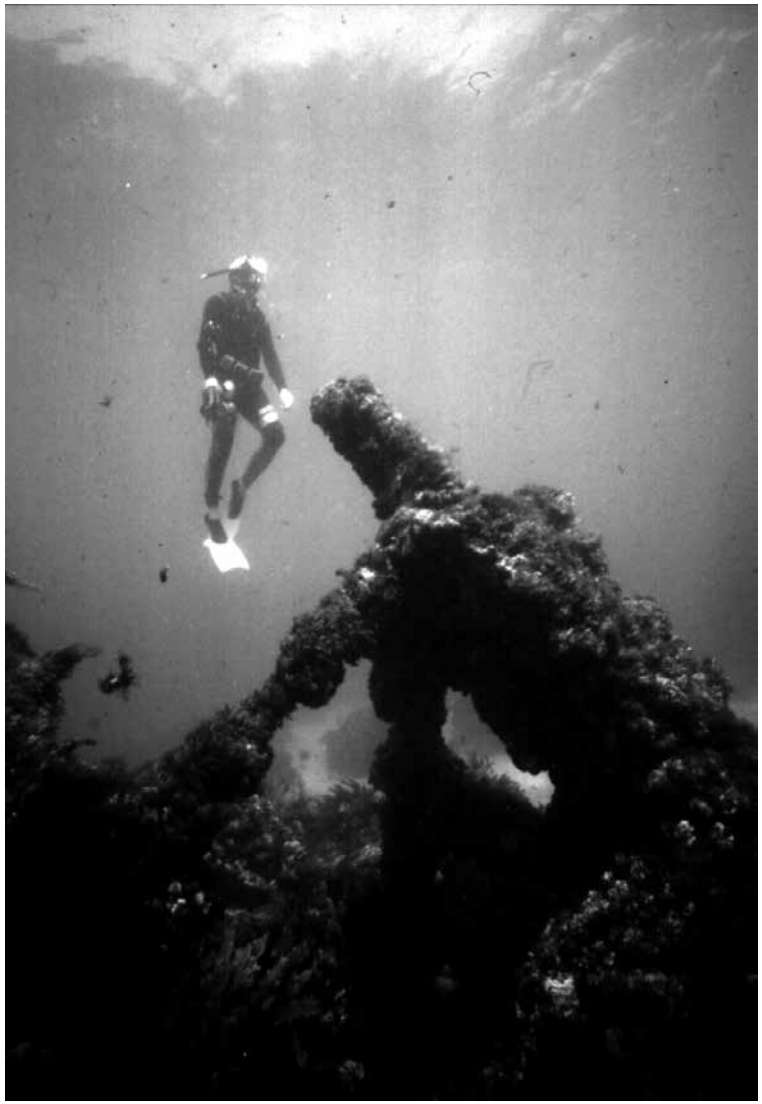


Figure 137
Highland Forest
wreck site
(HF 62)

Figure 138
A bell recovered from Highland Forest, *after conservation treatment (MA b file no. 432/71)*

James Service (1860–1878)

graphs for the wreck site of James Service (MA 1325)

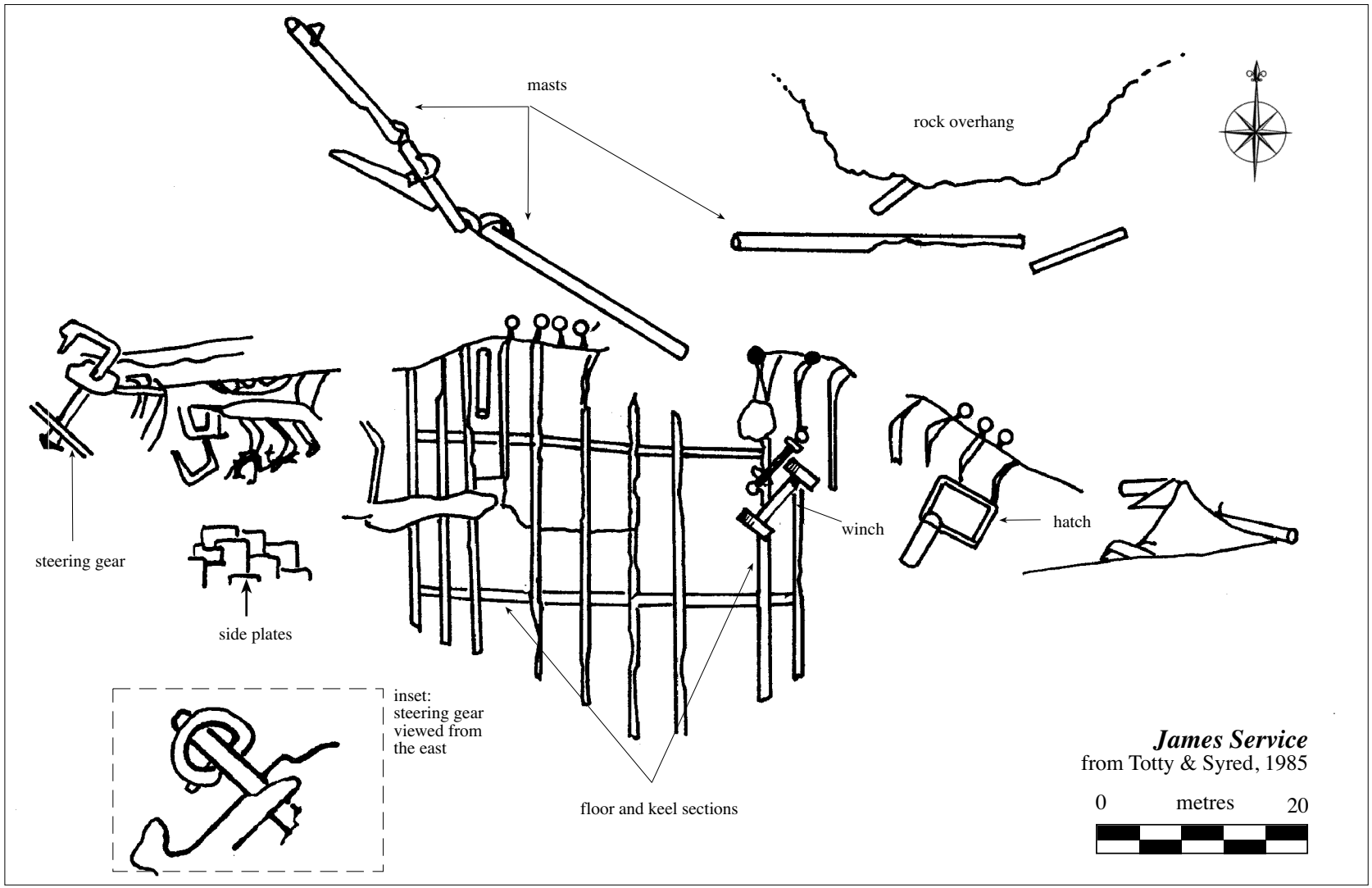


Figure 139
The wreck site plan for James Service
Figure 140
Transit photo-

Official number:	55609
Where built:	Govan, Scotland
Registered:	Melbourne
Rig type:	barque
Hull:	iron
Tonnage:	455 gross
Length:	46.7 metres (153.9 feet)
Breadth:	8.6 metres (28.1 feet)
Depth:	4.6 metres (15.1 feet)
Port from:	Calcutta
Port to:	Melbourne
Date lost:	22 July 1878
Location:	Five Fathom Bank, southern end of Murray Reef
Chart number:	DMH 277
GPS position:	
•	Latitude 32° 27.4800' S
•	Longitude 115° 39.8500' E
Finders:	H. Roberts and the Underwater Explorers Club (1962)
Protection:	*Historic Shipwrecks Act 1976* (gazetted 1977)

Unfinished Voyages, volume 2:242–4
MA file number: 66/74
ASD number: WA 189
Significance criteria: 1, 3, 4, 5, 6

The vessel

James Service carried three masts on two decks. The iron hull was clinker-built with a round stern and a demi figure-head of a man. It was built in Scotland by Dobie and Company, and was owned by James Service and others from Melbourne. It was engaged in the timber trade from Melbourne to Calcutta and twice visited the colony of Western Australia to get jarrah for India.

The barque, on a return journey from India, left Calcutta on 27 April 1878. Shortly after departure, the vessel was becalmed for sixteen days in the Bay of Bengal and the master suffered sun stroke that brought on delirium and dysentery. Convinced of a conspiracy, Captain Young's subsequent behaviour forced the crew to put him under restraint. In Penang he was charged as incompetent and, although the charges were not proven, it was recommended that he not resume command.

Captain Sievwright was then employed. When *James Service* departed Penang, ten passengers, all members of a theatrical group bound for Melbourne, and a crew of ten including the captain, were aboard. The cargo consisted of 3 000 cases of castor oil, 1 000 bales of sack bags and 600 bales of jute.

The vessel headed southward from Penang to round Cape Leeuwin, a course that should have taken it several hundred miles off the Western Australian coast. As there were no survivors of the wrecking, the events that led to *James Service* being broken in two on the Murray Reef can only be surmised from circumstantial evidence.

The wreck event

The wreck probably occurred on the evening of 22 July. An entry in a diary that washed up on the shore, believed to be in woman's script, stated that on the 20th the vessel had encountered boisterous weather for some time, and that on one occasion the wind had been so strong as to put the vessel on its beam ends with the yards touching the water.

A local stockman working along the coast saw masts above the surface of the water west of the River Murray mouth on 23 July. The longboat bearing the words 'JAMES SERVICE, MELBOURNE' was found on the beach. On the following day large quantities of wreckage lay strewn along the coast, including cases and tins of castor oil, luggage, cabin fittings, pieces of decking and many other sundry items. The trunks belonging to members of the theatrical group had also come ashore.

The first body to be found was that of a woman and on her petticoat and drawers the name 'J. TOW-

ERS' was stitched. The body of another woman was found and identified as Mrs Cowdery. Further bodies continued to be washed up along 64.4 kilometres (40 miles) of coastline. Six were buried in the Mandurah Cemetery. Most of the bodies were greatly decomposed and disfigured which made identification difficult. However, a fully clothed body in officer's dress with brass buttons embossed with anchors was believed to be that of the vessel's mate Mr Foreman. Later, in 1878, a diver examined the hull of the wreck and reported that it had broken in two. This was sold at auction for £20 in November of that year.

Site location

The site lies on the southern end of Murray Reef, and is found following a bearing 335° from the mouth of the Murray River.

Site description

The wreck lies in 5 to 8 metres of water. The axis of the keel runs approximately east to west with the bow facing west. Wreckage is scattered over an area 55 metres long by 12 metres wide. The bow section has collapsed sternwards and is canted over to the starboard side. Iron plating making up the outer hull has largely disappeared since the site plan was made in 1985. The underlying frames are still intact. The structure rises 2.5 metres from the bottom. Three dead-eyes with marine encrustation are visible towards the stern, on the port side of the vessel. Ribs are evident along the sides of the site.

Steering gear is visible at the stern. Mast pieces are to be found south of the main wreckage. Immediately south of the central wreckage on a south-east to north-west axis are two more mast pieces, one of which is 15 metres in length. Another mast lies 10 metres away. Hoops, wire rope and ship's fittings are also found on the wreck.

Artefacts

Before the vessel became protected under the *Historic Shipwrecks Act (1976)* material was recovered by local divers. In the churchyard of Christ Church in Pinjarra Road, Mandurah, an anchor and spider ring from the mizzen-mast of *James Service* have been placed. A skull found in 1973 in the sand dunes around Rockingham is believed to be from one of the victims of the wrecking of *James Service* (Sledge, 1974:11–12).

Statement of significance

Social

The wreck event had an important impact on the Mandurah community with casualties from the wreck event buried at the local cemetery.

References

Sledge, S., 1974b, '*James Service* wreck', *Port of Fremantle Quarterly*, 5.2:14–17.

Murphy, M. & Wells, S., 1989, The *James Service* site revisited, Maritime Archaeological Association of Western Australia Reports, No. 3, December 1988–June 1989:18–22.

Figure 141
A skull from one of the victims of the wrecking of James Service *(MA 339)*

3.1 Managing shipwrecks

3.1.1: Regional survey

Introduction

The Western Australian Maritime Museum first began a regional approach to wreck inspection in 1979 with a focus on the northern coast of the State (Sledge, 1979), then Jervoise Bay (McCarthy, 1979), Koombana Bay (McCarthy, 1982b), and the Abrolhos Islands (McCarthy, 1982c). The recording and survey of shipwrecks in discrete areas has been adopted in other States in Australia, including South Australia (Clark, 1990; McKinnon, 1993; Kenderdine, 1993), Victoria (Staniforth, 1985; Strachan, 1987; Foster, 1987, 1988, 1989), New South Wales (Kenderdine, 1995) and Tasmania (Nash, 1988).

The process of investigating wreck sites within the survey region in Western Australia has been complemented by the historical research of vessels wrecked in the State undertaken by Henderson (1980), Henderson & Henderson (1988) and Cairns & Henderson (1995) and published under the title of *Unfinished Voyages*. These three volumes contain an exhaustive discussion on the history and wreck event of all vessels lost between the years 1653 and 1900.

The following section outlines the practical and theoretical parameters that were the basis for the regional survey of the historic shipwrecks of Perth.

Survey brief

Objectives

- to identify and document the historic shipwrecks (defined by the State and Commonwealth legislation) that lie within the survey region;
- to identify and document the historic shipwrecks within the definitions of cultural resource management;
- to collate the data on these sites from records of the Department of Maritime Archaeology;
- to undertake additional fieldwork to supplement the records of the Department of Maritime Archaeology;
- to liaise with relevant government authorities with regard to the management of these sites;
- to prepare a publication that locates and describes the sites for dissemination to the diving and non-diving public, developers, planners and natural and cultural resource managers.

Methodology

- identification of all sites with the assessment of gaps existing in the current documentation;
- implementation of wreck inspection programme and conservation assessments on number of sites;
- preparation of wreck inspection reports and GPS data;
- compilation of all transit photographs and preparation of site plans;
- collation of data on files and preparation of historical précis, site descriptions, significance and recommendation statements;
- undertake some analysis of the resource within the references of maritime archaeology;
- liaison with community members and government authorities;
- preparation of book.

Funding

The funding for the survey was provided by the Department of Communication and the Arts (DCA, now the Australian Cultural Development Office, ACDO) as part of a grant used in the administration of the *Historic Shipwrecks Act 1976*. Support for the project was also provided by the Fremantle City Council and the Gingin Shire Council.

Survey parameters

Geographical

The overall extent of the survey region with respect to Western Australia has its most northern point adjacent to Ledge Point and extends to the most southern point of Murray Reef, just north of Mandurah.

Within the geographic area of the Perth region

Figure 140 Location map showing survey region in South-West Australia

a number of sub-regions have been identified, as shown in the overall map of the survey region at the beginning of PART 2. These have been imposed to allow for easy reference to the location of the wreck sites. They also describe some aspects of wreck site distribution. The five specific wreck site location maps are also included in PART 2. They encompass from north to south the following sub-regions:

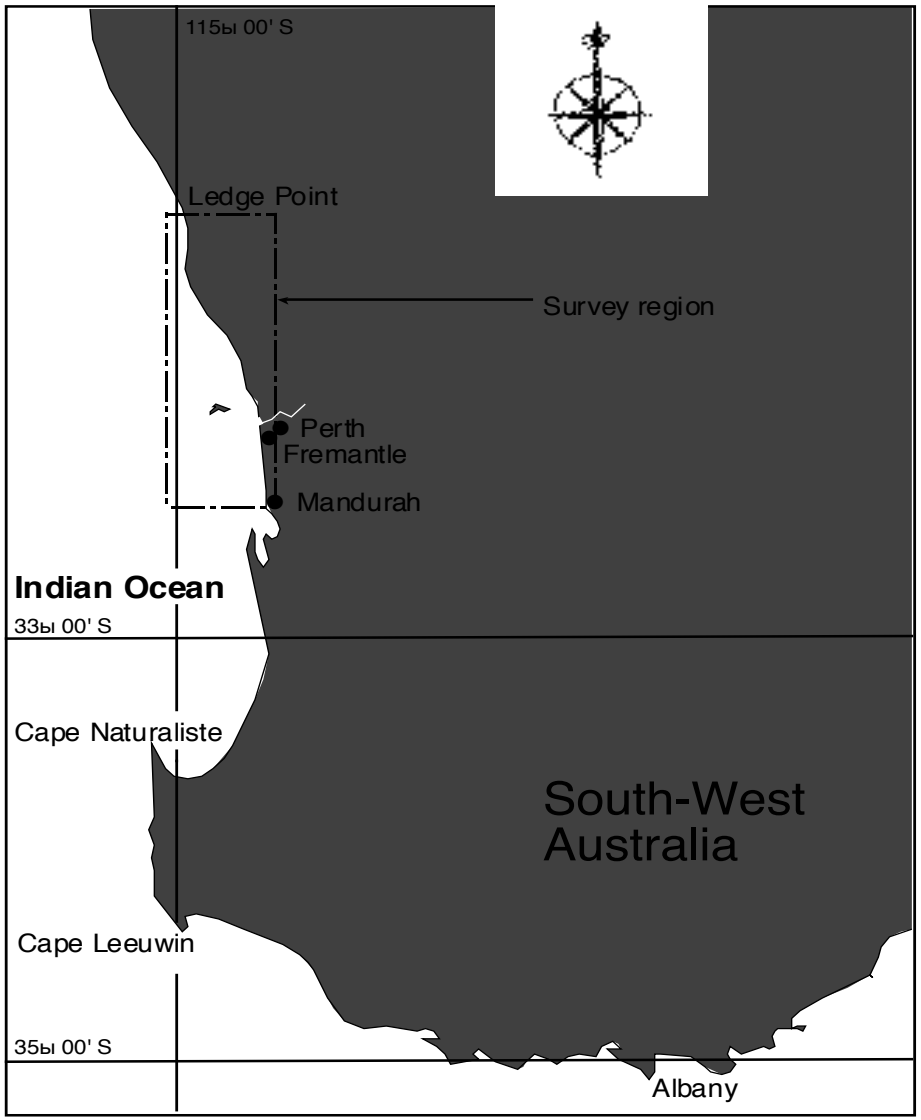
- Map 1. Ledge Point to Marmion Marine Park (south);
- Map 2. Rottnest Island;
- Map 3. Cottesloe to Pt Peron (inshore);
- Map 4. Fremantle to Pt Peron (offshore);
- Map 5. Pt Peron to Mandurah (north).

Thirty-eight historic shipwrecks lie within the survey region. They are covered by protective legislation (outlined below).

The marine charts used in the survey were a composite selection of those from the series issued by the Department of Marine and Harbours (DMH) and hydrographic services of the Department of Land Administration (DOLA). They are:

- DMH 087 Seabird 1:25 000 (1986);
- DMH 280 Guilderton 1:25 000 (1987);
- PWD 52015 Guilderton 1:25 000 (1979);
- PWD 51346 Quinns 1:25 000 (1978);
- DMH 001 Ocean Reef to Cape Peron 1:75 000 (1991);
- DMH 277 Warnbro 1:25 000 (1987).

The Global Positioning System Magellan Nav 1000 Pro (AUS datum) located the majority



of wreck sites on these charts (Figure 143). The position of sites found adjacent to Rottnest Island were established by the Department of Marine and Harbours.

Chronological

The period of history that the wreck sites represent extends from 1656, with the wreck of the Dutch East Indiaman *Vergulde Draeck*, to 1942 and the wreck of *Uribes*. The chronological parameters are constrained by the definitions in the Commonwealth legislation. This has application through automatic blanket protection for wrecks that occurred prior to 1919, or 75 years before the present. However, any vessel may be declared historic if it is considered to have historical, archaeological or other significance, as in the case of the *Uribes*.

Legislative

The survey region encompasses coastal waters under the jurisdiction of both State and Commonwealth Governments. The legislation that applies directly to shipwrecks is the *Maritime Archaeology Act 1973* (Western Australia) and the *Historic Shipwrecks Act 1976* (Commonwealth) including the most recent amendment in 1993. Further details on the operation and mechanisms of the legislation are outlined below. Of the 38 sites all have been protected under the Commonwealth legislation, except *Amur* which is protected under the State Act. The *Conference* wreck site is pending declaration as an historic wreck site under State legislation.

Some archaeological sites (jetties, for example) that related to the operation of trade in Western Australia have also been declared 'maritime archaeological sites' under the *Maritime Archaeology Act 1973*. These, however, remain outside the scope of this book.

There are a number of sites related to the maritime heritage of Western Australia that have been protected under the *Heritage of Western Australia Act 1990*. These include lighthouses, landings, wharves and such buildings that were associated with the early shipping trade in Fremantle. Discussion of these sites in the cultural landscape remain outside the scope of this book.

The project operated under the codes of practice embodied by the Australian International Committee on the Conservation of Monuments and Sites (ICOMOS) Burra Charter (1981) and the proposals of the ICOMOS International Committee on the Underwater Cultural Heritage (*Historic Environment*, 1992). It also adhered to the Australian Institute for Maritime Archaeology (AIMA) Code of Practice, and the *Guidelines for the management of Australia's shipwrecks* (AIMA & ACDO, 1994).

Thematic

The early discovery and settlement of Western Australia based on the historic shipping to Fremantle.

Cultural

Predominantly involving European, Asian and Aboriginal cultural groups.

Sources of information

This book has used two principal sources of information: historical data that has been compiled by various researchers and authors; and archaeological data from specific sites.

The material was drawn from the files at the Department of Maritime Archaeology. Additional data was assembled from the fieldwork and analysis conducted as part of the project. The Australian Shipwrecks Database and the artefact registration database at the Museum was also accessed.

A number of published histories were consulted and the most important of these for the purposes of this book was the series *Unfinished Voyages*, volumes 1, 2 and the draft of volume 3. These were authored by Henderson (1980), Henderson & Henderson (1988) and Cairns & Henderson (1995) respectively. The Department of Conservation and Land Management publications and a number of government department archives and libraries were also accessed.

A wealth of information and a number of site plans used in the compilation of this book were made available by the Maritime Archaeological Association of Western Australia (MAAWA). They are active proponents for maritime archaeology and have been meticulous in the documentation of the wreck sites they have researched.

Constraints

The project was confined to a nine-month period although it drew on research and the accumulation of data from a twenty-year period. The level of material presented in this book was largely contingent on the quality of existing material. It was also necessary to supplement the existing data through additional field work. For some wreck sites buried in the shifting sands of the sea-bed, relocation has not been possible. Where current location or site plan information does not exist this has been identified. In some instances the

approximate positions have been indicated.

The book was restricted to those sites declared historic under the protective mechanisms of the State and Commonwealth Acts. Given the volume of material collated on many sites in the survey region it was necessary to restrict the scope of the survey in an appropriate way. Government agencies have a mandate to conserve and protect historic shipwrecks and associated material, through public information. This book encompasses these objectives through collating the information from a large resource base.

There are also a number of significant sites that are known to exist but are not covered by the legislation, and a number of sites documented as having been wrecked in the region that have yet to be relocated. These have remained outside the scope of the survey. A significant shipwreck resource is known to be located in the Swan River, and the future documentation of these sites is one of the recommendations of the book.

Although the aim of the book is to facilitate access to the wreck sites it has not been possible to give comprehensive descriptions of site location given the variability of interpretation that such information is subject to. Transit photographs have been provided instead. These are considered a reliable and accurate method to relocate sites.

Figure 143
Taking a GPS reading on the wreck site of Omeo *(MA 4269)*

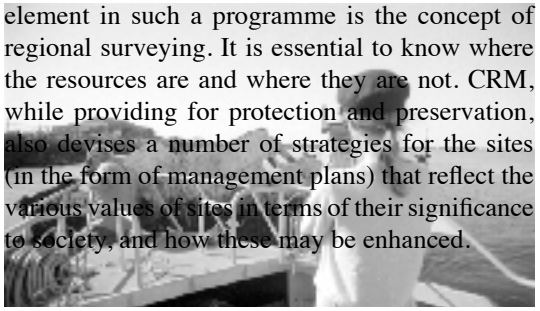
3.1.2: Cultural Resource Management

Introduction

An historic shipwreck represents a limited and finite resource. After a shipwreck has occurred the remains of the vessel cannot be added to and are vulnerable to destruction from environmental impacts and human interference. Through proper management of maritime archaeological sites, the lives and energies of people in the past have a chance of being rediscovered, preserved and retold for present and future generations. A cultural resource management (CRM) approach to the care of shipwrecks seeks to embrace the many values that they represent for community, for developers and for authorities charged with their protection.

Different approaches have been applied to the management of shipwrecks. Throughout the world these range from allowing treasure hunting and salvage to archaeology, mitigation, cultural resource management, recreation and tourism. CRM is concerned with the identification, assessment and management of shipwrecks. Assessment includes an evaluation of significance, research potential and protection strategies for potential impacts on sites. Short and long term possibilities for establishing and maintaining site protection are explored.

By fulfilling the above objectives managers encompass research, mitigation, recreation and other protective mechanisms. An important element in such a programme is the concept of regional surveying. It is essential to know where the resources are and where they are not. CRM, while providing for protection and preservation, also devises a number of strategies for the sites (in the form of management plans) that reflect the various values of sites in terms of their significance to society, and how these may be enhanced.



Values of shipwrecks

Social, cultural and aesthetic

Social and cultural values emphasise shipwrecks as sites that are linked to the fabric of our society. For example, a site may be celebrated and become enshrined in the folklore or oral history of a community. A wreck event may have been of such significance that it remains associated with a region for decades after the incident. Wrecks often generate songs, literature, art, poems and films.

Wreck sites also have particular aesthetic or romantic connotations for the community in general and as symbols they have the power to evoke intense feelings and images. As ruins they are an integral part of a cultural landscape offering the opportunity to access the past.

Aesthetic appeal of shipwrecks gives added reason to their protection *in situ*. The full restoration of shipwrecks can be financially prohibitive and tend to offer a sanitised view of the past. However, excavated material does offer the opportunity for a comprehensive interpretation of history when conserved, researched and displayed in an appropriate manner.

Archaeological, historic and scientific

The other attributes of shipwrecks of equal value are how they act as stimuli for archaeological, historical and anthropological research into our maritime heritage. Shipwreck sites are particularly valuable as a focus of material culture describing the nature of society. Vessels are compact, largely self contained structures that are effectively sealed off after the ship sets sail and cargo, crew and passengers have come aboard. In historic times

this closed society only opened up when another port was reached. Therefore, little material was lost until the wreck event (Delgado, 1988:7).

For archaeological research to take place there must be material remains. A shipwreck site's inherent value is contingent upon the condition of this material and what it can potentially tell us about society. Archaeological investigation is an effort to learn about the vessel, its cargo, what the crew did, how the ship was built and operated, and then assess what was going on in that period of history. Insights into these issues only come about through careful documentation of each artefact on the sea bottom, mapping and plotting its exact position and then perhaps recovering the evidence for further analysis (Delgado, 1988:7). The recovery of a data set through excavation requires interpretation using an number of other disciplines including historical research, scientific analysis of materials, statistical manipulation and other forms of research. An anthropological approach to the archaeological data for example, asks further questions about human behaviour. Knowing the characteristics and patterns of individual and group behaviour offers us a clear sense of our past, current and future horizons.

The archaeological value also depends on the site's environment. Certain processes degrade sites. As a vessel sinks parts wash away and certain organic material such as bodies, sails and clothes may disintegrate. Scientific investigation conducted on the structural remains can answer questions to do with the deterioration and preservation of the site. Many other elements of the hull structure, cargo and the personal effects of the crew remain (Delgado, 1988:7). The shipwreck sites of the survey region have significant potential for archaeological investigation. Many exist in shallow water, some in a surprisingly good state of preservation. Before the advent of diving technology the sites have been relatively inaccessible and not subject to the threats of continual salvage, vandalism and disturbance that affect land-based archaeological sites.

Recreational and interpretive

Shipwrecks often provide significant recreational opportunities. Diving has increased substantially in the past years and continues to grow as a major tourist activity. Shipwrecks can be considered underwater museums, and they offer spectacular habitats for marine biota. Many divers are aware of the importance of the preservation of these unique environments. In Western Australia the diving community has been a major lobby in the protection and research of shipwreck sites. It is through their concern and efforts that so many sites have been relocated and recorded. Further education about the value of wreck sites is required to prevent looting and destruction on some sites. Shipwrecks may also be considered of monetary value (not related to the potential of salvageable cargo) as a source of generating revenue through cultural tourism. It is for all these reasons that shipwrecks have been afforded protection. A document such as this one goes some way to promoting an understanding of the value of shipwrecks.

Principles and guidelines

The statutory managers of the shipwrecks are charged with many aspects of caring for the resource. Recently developed Guidelines and Statement of Principles in the *Guidelines for the management of Australia's shipwrecks* (AIMA & ACDO, 1994) recognise the increasing complexity of managing shipwreck sites.

> These Guidelines provide a common basis for the management of shipwrecks nationally by identifying strategies and practices for management and administration of the resource. They provide administrators with useful measures of the cultural and heritage values of shipwrecks and aid the identification and assessment of wrecks according to their historic, technical, social, archaeological (scientific) and interpretive values...[and] will facilitate decision making relevant to the allocation of the scarce resources available...(AIMA & ACDO, 1994:4).

The Statement of Principles cover the approaches to be taken to anyone who deals with historic shipwreck sites and related collections. These are concerned with:

- site and artefact management;
- collection management;
- establishing a shipwreck programme;
- research;
- survey and inventory;
- evaluation of shipwrecks and;
- information systems for shipwreck sites.

The document also addresses supporting procedures and programme outputs. This covers issues such as:

- funding;
- interpretation, education and publicity;
- public access and;

- volunteer programmes.

Evaluation criteria provide a mechanism for assessing and describing the significance of shipwrecks. These are inherently linked to the values that our culture places on heritage and as such are constantly changing. It has been recognised that it may be necessary to reassess shipwrecks in the future, in accordance with the changes in cultural values that may affect their significance. However, to allow for management strategies to be proposed a shipwreck site should be evaluated in terms of agreed criteria. These are stated in the Guidelines as:

1. Historic: *Significant in the evolution and pattern of history. Important in relation to a figure, event, phase or activity of historic influence.*
2. Technical: *Significant in possessing or contributing to technical or creative accomplishment. Important in demonstrating a high degree of technical or creative achievement for the period in question.*
3. Social: *Concerned with association with a community or communities in Australia today for social, cultural and spiritual reasons. Important as cultural items or places highly valued for reasons of social, cultural, religious, spiritual, aesthetic or educational associations by a community today.*
4. Archaeological: *Significant for the potential to yield information contributing to an understanding of history, technological accomplishments and social developments. Important for its potential to yield information contributing to a wider understanding of the history of human activity.*
5. Scientific: *Concerned with research potential through repeatable measured tests, and information about the composition and history of cultural remains and associated natural phenomena, particularly biota, through examination of physical, chemical and biological processes. Important in the generation and testing of hypothesis in conservation of wreck sites.*
6. Interpretive: *Significant for its potential to contribute towards public education through on-site or other interpretation.*
7. Rare: *Significant in possessing rare, endangered or uncommon aspects of history. Important in demonstrating a distinctive way of life or custom, process, waterway, function or design which is no longer being practised, is in danger of being lost or is of exceptional interest to the community.*
8. *Representative: demonstrating the characteristics of a class of cultural items. Important in demonstrating the principal characteristics of a range of human activities.*

Legislation

Two pieces of legislation are applicable to the protection of shipwrecks within the survey region and the State of Western Australia. They are the *Maritime Archaeology Act 1973* (Western Australia) and the *Historic Shipwrecks Act 1976* (Commonwealth). Both Acts are administered by the delegation of authority and in Western Australia this is the Director of the Western Australian Maritime Museum. The application of this legislation to the protection of shipwreck sites is defined by the location of baselines separating State and Commonwealth waters pursuant to sections of the *Sea and Submerged Lands Act 1973* and the *Coastal Waters (State Powers) Act 1980*.

Historic Shipwrecks Act 1976

Definition

An 'historic shipwreck' is a term that covers any ship lying off the coast of Western Australia which belonged to the Dutch East India Company, any ship of significance to Papua New Guinea, the remains of any ship at least 75 years old lying off the coast of any State or Territory. An 'historic relic' under the Act is any article coming from a shipwreck site.

Prior to 1993, the *Historic Shipwrecks Act 1976* did not automatically cover all shipwreck sites that occurred in Commonwealth waters. The Act required the Minister to declare each site that was considered by members of the public or practitioners of maritime archaeology to be of significance. A recent amendment to the Act gives automatic protection to any site that is at least 75 years old from the date of wrecking, whether the site has been relocated or is still not found, and this site is declared historic.

Preservation and duty

The responsibilities of the public with regard to this legislation include providing the Minister with a description of any sites located in Commonwealth waters and to declaring any article that may come into a person's possession that is deemed to have come from an historic shipwreck.

Access to declared historic shipwrecks for non-disturbance purposes does not require permits unless a protected zone has been established around the site. Permission is specifically required to enter a protected zone for any purpose. Access to a shipwreck for disturbance activities (such as excavation) is issued by the appropriate State delegates on behalf of the Commonwealth in accordance with section 15 of the Act, and the conditions that apply here are site specific. Permits are only issued in cases where archaeological survey and excavation leads to the answering of questions relevant to history and heritage, and the conservation, publication, illustration, explanation and display of the results is carried out. The proposed disturbance of a wreck site must be justified in the terms of the following:

- advancement of knowledge;
- ultimate protection of material or;
- public benefit for the greater access of material.

The projects and expeditions to be undertaken by community groups must be approved by the relevant delegate. The group must have the demonstrated ability to plan, equip, staff, finance, organise, carry out and record the proposed activity. All material evidence recovered from the area of the site together with any excavation report will be accessioned into the register of a museum or agency as directed by the delegate.

Community groups wishing to retain material recovered from shipwreck sites must demonstrate that they have access to the necessary conservation and curatorial expertise, and have the appropriate facility for storing and displaying artefacts according to approved standards (ACDO, 1993).

Permits and applications with regard to the investigation of shipwreck sites in Western Australia can be obtained from the Director at the Western Australian Maritime Museum, and through Commonwealth Government agencies.

Rewards and relics

The Act provides rewards to be given to people who first notify the appropriate authorities of the discovery of shipwrecks. Notification of the location of a shipwreck must be submitted to the appropriate authority.

Material derived from wreck sites is also protected (Figure 144). A recent amnesty with regard to all artefacts held in personal collections deemed to be from historic shipwrecks, resulted in a wealth of material being registered, recorded and photographed before being returned to the owners.

The reader is referred to copies of the relevant legislation for further details and to the recent publication *Historic shipwrecks: public access guidelines*, The Department of the Arts and Administrative Services (now DCA), 1993.

Register of Historic Shipwrecks

The Federal Minister is required to keep a register which records all the information on all Dutch shipwrecks and relics, and all other wrecks and

relics declared under the Act. The register is open for inspection by the public.

The requirements of the legislation has led to the development of the Australian Shipwrecks Database (ASD). This database contains historical details for all known wreck occurrences, whether the vessels have been located or not. For those vessels that have been located site specific information such as latitude and longitude, and legislative status is included. It is meant primarily as a research tool and each State delegated authority is in the process of updating regional records to include wrecks up to the present day.

Maritime Archaeology Act 1973

The *Maritime Archaeology Act 1973* (Western Australia) pre-empted any of the Commonwealth legislation by several years. It was developed in response to the discovery of four Dutch shipwrecks off the Western Australian coastline and was originally embodied in the *Museum Act Amendment Act 1964*. The later legislation sought to remove the emphasis on the act of wrecking and introduced the concept of 'historic ship' as any vessel lost, wrecked, abandoned, or stranded before 1900, whether above or below the low water mark.

In Western Australia the Maritime Archaeology Advisory Committee was established in 1973 to review the significance of sites put forward for declaration. The Department of Maritime Archaeology submits all newly relocated sites for consideration under this process. A report on the significance of the site is prepared for the Committee, and upon their recommendation the site is submitted to the Director of the Western Australian Maritime Museum, and then the Minister for declaration. Once this process has been completed the site will be declared as an historic shipwreck.

In Western Australia the provision of rewards for the finders of wreck sites has been a major part of the implementation of the legislation. By offering rewards the State Government seeks to acknowledge the contribution of the community in the protection of the resource.

Other issues

Blanket protection

Prior to 1993, the number of sites declared by the

Figure 144
Mameita-Gins from Vergulde Draeck *(Edwards Collection, GD 5)*

Commonwealth throughout Australia through the *Historic Shipwrecks Act (1976)* was 150 (MacIntyre, 1992:2). In response to the concerns expressed by the practitioners of maritime archaeology in each State, an amendment occurred to the legislation on 1 April 1993 whereby blanket protection was provided for all sites over 75 years. This sought to recognise the inherent difficulties in definition of the term 'historic' and gave greater range to the significance of a wreck to include the attributes of scientific, archaeological, recreational, educational and aesthetic potential. With this amendment the number of protected sites in Australia has increased to several thousand (MacIntyre, 1992:3).

Baselines and territorial waters

Australian waters constitute those that extend from the low water mark to the outer edge of the continental shelf and include waters from the external territories. State waters are to the landward side of the low water mark and include rivers, bays and areas specifically designated as State waters such as between some islands and the coast. The Crown Law office has advised on the position of Garden Island and the Cockburn Sound area with regard to the application of legislation.

> Cockburn Sound is not a true 'bay' in the sense of a landlocked water. It partakes more of the character of Investigator Strait-Backstairs Passage system of waters…This conclusion was reached despite the particular reference in South Australia's constraining instruments to 'bays' and 'gulfs' as being included within the State limits…The Privy Council's decision…to the effect that the *Solent*, which lies between the English mainland and the Isle of Wight constitutes 'high seas' (in the sense of waters outside the realm of) lends further support to the conclusion that Cockburn Sound was not, at the inception of the colony of Western Australia, within the bounds of the colony (Brazil, P., 1980:pers. comm., MA file 28/80).

The territorial sea baselines determine the limits of Australia's maritime zones for the purposes of international law. They do not represent the limits of the States. The limits of the States are defined by each State at Federation and in general fall inside the baselines that have been drawn for the purposes of international law (Campbell, 1992:pers. comm., Office of International Law, Attorney-General's Department, MA file 28/80).

Museum policy

The Commonwealth and State legislation also directs the policy and objectives for the programme of maritime archaeology at the Western Australian Maritime Museum under the National Historic Shipwrecks Programme. The Museum seeks to:

- conserve and protect historic shipwreck sites and associated material as a cultural resource for the nation;
- develop a comprehensive register of historic shipwrecks and associated material;
- obtain the support of an informed public for historic shipwrecks as a cultural resource;
- promote commitment of Government authorities to the protection and preservation of historic shipwrecks and associated material.

Department of Maritime Archaeology Programme

As directed through the relevant legislation outlined above, the Museum seeks to manage the large number of wreck sites under its jurisdiction through identification, evaluation, protection and interpretation of the resource. The following discussion outlines some of the elements of this programme.

Records system

Western Australia has been divided up into 39 wreck areas with each region corresponding to existing marine survey charts. Within each area all known or potential positions for wreck sites are located. A site that has been located and subject of a wreck inspection, has its own file. All material from wreck inspection reports, excavation summaries, gazettal notices and the correspondence with various local bodies and members of the public about the site, are contained on these files.

Files have also been compiled on a thematic basis. For example:

- Wrecks of steam vessels;
- Sailing vessels from 1780 onwards;
- European wrecks and;
- Southeast Asian, indigenous and miscellaneous sites.

Other land-based archaeological sites are also recorded in association with wreck sites. Files exist on lighthouses, wharves, jetties and shipbuilding yards as places that represent the infrastructure for the operation of colonial shipping to the Port of Fremantle. These sites are recognised as important elements in the appreciation, interpretation and preservation of a maritime cultural landscape.

Some of these land-based sites have been protected under the *Maritime Archaeological Act 1973* (Western Australia), or under the *Heritage Act 1990* (Western Australia). The Long Jetty site off Bathers Beach is an example of archaeological remains (within the survey region) that represents historic shipping in Western Australia.

Photographic material compiled on the wreck sites is contained in three indexes: one for black and white photographs; another for colour slides; and one for video. Each set of negatives and each slide or video has its own unique catalogue reference number. Apart from being a visual record of a site visit, the photographic record can be an invaluable tool in the surveying of wreck sites through photogrammetry and the production of stereo images.

Databases

The prerequisites to the successful management of a large number of wreck sites is through the identification of the potential wreck resource, in an easily accessible form. It should provide details and construction records, references to contemporary accounts of wreck events and salvage, dates of loss, and other information that may help in the identification and relocation of vessels. A coordinated and computerised inventory has been established throughout Australia. Information contained on the Australian Shipwrecks Database (ASD) gives each wreck site a unique number. Members of the public may in the future be able to access State specific information through the Museum in the form of a multi-media interactive display. There is also the intention to publish the ASD on the World Wide Web computer network. The variables included in the database are name, rig, construction, tonnage, where built and registered, dimensions and engines, dates of building and wrecking, crew and trade routes, location of wrecking and the number of deaths. The location and legislative status is also recorded.

The total number of sites on the Western Australian section of the database including unfound sites is approximately 1000. The historic shipwrecks in the survey region comprise 8 per cent of this total number. Figure 145 shows the frequency of losses for vessels within Western Australia. The frequency of losses for shipwrecks that lie within the survey region follow a similar mean distribution curve (the reader is referred to 3.3 later in the Appendix for a further analysis of the shipwreck resource).

The Western Australian Maritime Museum is a repository for artefacts associated with wreck inspection, mitigation and the excavation of wreck sites, and that material given through donation for long-term care and presentation. The artefact database holds information on each item with respect to identification, condition, conservation treatments received, display and ownership, and details with regard to its provenance on the wreck site. Almost all the sites within the survey region are represented by artefacts.

Figure 145
Frequency of losses for vessels in Western Australia (ASD)

Wreck inspection

Wreck site inspection is most often carried out in response to the report of a site to the Department of Maritime Archaeology by members of the public. The location and description of the vessel is compared to existing charts and files to establish if it is already known, or if it may be identifiable as the remains of a vessel known from historical records. A visit to the site is then arranged for as soon as practical, perhaps to coincide with other work in the region. Seasonal weather conditions are limiting factors in the response to the report of a new site. Locating the site also relies on the availability of informants.

When a regional survey is undertaken to locate sites, the tools of remote sensing are particularly relevant. Magnetometers, side-scan sonar and echo sounders facilitate the process of establishing the presence of a wreck site. Remote sensing is generally undertaken in areas where historical records, local knowledge and other factors suggest the strong possibility of a site.

The inspection of a site initiates a procedure for the identification of a shipwreck and the ongoing monitoring of the site condition. It identifies the

structural integrity of the remains, significance and potential for archaeological, historical and scientific research, excavation and interpretation. Wreck inspection is generally a non-interference activity, although items may be removed for site identification purposes.

To be a useful management tool the wreck inspection seeks to record (Figures 146 & 147) or obtain the following information:

1. Conditions on the site including: weed cover, bottom type, visibility, surge, sea state, currents, tide and colonising biota;
2. Description of the site including: the spread of wreckage, length, breadth, height above the sea-bed, depth of the site, depth of burial, visible cargo, ballast, machinery and ship's fittings, and evidence of possible looting or unlawful activity on protected sites. Information on fastening types and sizes, frames, keels and planks, types of knees and such features as engine designs are also relevant. Recording sites in detail may not always be possible given the constraints of resources and access to the site;
3. Photographic and illustrative record including: video, the production of an overall photomosaic and the photographic recording of details. This should be accompanied by manual recording of the site for an on-site plan illustration;
4. Samples of artefact material from the site where these aid in the identification of the vessel, or for their immediate protection from looting or destructive environmental elements. It should be recognised that most articles on wreck sites are more stable when left *in situ*;
5. Relocation data: sailing directions, map reference numbers, compass and/or sextant bearings, GPS positions and visual transits (preferably photographic);
6. Conservation data including: temperature, salinity, pH and dissolved oxygen content, water purity and movement, bottom type analysis and corrosion products. This allows for a database of information to be established recording deterioration in the integrity of structure, and for comparative analysis with other sites, aiding a programme of protection (McCarthy, 1982:49–50).

Sites should be inspected on a regular basis. This establishes a way of gauging either the environmental or cultural rate of deterioration on shipwrecks. It identifies possible protective strategies involving *in situ* conservation. Recommendations made as a result of wreck inspections provide the basis of future management of the resource.

Figure 146
Using a video on the wreck site of Lancier *(LAN 45)*

Figure 147
Drawing board used to record data underwater (SURV 1)

Identifying wreck sites

Contemporary accounts of a vessel's loss are a primary source of information for the identification of wreck sites. These include the records of preliminary inquiries and court findings, newspaper

reports of the incident, and personal diaries and other correspondence. For a more recent wrecking oral historical evidence may also be available. Early eighteenth and nineteenth century shipping records such as Lloyd's Shipping Register, Bureau Veritas, Norske Veritas, American Bureau of Shipping, and naval and local customs registers and surveys, give a variety of information that can be matched to the physical remains recorded in the wreck inspection process. This includes lengths, construction materials, wood types, number of masts, fastening compositions (copper or copper alloys), sheathing compositions, types of knees, number of boilers, number of grates per boiler, engine types and numerous other details of ship construction. Lloyd's Register also provides data on minimum sizes for fastenings, anchor chains and other ship's fittings. These are related to the tonnage of a vessel and therefore can be used as a crude device for measuring a ship's tonnage (McCarthy, 1982:50).

Matching artefacts and ship's fittings to the approximate period of their manufacture is another technique that can aid identification. Common types of archaeological material from wreck sites include sheathing, sailors' pipes, buttons, bottles, ceramics, coins, engines, stoves, anchors, windlass, chains etc. There is a wide variety of published material that is useful for dating artefact types including treatises on anchors, artillery, patent office records, ceramic and bottle guides. Figure 148 shows a variety of manufacturers' symbols and marks found on ceramic material excavated from the *Eglinton* wreck site.

It is a comparison between the historical record and the archaeological data that potentially leads to the reinterpretation of the assumption made using historical sources, where information has been previously inaccurate, mis-recorded or incomplete. In some instances, no historical records exist to provide information on a vessel and the wreck site itself remains the only source of data available to the researcher.

Management plans and significance assessments

A management plan gives the basic direction to the future action associated with a site and its requirements in terms of interpretation, protection, excavation, research and publication. The assessment of significance of a site provides managers with a way to channel resources for on-site preservation, risk management or excavation. There is much debate concerning the validity of comparing one site to another, since all possess a degree of 'cultural significance'. However, in times of limited funding it appears to be a valid and practical approach.

For the 38 sites identified as part of this survey the level and nature of the assessment was contingent on the available information on each site. Sites with a substantial amount of specific history, excavation data or site survey information had the potential for greater analysis and fuller significance assessments.

The assessments of significance found in this book are based on the criteria outlined in the *Guidelines for management of Australia's historic shipwrecks* outlined above, and the Australian ICOMOS Burra Charter (The Burra Charter, 1981). Many wreck sites display common attributes, therefore it has been possible to list the criteria (1–8, outlined above) which apply to each particular site in the data summary section in PART 2. For example, most sites are historically significant for their contribution to the development of Western Australia, whether part of exploration, immigration, or local and overseas trade networks, as part of the goldrush or in opening up of the north-western region. All archaeological assemblages offer the opportunity for Western Australia's colonial history to be re-examined, through research into the origin, value, quantity and quality of cargo items. The study of vessel remains has the potential to yield information on design and construction not necessarily available through the historical record. Through establishing on-going conservation monitoring, sites are scientifically significant for their potential to yield data that may aid in the assessment of deterioration and strategies for preservation. Through interpretation, each site has educational significance that can demonstrate the development of Western Australia, and the importance of wreck site protection. Most sites provide recreational opportunities and may already be included in the wreck trails for the Rottnest Island, Mandurah and Rockingham regions. Where appropriate, site specific significance statements have been made in PART 2.

Excavation and collections management

Recovery of archaeological material is a destructive process and excavation disturbs material that has established an equilibrium with its surrounding environment either under sediment or within coralline formations. Conservation and curatorial

demands require perpetual maintenance and an abiding commitment of funds and professional expertise.

The difficulties associated with this have helped to stimulate (along with the development of significance assessments and management plans) a move away from *ad hoc* excavation of sites to excavations particularly designed to answer specific questions, and to the preservation of sites *in situ*. However, archaeological intervention on historic shipwrecks is the only way to rediscover, through the systematic recovery of material, the life and times of ordinary people and the maritime settlement of Australia. Extensive planning and identification of the appropriate methodology are essential prerequisites to excavation.

A number of sites in the survey region have undergone extensive excavation. These include:

- *James Matthews* (Figure 149);
- *Eglinton;*
- *Vergulde Draeck*;
- *Day Dawn*.

Partial excavations have been conducted on *Star, Belle of Bunbury, Elizabeth* and SS *Macedon*. The analyses of the excavated material have resulted in a number of displays and publications. Further references to these sites are contained in PART 2.

Site stabilisation after excavation is an important element of management programmes. Relocation of sites for protection is also possible. The wreck site of *Day Dawn* was moved to preserve it from modern naval shipping activities. The process of relocation on the sea-bed at Garden Island is shown in Figure 150.

One of the most important questions that the Western Australian Maritime Museum faces is how to properly care for recovered artefacts as a product of excavation. Conservation treatments are costly and long-term processes. A museum is charged with the maintenance of collections in perpetuity. The issue that this process raises is how much more material can be collected and for what eventual purpose? What questions do we aim to answer now and in the future? Can we determine what the future generations will regard as important? Does the current limit of resources for the conservation of material mean that few items should be well cared for, or many items stored with few opportunities for the treatment they require?

Figure 148
Manufacturers' marks from artefact material excavated from the wreck site of Eglinton.

Conservation

Conservation of shipwreck sites and artefacts that come from them are a vital part of management strategies. This work involves a multidisciplinary approach, where archaeologists and materials scientists must work together to plan the effects of excavation, the long term stability of the site and the nature of the environment.

A vessel hull that has sunk without breaking up will provide much of the protection for its contents. Slowly, sand, silt and mud may begin to bury it thereby preserving a large quantity of material.

Figure 149
Recording hull structure of James Matthews *during excavation of part of the site (MA 695)*

The underwater environment is inherently stable in that it has a buffered pH of about 8.2. It is usually the movement of water, sand and silt which cause the majority of damage to objects and hull structure. Location of sites on reef tops where little protection is offered means that the hull may be the only remains to survive in the long term. Artefacts can be found in the solution holes of the reef.

In the tropical and sub-tropical waters of Western Australia wooden artefacts must survive the ravages of wood boring marine organisms (teredo worms were often present in the ship's timbers when the vessel was built); often it is only when the timbers or objects are buried under coral debris, ballast mounds or sand that any significant structure remains. However, the shipwreck can provide an invaluable source of historical information and its contents survive as a time capsule representing the historic shipping period (Pearson, 1987:preface).

Problems of conservation begin to occur when material is raised without the benefit of adequate and immediate conservation facilities. Waterlogged wood, if allowed to dry out can shrink, warp and crack, cast-iron cannon balls may spontaneously crumble, bronze objects that may look solid will be mineralised, and very soft and porous. Glass and ceramics, if not desalinated, may lose surface layers due to salt crystallisation.

Considerable research has been undertaken in recent years on the treatment and conservation of marine finds including metals, wood, fur, textiles, leather, bone, rope, ivory, glass and ceramics. The Department of Materials Conservation at the Western Australian Museum has been highly active in the research of techniques used in the preservation and the deterioration of submerged material (Figure 151). It is also involved in the ongoing treatment of excavated artefacts and hull structure. Today archaeologists and conservators work together in all aspects of the wreck inspection and the excavation programmes undertaken to facilitate an understanding of the degradation process.

> The routine measurement of electrochemical parameters such as the surface pH of degrading artefacts and the corrosion potential of metal objects on wreck sites has a recent history…conservators have found that the knowledge obtained through

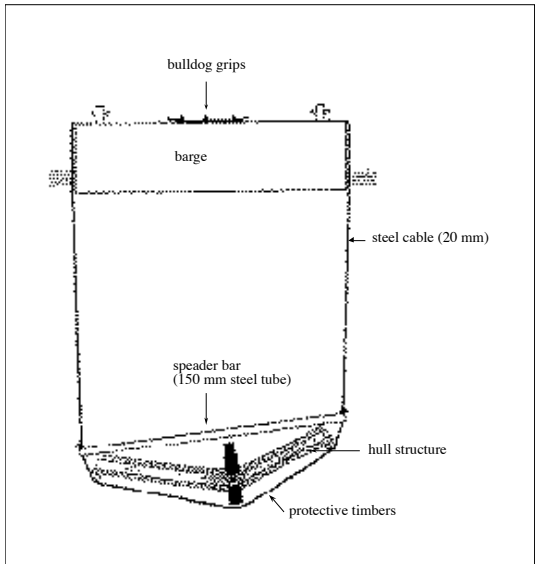


Figure 150
Day Dawn *rigged for relocation (from Henderson & Kimpton, 1991:27)*

these on-site measurements is an invaluable aid to understanding the corrosion mechanisms and the modes of deterioration of materials on archaeological sites (MacLeod, 1989).

With the increasing trend away from excavation, toward the protection of wreck sites *in situ,* there has been research in the effective methods of site stabilisation. For example, the micro-environment existing under concretions (a conglomerate of iron corrosion products and marine organisms) permits corrosion to proceed at a steady rate. Essentially this can be halted or substantially decreased for the time an iron object is on the sea-bed by the attachment of sacrificial anodes. Cathodic protection can also be the pre-treatment of artefacts prior to excavation, and thus reducing treatment time when these items are brought to the surface (Carpenter and Richards, 1994).

The potential of scientific analysis on the sea-bed and the study of shipwreck material is far reaching. For example, the fouling of ships' hulls with barnacles was a significant problem for early mariners, and of major economic importance to the shipping trade (MacLeod, 1982:249). As barnacles grow and secrete their exoskeletons of calcium carbonate, they act not only as a fouling mechanism but as a device for recording the temperature of the sea water. This type of information can be used to track the movement of vessels as they travelled around the world, through waters of different temperatures.

Liaison

The effective management of shipwreck sites involves the coordination of a number specialists and voluntary assistants who contribute a range of expertise and resources. Within the survey region the Department of Conservation and Land Management (CALM) is the primary government authority which has an interest in the preservation of wreck sites as part of marine parks.

Marine parks allow for the protection of the marine life that is often an intrinsic value of wreck diving and part of the public appreciation of shipwrecks. Areas closed to fishing and anchoring also prevent sites from being damaged by anchors, nets and pots. In some areas the density of archaeological remains such as those at Rottnest Island promote that area as a single management unit. Any publicity that identifies the objectives of the park and resources within it will extend to the protection of shipwrecks. Parks also provide a protective mechanism for sites that have not yet been discovered or declared under legislation. By establishing memoranda of understanding between the Museum and other agencies there is an enhanced level of protection and interpretation available for sites, through greater communication and liaison. The principle marine park within the survey region is the Marmion Marine Park. However, the Thomson Bay area at Rottnest Island has similar status. CALM are in the process of planning a park encompassing the Penguin Island and Warnbro area to be gazetted as the Shoalwater Marine Park.

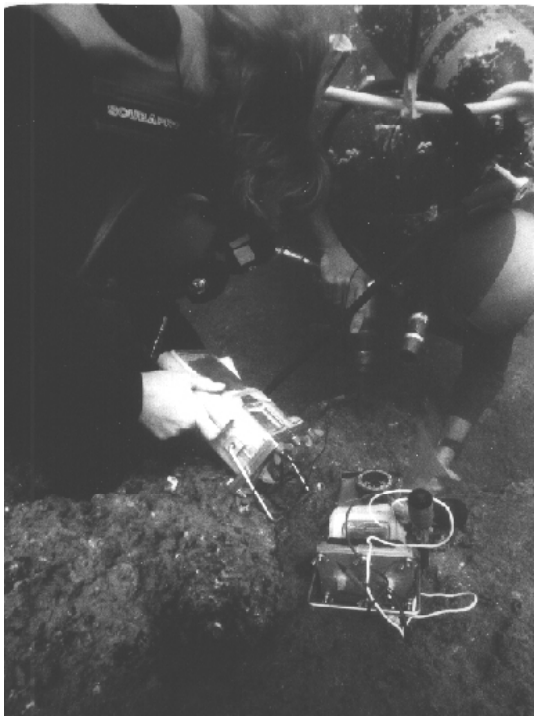


Figure 151 Conservators taking corrosion potential measurements (Jon Carpenter, Department of Materials Conservation Collection)

Amateur and community groups, dive charter operators and developers can act in such a way as to effectively protect and promote sites with which they are culturally or historically connected, or are bound by legislation to recognise. A variety of people can often offer valuable information on wreck sites and thus contribute to the overall body of knowledge assembled for the better management of sites. Volunteers should be encouraged to contribute to the recording of sites, historical and archival research.

Interpretation and education

One of the most important aspects of the Museum's CRM programme is interpretation and education (Figure 152). It seeks to do this through:

- display of shipwreck material;

- school and public education programmes;
- publication and dissemination of material;
- promotion of objectives through media and public lectures;
- providing information and answering requests;
- assisting community groups;
- providing access to databases and library facilities;
- promoting shipwreck trails;
- liaising with the diving community;
- training volunteers in wreck site and artefact management.

The Western Australian Maritime Museum has encompassed a number of these elements within the survey region. Many artefacts derived from shipwrecks are on display at the Museum. Shipwreck trail pamphlets for Rottnest Island (*The Rottnest Wrecks Heritage Trail*) and the Mandurah (*The Mandurah Wreck Trail*) areas have been developed by school groups and are available through the Museum, dive shops and tourist offices. Similar pamphlets for the Fremantle, Rockingham and the Moore River areas are recommendations of this book, and have already been considered for development. A number of volunteers have assisted with the field work and archival research. Recommendations involve the further production of interpretive material including: a video demonstrating the historical importance, research potential and diversity of sites within the region; and, a multi-media interactive installation at the Museum which would offer enhanced access to wreck sites information and the associated artefact collections.

Figure 152
Interpretation plaque as part of the Rottnest Island wreck trail (RIW 54)

3.2 The coastal environment

Climate

Historical descriptions

Maritime explorers prior to Charles Fremantle (including de Vlamingh, 1696–97; the French scientists, 1801; and Stirling, 1827) who came to the Perth region, approached the continent from the north of Rottnest Island. Each was apprehensive about the reefs to the west of the Island but even more concerned about the broken water extending southwards (Stragglers Reef, Carnac and Garden Islands). Volkersen (1658), who sailed close to the continent in his search for *Vergulde Draeck* also saw dangerous reefs.

The Commonwealth Bureau of Meteorology, under the direction of H. A. Hunt (1929) compiled the results of rainfall observations made in Western Australia for the period between 1876 and 1927. The data was tabulated from 1374 measuring stations throughout the State. This document has significance to the present study as it records notable meteorological events as far back as 1831 including: aurora; bush fires; heavy rainfall and cloud bursts; thunder, lightning and wind storms; hurricanes, cyclones and heavy gales. It also tabulated overcast and clear days; cloud and sunshine; winds for Perth between 1897 to 1927 and the average resultant wind every three hours; the daily velocity of winds, thunder, lightning, dew and fog.

The summary of meteorological occurrences includes newspaper references and observers' reports for notable events. Newspapers such as the *Daily News* and *The West Australian*, and the records of sea captains were also used as contemporary reference material. In some instances it has been possible to correlate the climatic information on specific days to the report of wreck events or stranding. For example, under the section headed *Windstorms* the following was reported in 1843:

> 11th April-Swan River, Perth, and Bunbury-Perth was visited by a most terrific gale from the north-west, amounting to a full hurricane. Strong gales have frequently occurred during the winter months from this quarter; but this gale was unusually severe, although it lasted such a short time. It set in about 6 p.m., and lasted until nearly 10 p.m., when it gradually lulled. The gale was so sudden and tremendous as to force the *Success* to drift ashore with two anchors down (cited in Hunt, 1929:165).

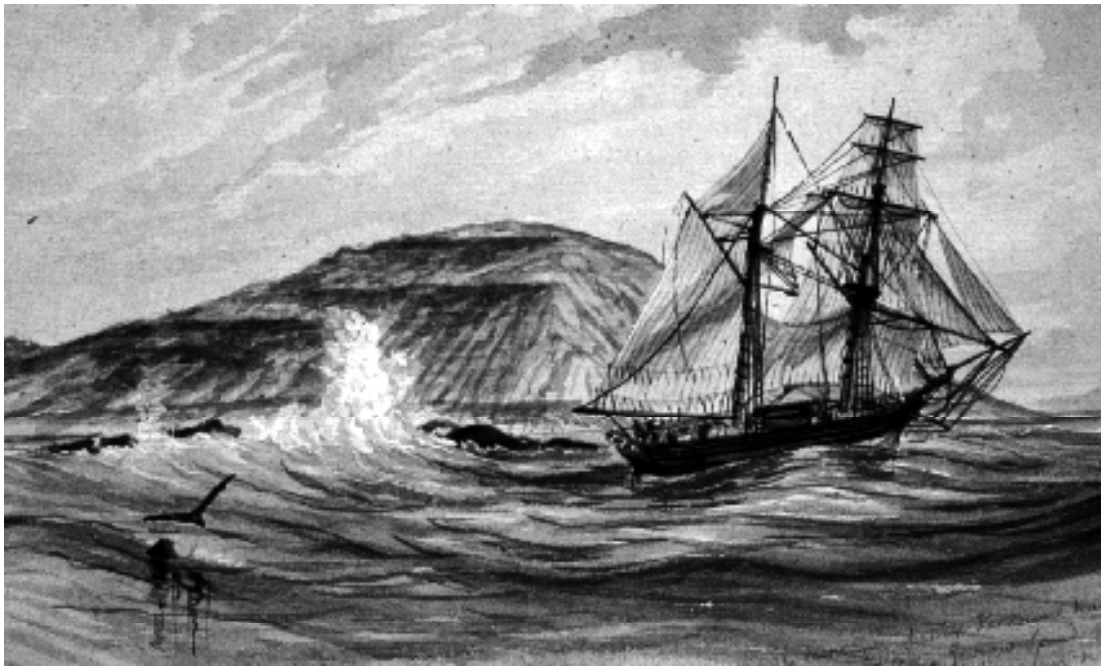


Figure 153
Small coastal vessel sailing off Western Australia (MA IL 318)

Further insights into the hazards faced by captains in visiting and mooring their vessels along the exposed coastline of Western Australia are evident from early reports. In 1845

> 28th February-Perth-A terrific hurricane visited the Colony. The barometer fell steadily over five days until it reached 29.00; the wind from the north and north-west gradually increased and the barque *Merope* was stranded on Parmelia Bank. The *Halifax* packet parted her cable at midnight and grounded

on Success bay. The general opinion is that it blew harder than in the winter (cited in Hunt, 1929:165).

Notes were made on the Australian winter for 1851:

> [It]...was a period of unusual atmospheric perturbation. Early in May the Swan River papers stated that 'the beacon on Challenger Rock has suffered by the late stormy weather'. In the month of June a most violent cyclone, passed along the whole south coast of Australia, from Cape Leeuwin to Van Dieman's Land and New Zealand (Hunt, 1929:165).

Several of the wreck events that occurred in the survey region were also recorded. In 1899:

> 11th July-Fremantle-A severe storm occurred, in which the *Carlisle Castle* and *City of York* were wrecked close to Fremantle. The centre of the storm passed along the Southern Ocean, the lowest barometric reading being 29.195 inches at Leeuwin, at 2 p.m. on the 11th. At Fremantle the greatest velocity of the wind was 71 miles per hour at 11.20 a.m. The gale commenced to subside on the 12th (cited in Hunt, 1929:176)

Figure 154
Mean pressure distribution over the Indian Ocean in January and July (after van Senden, 1991:figure 4)

CONTEMPORARY DESCRIPTIONS

In Koppens climatic classification, south-west Australia has a 'Mediterranean' climate controlled by the annual movement of the anti-cyclonic belt from latitude 40° south in the summer to 30° south in the winter, with cool wet winters and dry hot summers. In summer the region lies in the tropical low zone with easterly winds known as the south-east trades and in winter enters the high pressure belt with the westerly winds known as the Roaring Forties. During the winter the anti-cyclonic pressure systems are periodically (approximately every seven days) displaced by the rapidly moving, low pressure cyclonic systems of the Roaring Forties that sweep eastwards across southern Australia, bringing strong winds and rain (Hearn, 1991:6).

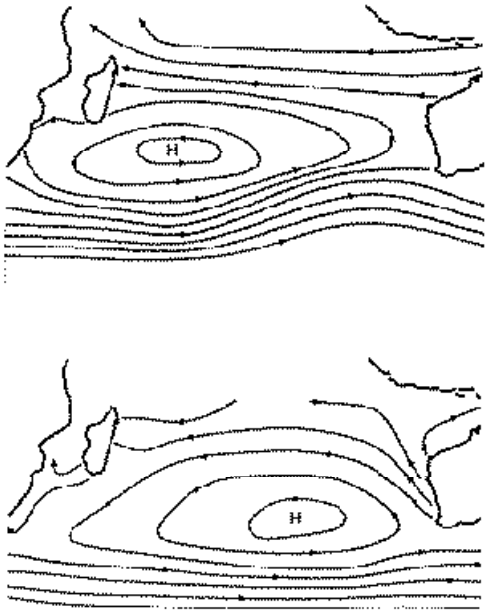
The strength and intensity of the pressure systems within the anti-cyclonic belt is affected by the inter-annual variability linked to the Southern Oscillation Index (SOI). Rainfall and the annual discharge from rivers show a strong correlation (van Senden, 1991:9). Relevant to the survey region is that while seasonal trends of the variability in the south-east Indian Ocean and local rainfall are influenced by these inter-annual variations, the near-shore zone responds to local winds and surface heat fluxes that lead to baroclinic circulation (Figure 154).

Winds

The sequence of winter weather consists of anticyclones separated by cold fronts (the Roaring Forties). An anti-cyclone centred east of the coast will bring north-westerly winds with warm air. As this system moves eastwards it gives way to the air stream associated with the next high and the wind changes to the south-west and brings cold polar air. It is a sudden change and is associated with a cold front. Wind strengths are very high (c. 20 ms^{-1}) near the front producing the maximum wind strengths experienced in these coastal waters. A belt of rain accompanies the front and is responsible for the majority of the rainfall in this region (Hearn, 1991:6). The major storms have a duration of 10 to 55 hours, with winds from 15 ms^{-1} to 25 ms^{-1} gusting to 35 ms^{-1}. The synoptic situation which produces these gales repeats itself every five to ten days but severe gales only occur several times in one season.

In summer, the south-west of Australia lies north of the anti-cyclonic belt which produces easterly winds and dry descending air producing high temperatures and clear skies (Hearn, 1991:6).

Mean monthly wind vectors for the period 1971 to 1975 at Fremantle illustrate the seasonal nature of the wind field (Figure 155). In summer the mean



wind is dominated by the southerlies; in the winter the mean winds are much lighter and predominantly from the west (van Senden, 1991:9).

Except during the passage of cold fronts in winter, the coastal region is subjected daily to a sea-breeze cycle. This involves a wind from the south-west which starts in the late morning and can reach speeds of 10 ms^{-1} during summer afternoons.

There are approximately seven to ten tropical cyclones between the Cocos Islands and Darwin and three of these affect the north-west coast, although these rarely travel as far south as the Perth metropolitan area. There is a suggestion that cross-shore cyclones on the Australian North-West Shelf create continental shelf waves that would propagate southwards (Hearn, 1991:7).

The wind roses (Figure 156) show that the dominant wind direction is from the south-east. Mean wind speeds are close to 7 ms^{-1} except in the late autumn and spring when the wind speeds are marginally lower (Hearn, 1991:7). A study undertaken between 1971 and 1978 (Steadman & Craig, 1983) showed that the probability of a calm is much higher in the autumn and winter than the summer due to the effects of the sea breeze.

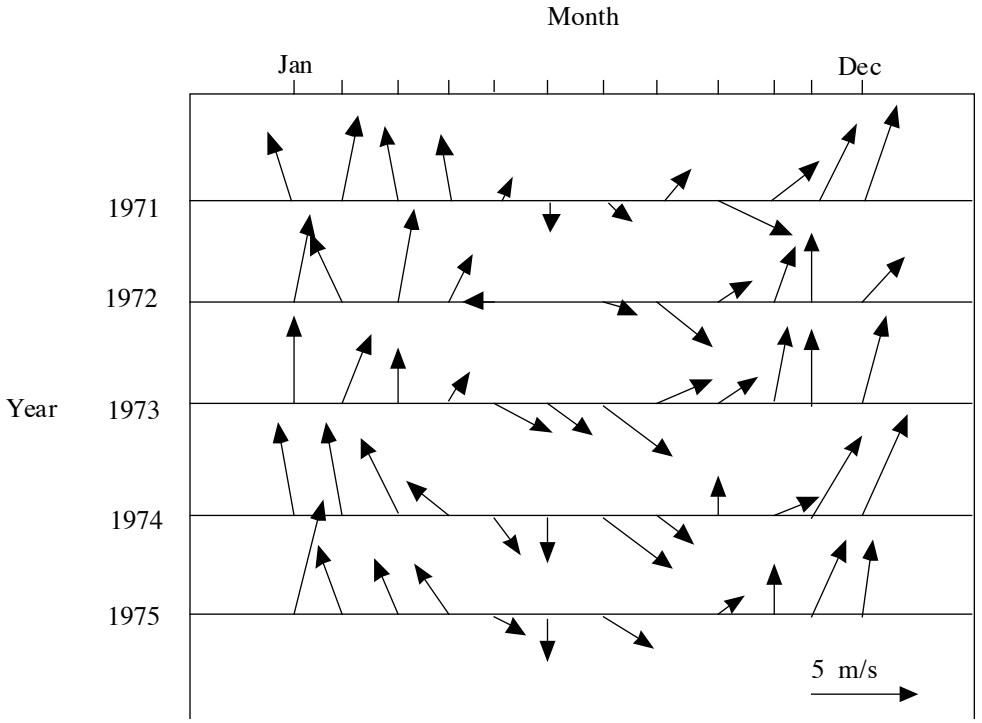


Figure 155
Mean monthly wind vectors from 1971 to 1975 (after van Senden, 1991:figure 6)

Temperature

The mean air temperature at Fremantle varies from 13.5° C in the winter (July) to 22.5° C in summer (February). Rainfall is highest from May to August and the dry occurs between November and March.

Wave climate

Waves reaching the coast of south-west Australia are composed of swell developing in the Southern and Indian Oceans and through locally generated wind waves. Much of the swell is dissipated on the offshore reefs and does not enter the coastal basins as indicated by information from the wave rider deployed in the late 1970s (Figure 157) throughout Cockburn Sound. For the inshore buoys, wave attenuation is about 70 to 85 per cent and the wave period between 5 and 12 seconds at the outer stations but 2 to 6.5 seconds at Parmelia Bank. This tends to indicate that waves in Cockburn Sound are locally generated and the fetch is limited by Garden Island (Hearn, 1991:7).

For coastal basins that are only protected by offshore reefs, a variable amount of swell does penetrate although generally basins are low energy. Analysis of data collated offshore at Guilderton showed wave attenuation to be around 50 per cent although this varies with wave height and period, and mean water level. The general patterns exhibited large attenuation of the wave field offshore, and an influence by local winds and a fetch limited sea inshore. Similar results were found from wave rider deployment offshore from Mandurah, and it is expected that these conditions are typical of the northern and southern basins with

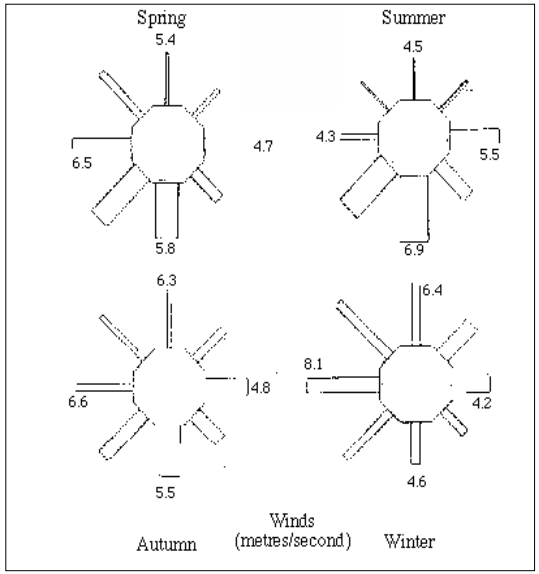


Figure 156
Seasonal wind roses for Cockburn Sound (after Hearn, 1991:figures 3a–d)

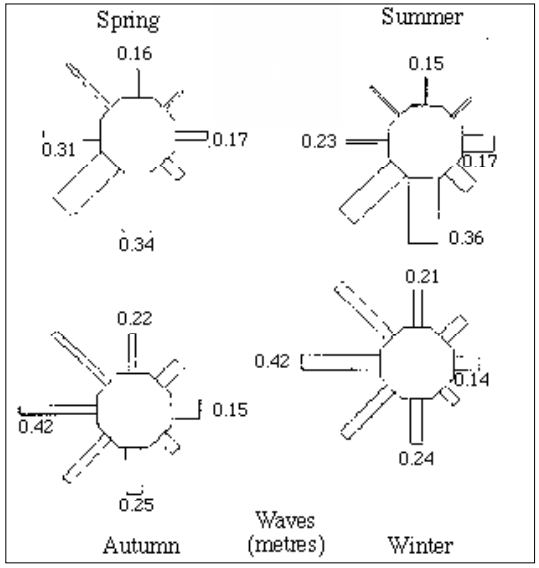


Figure 157
Seasonal wave roses for Cockburn Sound (after Hearn, 1991:figures 5a–d)

Figure 158
Major topographical features and coastal basins in the survey region (after van Senden, 1991:figure 2)

slightly higher attenuation in the more sheltered Cockburn Sound (van Senden, 1991:13).

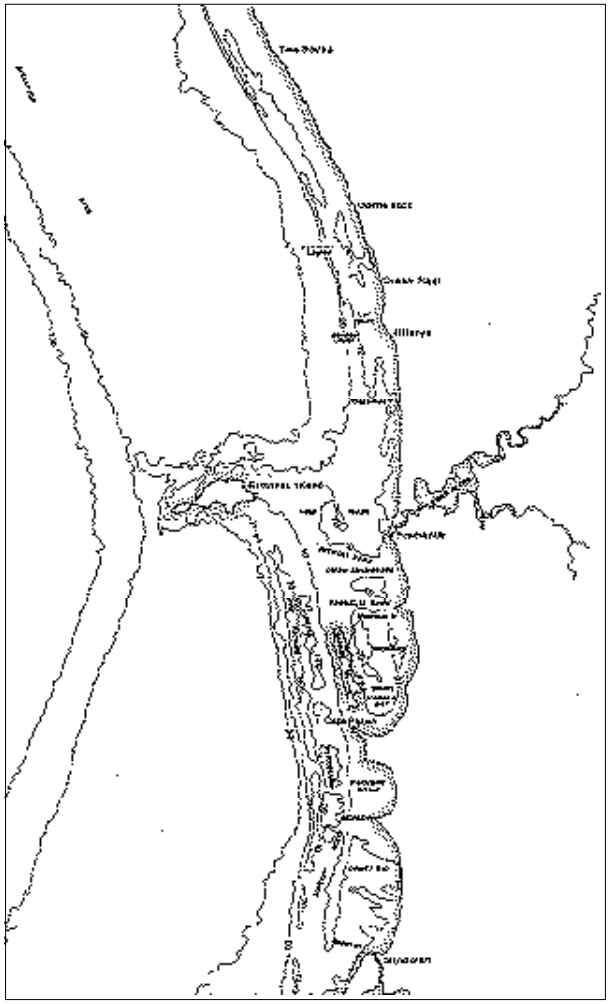
Coastal basins and bathometry

The Perth metropolitan waters are characterised by a series of coastal basins bounded by a chain of offshore limestone reefs and islands aligned roughly parallel to the shore. The major topographical features and coastal basins in the survey region are shown in Figure 158.

North of Rottnest Island the reef chain is located approximately 5 to 6 kilometres offshore. The channel between the reefs and the shore consists of shallow regions of less than 5 metres depth interspersed by deeper basins typically 10 metres in depth. There are three sub-regions within this channel, Marmion Lagoon, the Whitfords Lagoon and to the north a less well-defined and unnamed area between Quinns Rocks and Two Rocks (van Senden, 1991:7).

The Marmion Lagoon is open to the south of Trigg Island Point and is bounded by the Little Marmion Reefs offshore; shoals to the north toward its northern extent, Lal Bank, the Three Mile Reefs and the offshore reef chain. To the north, shallow outcrops occur throughout the Quinns Rocks to Two Rocks region.

South of Rottnest Island the coastal basins are more clearly defined by distinct sandbanks and offshore reefs that form natural barriers. Five Fathom Bank is a chain of reefs (varying from 0 to 15 metres in depth) extending from Rottnest Island 15 kilometres south to Mandurah and it forms the outer boundary of the area. Seaward of Five Fathom Bank, and to the north of Rottnest is



Direction Bank. Lying parallel to the Five Fathom Bank and 5 kilometres inshore is another chain of reefs and islands including Stragglers Reefs, Carnac Island, Garden Island, Cape Peron and the Murray Reefs. The 20–metre deep trough between these two chains is known as the Sepia Depression (van Senden, 1991:8).

At the southern end of the region, and inshore of the Murray Reef, lies Comet Bay which is roughly 10 metres deep and has various channel connections to the deeper ocean waters offshore. At its southern end lies the Mandurah Channel entrance that connects Peel-Harvey Inlet with the sea. Becher Point marks the northern extent of Comet Bay and to the north of this lies Warnbro Sound which consists of large shallow regions and a 20–metres deep inner basin connected to the open sea by narrow entrance channels 5 metres deep. The boundaries of the various sub-regions and coastal basins of the Perth metropolitan waters are shown in Table 1 (van Senden, 1991:8).

To the north and east of Cape Peron lies Cockburn Sound which is sheltered from the prevailing south-westerly winds and swell by Garden Island. A small-boat channel, South Passage which is approximately 5 metres deep found at the southern end of Garden Island, connects Cockburn Sound to the Sepia Depression. The Sound has a 20–metre deep basin bounded in the north by Parmelia Bank (2 to 5 metres deep) into which a 14–metre deep shipping channel has been dredged to connect the Sound to Owen Anchorage, the next basin to the north. The Owen Anchorage basin is approximately 14 metres deep and is bounded offshore by Carnac Island and the shallow

Local name of region	**Depth in m**	**Dimensions of basin in km (N–S & E–W)**	**Boundaries**	
			North-South	**East-West**
Comet Bay	10	20 x 8	Becher Pt	Shore
			Pt Robert	Murray Reefs
Warnbro Sound	10–20	7 x 4.5	Cape Peron	Shore
			Becher Pt	Murray Reefs
Cockburn Sound	20	17 x 7	Mangles Bay	Shore
			Parmelia Bank	Garden Island
Sepia Depression	20	50 x 5	Rottnest Island	Garden Is/ Murray Reefs
			Mandurah	Five Fathom Bank
Owen Anchorage	14	5 x 8	Success Bank	Shore
			Parmelia Bank	Stragglers Reefs
Gage Roads to Trigg Island Pt	20	22 x (6–15)	Lal Bank	Shore
			Success Bank	Rottnest Is/ Trigg Is
Marmion Lagoon	8–10	8 x 5	Lal Bank	Shore
			Trigg Island	Marmion Reefs
Whitfords Lagoon		15 x 5	Quinns Rocks	Shore
			Quinns Rocks	Three Mile Reef
Two Rocks to Quinns Rocks	7	25 x 5	Two Rocks	Shore
			Quinns Rocks	Offshore Reefs

Table 1 Approximate boundaries of the various coastal basins in the survey region (after van Senden, 1991:8)

Stragglers Reefs, and to the north by Success Bank, which is between 2 to 5 metres deep. A 14–metre deep shipping channel has been cut across Success Bank and connects Owen Anchorage to Gage Roads. The area inshore from Rottnest Island and north to Trigg Island Point is not as well defined as the other basins. It includes the Gage Roads basin in the south, large sandy shoals near Rottnest Island and in the centre and towards the north a large area of relatively flat bottom with depths ranging between 10 and 13 metres, interspersed with the occasional limestone outcrop (van Senden, 1991:9).

Geology and geomorphology

The survey region area is underlain by Tamal limestone and is partially covered by yellow quartz sand and the younger carbonate-rich Becher and Safety Bay Sands. Tamal limestone was deposited during the Pleistocene period (1.5–1.8 million years ago) as a series of parallel beach and dune ridges. Since deposition this sediment has cemented into a porous limestone that incorporates solution pipes and dense capstone layers (Pobar *et al*., 1992:27). The upper Safety Bay Sands comprise the beach, beach ridges and dune sediment. The underlying Becher Sands have formed beneath the seagrass covering.

The survey region is characterised by a series of limestone ridges, the largest of which forms the mainland coast. As described above, the offshore lower ridges form broken chains of islands and reefs that are often separated by linear depressions. The reefs often display numerous complex underwater structures including cliffs, caves, solution pipes and platforms. The ridges have, in places, eroded to form cliffs and wave cut platforms with rocky headlands separating small sandy bays.

Superimposed on the limestone basement areas are land forms associated with the younger sandy sediment. Dunes are often stabilised by vegetation.

The structure of the platforms in the Perth area has been summarised by Semenuik and Johnson (1985) and Serle and Semenuik (in Wells *et al*., 1993). While there is considerable variation from one platform to another, a typical structure can be outlined (Figure 159). Shoreward the platform may be backed by a cliff which may extend to a height of as much as 25 metres. The lower portion of the cliff overhangs the platform at about 3 metres above the base, representing a previous sea level. Beneath the visor is an undercut notch which eroded sub-tidally and this slopes gradually to the platform surface. Platforms vary in height from 1 to 0.3 metres above the surface as in the case of Rottnest Island. In width they vary from a few metres to hundreds of metres wide (Wells *et al*., 1993:4).

Hydrology

The survey region lies in an area with a temperate water temperature regime. Examination of temperature fluctuations in Cockburn Sound and Gage Roads measured over an eight-year period from 1960 to 1967 ranged from 14.5° C in July 1960 to 24.7° C in February 1961. There was a seasonal pattern of minimum temperatures of about 15° C in the winter to a maximum of 23° C in the summer months (Wells *et al*., 1993:5).

Sea-water temperatures for Marmion Marine Park range from 22° C in the summer months to a minimum of 17° C during July and September. There is a drop in the water temperature close inshore because of the direct loss of heat to the atmosphere (Pobar *et al*., 1992:28).

Discharge from the Swan River, Moore River and the Peel-Harvey estuary follows about one month from the winter rains. During large floods the discharge can increase ten-fold over the annual mean and can transport a considerable nutrient load

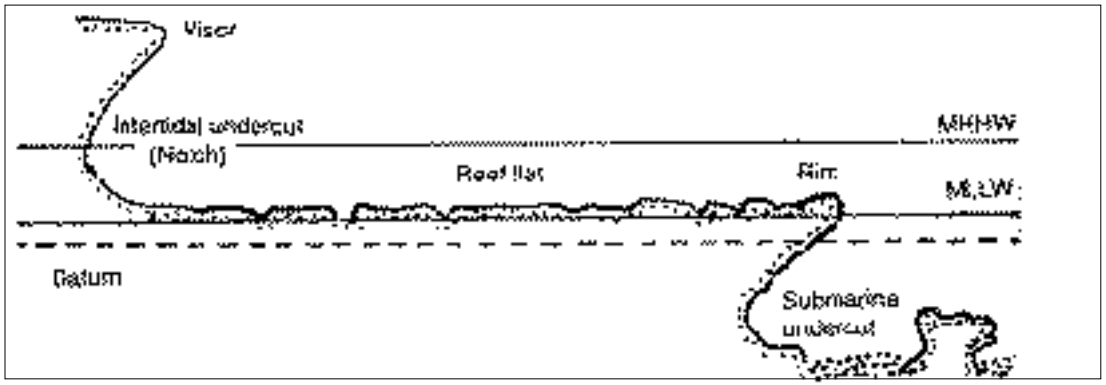


Figure 159 Structure of a typical intertidal platform in the Perth metropolitan area (from Wells et al.*, 1993:4)*

to the coastal margins (van Senden, 1991:10).

Salinity measured at the Marmion Marine Park ranges from 36.1 gml^{-1} in the summer down to 35.3 gml^{-1} in the late winter. Salinity fluctuates in accordance with sea-water temperature. The effects of ground waters and the nutrient levels vary throughout the survey region and are not easily summarised.

Tides in the metropolitan area are mixed. Clear semi-diurnal tides with two highs and two lows occur on most days, although days also occur where there are diurnal tides and those when little tidal movement occurs at all. The range on any given day rarely exceeds 0.7 metres. Mean sea level varies during the year by 0.3 metres. During winter, when the prevailing south-westerly or southerly airflow is onshore, the mean sea level tends to increase. In summer the prevailing winds are offshore and this tends to lower tidal levels. If easterly airflows continue for several days such conditions can result in massive mortalities of organisms on the platform surface (Wells *et al*., 1993:5).

Circulation

Water movement on the inner continental shelf off Perth is driven mainly by wind stress. Water generally flows northward in the summer and southward in the winter. In the shallow, near-shore waters, local wind currents become more dominant than the regional water movements. Mean current speeds range between 0.05 ms^{-1} and 0.1 ms^{-1} (Pobar *et al*., 1992:26).

In the general pattern of oceanic circulation found in all other major oceans there is a system of surface currents that form a gyre along the oceanic boundaries and these flow in a clockwise direction in the northern hemisphere and counter-clockwise in the southern hemisphere. It would be expected then that this regime would produce a north-flowing surface current along the coastline of Western Australia. The flow is in fact in the opposite direction flowing southward along the west coast. It is known as the Leeuwin Current. The presence of this current was suspected as early as 1897 and early collecting at Rottnest Island led local marine biologists to conclude that there must be a current bringing tropical species south from areas such as the Houtman Abrolhos (Wells *et al*., 1994:6).

The complex of chains and reefs within and adjacent to the survey region tend to act as partial barriers, restricting the exchange between inshore and offshore waters. Under stable wind conditions local circulation patterns tend to establish themselves as a result of the interaction between wind stress forces and the sea floor topography. Circulation is an important flushing mechanism and also affects the temperature regime experienced by reef (and wreck site dwelling communities).

Coastal processes

While it is not possible to detail the coastal processes operating within each basin or sub-region a summary of the interactions between winds, waves, hydrology and geology at the Marmion Marine Park give an example of the forces acting on the coastline.

In general, swell induced onshore transportation occurs in a complex zone of swell wave interference behind the Marmion reefs. This has resulted in a major movement of sediment from the reefs to the mainland coasts forming in this case Lal Bank, Whitfords Plain and the transgressive dunes found here (Pobar *et al*., 1992:29–30). Minor onshore transport is evident as a thin plume of sand moving across the seagrass.

In the surf zone, swell induced long-shore transport moves sand towards the zone of onshore transport. Local wave induced long-shore transport moves sediment northward in the summer. The coast erodes during the winter. Seasonal recycling of beach and foreshore material to an offshore bar also occurs (Pobar *et al*., 1992:30).

Studies on the inshore transport of sediment is of particular importance to the periodic burial and exposure of wreck sites on sand. Sediment movement is most closely controlled by the long waves generated by storm activity in the Indian Ocean, causing a resonance between the shore and offshore reef chain. Although present understanding of the mechanisms is limited, many of the mobile bottom features such as sand-bars and beach cusps are thought to be associated with the oscillations found in the region (van Senden, 1991:19).

Marine biota

The south coast has a warm temperate southern Australian marine biota. This coast extends from Cape Leeuwin at the extreme south-west of the continent eastwards to the South Australian border. Like the north coast, the coast from Cape Leeuwin

to North-West Cape is a region of biogeographical overlap with a mixture of southern Australian warm temperate species and Indo-West Pacific tropical species. There are a number of major distribution limits on this coast and superimposed on the tropical temperate division of biota is a small proportion of species endemic to Western Australia.

The Leeuwin Current has two effects on the distribution of marine flora and fauna. Firstly, it carries larvae from tropical species much further to the south than they would otherwise extend. With the increased surface temperature associated with the current the larvae can survive and grow. However, the second effect is that the larvae tend to extend southwards along the outer continental shelf and not along the coastal fringes, although some of the resultant warm water species have been identified in these coastal regions.

Survey work has been conducted in specific geographic areas including Rottnest Island, Marmion Marine Park and the regions of shallow water reefs along the coast. Review of the literature shows quite distinct differences in the range and diversity of fish species, the distribution of benthic fauna and marine flora throughout the sub-regions under survey. For the purposes of this book the reader is referred to individual studies.

- Cockburn Sound (Wilson *et al*., 1978) for benthic fauna;
- Marmion Marine Park (Pobar *et al*., 1992) for general marine biota;
- Rottnest Island (Wells *et al*., 1993) for marine flora and fauna;
- Near-shore reef fish fauna of the west and south coasts of Western Australia (Hutchins, 1994).

Semenuik and Johnson (1985, cited in Wells *et al*., 1993) divided the rocky shores of the Perth area into four types:

(1) those with a platform and notch;
(2) rocky shores backed by sandy beaches;
(3) rocky shores with breccia; and
(4) shores with a truncated profile.

These platforms are affected in several ways by the biota that are living on them. Bioerosion from rasping animals such as sea urchins and abalone degrades the rock surface and creates the crevices found at the seaward margins of the platforms. Beds of algae or mussels trap and bind the sediment. The biota, particularly animals with calcareous exoskeletons, provides a source of sedimentary particles as they are broken down. The implication for the wreck site structures colonised by this biota is significant. The formation of concretions on metal objects and other protective coatings acts in such a way as to stabilise the fabric from further deterioration. It has also been noted that the biota living on platforms is zoned and when preserved *in situ* it provides a guide to the previous structure of the platform (Wells *et al*., 1993:4). One study undertaken on the mollusc growth found on the hull of a shipwreck site has been used to determine the length of time since the vessel was careened and is a record of the waters and temperatures through which the ship passed (MacLeod, 1982:249).

Conclusion

Other factors of the physical oceanography include the regional circulation and the Leeuwin Current; sea level oscillations and associated currents; tides; low frequency and spurious oscillations. The dynamics of these physical processes are too complicated to undergo review for this document. However, the reader is referred to studies undertaken as part of Environmental Impact Assessments for coastal developments, and as research projects associated with various government bodies. Pearce (1983) includes a substantial bibliography of physical oceanography in south-western Australian waters and references in Hearn (1991), D'Adamo (1991) and van Senden (1991) include a selection of more recent studies relevant to the greater Perth metropolitan region. Marine flora and fauna is well described for the Rottnest Island environment in Wells *et al*. (1993), and for other sub-regions in the publications mentioned above.

The synthesis above has been restricted to a discussion of gross or macro environmental parameters that are prevalent throughout the survey region. Each wreck site needs to be assessed in terms of the individual environmental factors that are active in the deterioration and preservation of the wreck fabric. Such factors include the salinity, temperature, turbulence and dissolved oxygen, water depth, pH and corrosion potentials; colonising flora and fauna and others. Some analysis of the wreck sites in terms of environmental criteria, that are considered to be indicators in wreck preservation, is in 3.3.2 later in the Appendix.

3.3 Analysis of the shipwreck resource

3.3.1: Ship technology

Introduction

In the 1840s and 1850s major structural changes occurred for the sailing vessel when wooden ships were replaced by those of composite construction. Throughout the 1850s, 1860s and 1870s, improvement to the marine engine was the single most important technological development in shipping, while the refinement of the screw propeller and better ways of manufacturing iron were also significant. Siemens steels, used for manufacturing boilers, enabled them to operate at higher pressure and increased horsepower, but without a corresponding increase in fuel consumption. When the triple-expansion engine was introduced, it further reduced fuel consumption. The resultant space created meant that extra cargo could be carried making steam-powered vessels competitive with sailing vessels even on long distance voyages (Henderson, 1977:204).

> As the steam engine improved, sail was displaced first from the shorter trade routes, and then from the long-distance deep-sea trades. The establishment of coaling stations, initially supplied by sailing vessels, enabled steamships to reach almost anywhere in the world, including Australia. By the 1890s steamers were encroaching on the Australian wool trade, just as they had done earlier...with the mails, passengers and manufactured goods (Henderson, 1986:60).

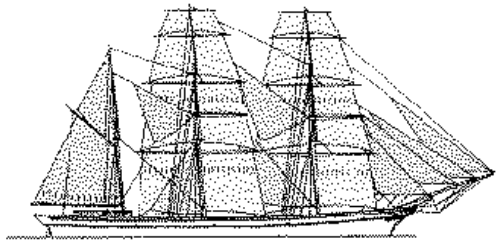
The study of technological change in an isolated region such as that of Western Australia offers an opportunity to examine the development of shipping in a world context. It is probable that there was a delay in the time taken for the diffusion of the new methods developed overseas to be adopted in colonial shipbuilding yards. Market disequilibrium occurred whereby the innovating entrepreneurs were able to embrace the new technology, but a much slower rate of change was stimulated throughout the rest of the industry. The colonial trades and shipbuilding industry would have followed a more gradual learning process that embraced the economic advantages of adopting such changes. The wreck resource tends to reflect the use of vessels that were built prior to the major changes even though they operated during the period of maximum development. The dynamics of these changes and how they are reflected in both the historical and archaeological record is discussed below.

Sail and rigs

The predominant rig types employed on the major trade networks to Western Australia and the Port of Fremantle were the barque, schooner, brig and brigantine.

The barque (Figure 160) is a three-masted vessel, square-rigged on the fore and mainmasts and fore-and-aft rigged on the mizzen (Kemp, 1992:61-2). The barquentine is a vessel resembling a barque but square-rigged on the foremast only with the main and mizzen masts being fore-and-aft rigged. The four-masted barque or jackass barque (Figure 161) is a vessel square-rigged on the foremasts and fore-and-aft rigged on the two after masts. These barques were particularly popular in the late nineteenth and early twentieth century as they were considered to be reliable in stormy waters. Examples of this type of barque from the survey are *Omeo* and *Ville de Rouen*.

The schooner (Figure 162) is a vessel rigged with fore-and-aft sails on two or more masts, and originally carrying square topsails on the foremast, though later with the advance in rig technology



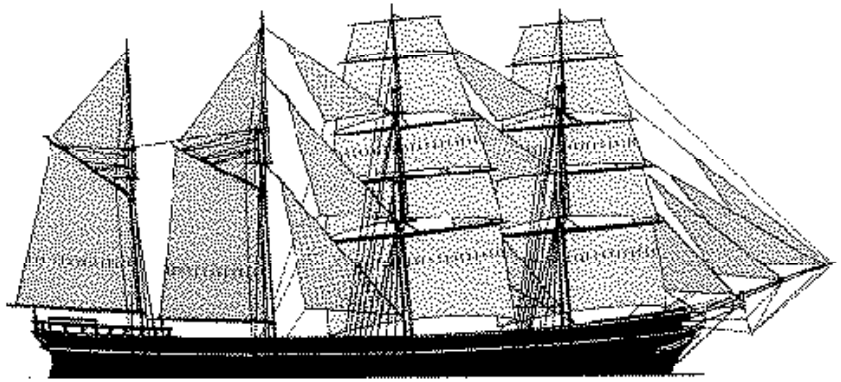


Figure 161
A jackass barque with a similar rig to Omeo, *c. 1870s (Burningham, 1992)*

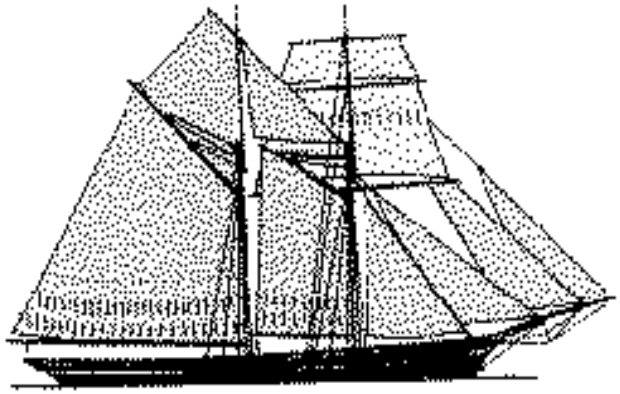
and design these were changed to jib headed or jackyard topsails. By traditional definition the schooner only had two masts with the mainmast taller than the fore, but three-masted, four and even five-masted vessels were built. Their main attraction was that they required a smaller crew size than a square-rigged vessel of comparative size (Kemp, 1992:759).

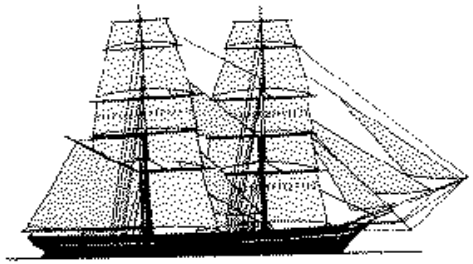
The term brig was originally an abbreviation of the brigantine (Figure 163) but was later classified as a distinct ship type after modifications to the original rig. The true type was a two-masted vessel, square-rigged on the fore and mainmasts. The brigantine was a two-masted vessel with a square rig on the foremast and fore-and-aft rigged on the mainmast (Kemp, 1992:109).

The ship, in its strictest maritime definition, signifies a particular type of vessel with a bowsprit and three masts, each with a topmast and topgallant mast and square-rigged on all the three mainmasts (Kemp, 1992:780). A fully rigged ship is shown in Figure 164.

Originally, merchant vessel design reflected a situation where the time spent on a voyage was less important than the maximum carrying capacity, which was optimised. This was demonstrated by the average merchant vessel sailing ship having a length to breadth ratio of three to one (3:1). Developments in vessel design were stimulated in the new trades to the east of Europe, with the promise of great economic profit. With the continuing growth in the trade in the seventeenth, eighteenth and nineteenth centuries and the consequent importance of the time on the voyage in relation to profits made, a change in hull design was prompted that sought to improve speed. Time was important because of competition for trade commodities. This was realised by increasing the length to breadth ratio to five or six to one (5:1; 6:1; Kemp, 1992:784).

In Britain, from 1773, the tonnage of vessels was calculated for the purposes of collecting





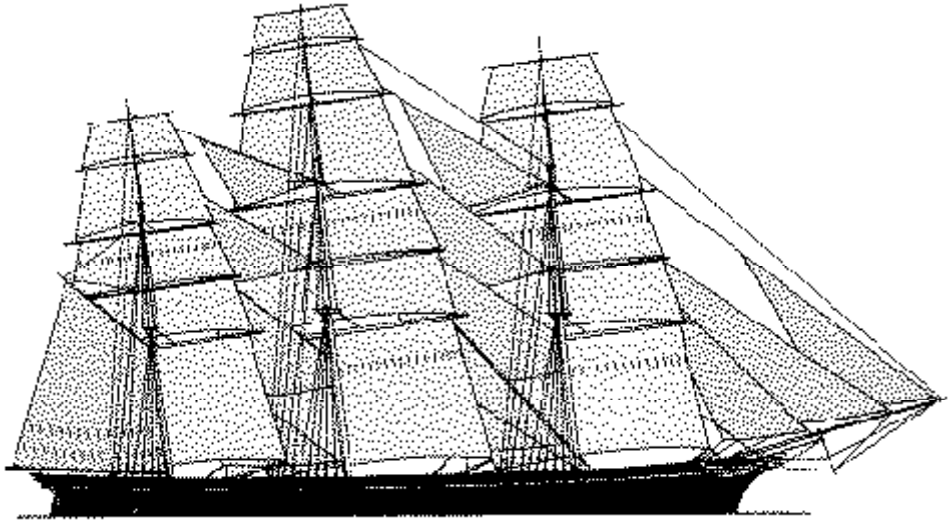


Figure 164
A full-rigged ship (clipper), c. 1860s (Burningham, 1992)

port and harbour dues. Called the British Old Measurement, the formula for calculation of cargo capacity remained in use until iron construction and steam propulsion were introduced in the 1850s. The changing hull shapes from typically bluff-bowed, full-bodied ships to longer, narrower hulls meant two calculations (giving gross and net tonnages) were needed to assess the cargo-carrying capacity of vessels.

Improvement in the rig, by increasing the number of sails carried on each mast, was also a method of decreasing voyage time. During the latter part of the historic period, developing competition saw some owners increasing the number of masts to four or five.

Square sails needed more crew to handle them than the fore-and-aft sails. The square sail had to be gathered up to the yard and made fast in several places aloft. The fore-and-aft sail rig on the other hand comes down as the halyards are let go. Whereas the square sail had to be handed over the braces, the fore-and-aft went over by itself. The former did have a distinct advantage, however, in running long distances before the wind such as those characterised on the Cape of Good Hope and Cape Leeuwin runs (Henderson, 1977:207). Until the introduction of the donkey winches fore-and-aft rigged vessels were limited in tonnage and size by the fact that sails over a certain area could not be raised due to their weight (Henderson, 1977:207).

When examining the shipping trade to and from the Port of Fremantle in the nineteenth century the barque-rigged vessel appears as the most popular. This was because its square rig could be effectively used for running in front of the trade winds. The fore-and-aft rig on the mizzen was employed for its economy of handling. The schooner, also with the fore-and-aft rig, was employed in the trade to Asian ports, the intercolonial trade to Western Australia and other States, and on coastal runs. The brig with the lower fore-and-aft sail on the mainmast together with a gaff and boom meant this rig type was well suited to deep-sea work and it was therefore used predominantly in the Asian and intercolonial trades (Henderson, 1986:45).

Even after the introduction of steam propulsion, there remained for many years a profitable existence for the merchant ships under sail. At first the limitations of sufficient bunker space for long ocean voyages made the steamship an uneconomic medium for the long distance transport that characterised the Australian run. The China tea trade and the Australian wool trade (a major export for Western Australia) were examples in which the sailing ship not only held a distinct advantage but stimulated the design of the clipper ship. These trades continued on until the Suez Canal opened and the steam-driven vessel began to dominate. As noted above, on the Cape of Good Hope route sailing vessels continued to predominate. Competitive aspects of the trade encouraged the great four-masted schooners and five-masted barques which were so efficient (Kemp, 1992:784).

Between 1870 and 1890, analysis of the historical records show that there was an increasing number of vessels of similar rig type entering the Port of Fremantle. Barques, schooners and brigs were almost equal in popularity in terms of numbers in the 1870s, but by 1890 at least five times as many barques were in use (Table 2).

A comparison of the historical record with shipwrecks and the archaeological record (shown in Tables 3 and 4) reflects the same general trends with the predominance of the barque used in the trade with Fremantle. Although analysis of the historical record has yet to be undertaken for a greater time period, some inferences may be drawn from comparison with the archaeological resource.

Tonnage

For the sailing vessel, the reason for increasing size and tonnage is related to the improved condition of the market supply and demand on the London to Fremantle route. This occurred as the population increased and the wool industry prospered. Increasing use of the barque rig as already discussed meant that a lower crew to tonnage ratio could be used. The archaeological

Vessel type	Number of vessels	Total tonnage
barques	791	77187
schooners	355	13468
brigs	176	7852
brigantines	55	3100
ships	16	4794
ketches and cutters	6	

Table 2
Historical record: vessel types visiting Fremantle between 1870 and 1890. This analysis excludes coastal vessels and was compiled using the Fremantle Register of Arrivals

Table 3
Details of the historic shipwrecks in the survey region

Vessel	Rig	Hull	Where built	Date built	Wrecked	Age
Vergulde Draeck	jacht	wood	Holland	1653	1656	3
James	brig	wood	America	1812	1830	18
Elizabeth	barque	wood	Singapore	1830	1839	9
Cecilia	barque	wood	Seychelles	1834	1839	5
James Matthews	brig	wood	France	?	1841	?
Eglinton	barque	wood	Canada	1842	1852	10
Robertson	brig	wood	England	1843	1859	16
Chaloner	ship	wood	England	1851	1874	23
Condeur	brig	iron	Scotland	1849	1874	25
Contest	barque	wood	Canada	1860	1874	14
Zephora	barque	wood	England	1869	1875	6
Gem	cutter	wood	England	1835	1876	36
Star of the Nile	barque	wood	England	1852	1876	24
Lady Elizabeth	barque	composite	England	1869	1878	9
Olivia	schooner	wood	England	1860	1878	18
James Service	barque	iron	Scotland	1860	1878	18
Star	schooner	wood	Pennacle	1876	1880	4
SS Macedon	screw st.	iron	England	1870	1883	13
Mica Plains	barque	iron	England	1876	1886	10
Belle of Bunbury	schooner	wood	Bunbury	1877	1886	9
Day Dawn	barque	wood	America	1851	1886	35
Janet	schooner	wood	Pennacle	1878	1887	9
Avon	barque	wood	England	1862	1887	25
Clanton Bolton	barque	iron	Iceland	1863	1890	27
Rowan	barque	wood	England	1864	1891	27
Wildfire	ship	iron	Scotland	1882	1893	11
Fisherman Dredge	dredge	iron	England	1893	1893	0
Data	brig	wood	Finland	1879	1893	14
Villalba	barque	wood	Scotland	1883	1897	14
Bayla	barque	iron	England	1864	1898	34
City of York	barque	iron	England	1851	1899	38
Carlisle Castle	ship	iron	England	1868	1899	31
Highland Forest	barque	wood	Scotland	1884	1901	17
Ville de Rouen	barque	iron	France	1891	1901	10
Conference	barque	iron	England	1855	1904	49
SS Orissa	screw st.	iron	England	1886	1905	19
Ocean	barque	iron	England	1858	1905	47
Orides	schooner	wood	Scotland	1868	1942	74

record confirms this trend.

Hull construction

The shift from the use of timber for hull construction through to the use of iron and timber composites and then all iron, was perhaps the most important technological innovation occurring to sailing vessels in the mid to late nineteenth century. The benefits of the iron hull were considerable. In the 1850s iron vessels were analysed for their economically desirable features. They were considered by merchants to be the preferred choice in terms of strength and light weight, the greater cargo capacity, safety, speed, durability, the economy of repairs and for the reduced depth of water in which the vessel could operate. It was concluded that:

Table 4
*Archaeological record: vessel types visiting Fremantle between 1820 and 1920 represented in the archaeological record. * Brigs and brigantines were counted as a one element*

Vessel type	Number of vessels	Total tonnage
barques	29	11018
brigs *	5	1261
schooners	5	724
ships	3	52
cutters	1	
other	2	

> ...experience proves that iron vessels possess advantages under all the heads above in so eminent a degree as to render them superior to the wooden vessel (Grantham, 1859, *Iron shipbuilding*, 2nd edition, Lockwood & Co., London, quoted in McCarthy, 1985:221).

In the 1850s, 10 per cent of the new tonnage added to the British shipping registers was for iron vessels, in the 1860s this was 30 and 60 per cent for sailing vessels. For steam the proportion went from 26 to 80 per cent in 1860 (Corlett, 1970:217).

However, iron hulls were subject to fouling and this was a considerable problem over the long distance trades where speed was a vital consideration. Corrosion also shortened the lifespan of early iron and steel vessels. The costs of producing large enough plates to minimise the possibilities of leakage was high and another deterring factor in the economics of trade.

Attempts to overcome these problems were addressed through the building of composite ships with wrought iron frames and wood planking. Iron deck supports were in use in the eighteenth century and the idea was incorporated in a large number of early nineteenth century British-built vessels.

> The spectacular revival (of sail) after 1874 coincided with the building of a new and larger type of sailing ship – full bottomed yet fast and designed for a particular trade. The 'composite' wood and iron ship of the late 1860s faded out of the picture to be replaced by the stately and loftily rigged iron cargo vessel, with steel masts and rigging and the latest labour saving machinery which halved the number of seamen and subsequently reduced the cost of the operation (Graham, 1956:80).

Examination of the archaeological record within the survey region indicates the predominance of wooden hull types (Table 5 and Figure 165).

Henderson (1977) notes in his discussion of the historical record:

> …there is insufficient available evidence for a discussion of the hull form of vessels calling at the Western Australian ports, and the records containing the information about the changes in hull construction materials are not easily dealt with. The Fremantle Harbour Masters' Register of Arrivals does not indicate the materials used in hull construction over the period, and Lloyd's Shipping Register in the early years, does not differentiate between wood and composite vessels...Some vessels listed in Lloyd's as simply "felt and yellow metalled" were in fact composite built rather than wood (Henderson, 1977:210-11).

It is the archaeological record then that provides an indication of the proportion of hull types employed in the trades to Western Australia. Continuing analysis of the remains will further identify the discrepancies seen in the listing of composites and those wooden vessels sheathed in yellow metal. The predominance of iron and copper fastenings can also be examined.

Figure 165 Percentage of hull types for shipwrecks in the survey region

Hull type	Number of vessels
wood	23
iron	14
composite	1

Table 5 Frequency of hull types for the shipwrecks in the survey region

An examination of the numbers of differing hull types built in comparison to the fifty-year periods of construction reflects the predominance of wooden vessels. The change in ship design and construction technology is revealed by the increasing use of iron vessels (Table 6) between 1850 and 1900.

Ports of construction

For vessels appearing as shipwrecks in the archaeological record, the principal country at which vessels were constructed (Table 7 and Figure 166) reflects the dynamics of the trade issuing through the Port of Fremantle. The strong correlation between the colony and Britain as a port of construction suggests that most of the trade was controlled from there.

Table 6
Frequency of hull types constructed and subsequently wrecked in Western Australia, showing the rapid rise in the use of iron (fifty-year increments)

Period of construction	Number of vessels (wood)	Number of vessels (composite)	Number of vessels (iron)
1650-1800	1	0	0
1800-1850	5	0	1
1850-1900	17	1	13

Table 7
Countries of origin of vessels in the wreck resource, by frequency

Figure 166
Countries of origin of vessels in the wreck resource, by percentage

The percentage of overseas-built vessels makes up 92.1 per cent of the archaeological resource for sailing vessels. Australian-built vessels are the remaining 7.9 per cent. Of the total shipwreck resource in the survey region when combined with steam-powered vessels, overseas-built vessels make up 89.2 per cent and locally built the remaining 10.8 per cent.

Frequency of losses

The mean distribution curve (Table 8 and Figure 167) for vessels lost during the historic period tends to reflect the increasing volume of trade in the 1870s and 1880s. Factors that also contributed to an increasing number of vessels calling at Fremantle included immigration and the goldrush. The causes (human, environmental, related to design or to port facilities) for the wreck events are discussed in 3.3.2 later in the Appendix. The reduction in number of wreckings in the early twentieth century may reflect improved navigation aids, knowledge of the coastline and other factors affecting the sailing of vessels. It also corresponds to improvements in vessel design. The development of alternative methods of land transportation (roads and railways), which reduced the number of vessels moving along the coastal routes, was a factor in lowering shipping casualties.

Average age

The average age of vessels employed in the trade to and from Western Australia has been derived from historical sources. Henderson (1977:216) states that in 1870 the average age was 7.5 years, in 1880 it was 15.2 years and by 1890, 17.5 years. These figures tend to indicate that although a relatively modern fleet was employed in the beginning of the colonial shipping period it was hardly replaced with new vessels over the next twenty years. Fewer sailing vessels were being built internationally and the remaining sailing vessels were pushed from the major trade routes to make place for steam. This corresponded with an influx of sailing vessels to the less lucrative Western Australian trades and the age of the vessels rose accordingly.

Country built	Number of vessels
England	18
Scotland	6
Western Australia	3
Canada	2
America	2
Finland	1
France	1
Holland	1
Ireland	1
Seychelles	1
Singapore	1

Decade	Number of vessels
1600s	1
1700s	0
1810s	0
1820s	0
1830s	3
1840s	1
1850s	2
1860s	0
1870s	9
1880s	7
1890s	10
1900s	4
1910s	0
1920s	0
1930s	0
1940s	1

Table 8
Frequency of losses per decade for vessels in the survey region

From the shipwreck resource within the survey region (excluding steamers) the average age of vessels when wrecked are detailed in Table 9 and Figure 168.

For sailing vessels, the average age was 21 years when wrecked (analysed using data presented in Table 3). This is higher than the average age of those involved in the trade through the Port of Fremantle, as docu-mented historically. There is an important distinction to be ob-served in the age of sailing vessels in the archaeological record, between locally and overseas-built vessels. Whereas overseas-built vessels had an average age of 21.6 years the locally built were only 7.3 mean years when wrecked.

The break-down of age and nationality of construction shows that Australian-built vessels were younger when wrecked than those built overseas. This analysis of the wreck site resource for other regions in Australia has stimulated a number of questions as to whether Australian-built vessels were of an inferior quality or of faulty construction. Jeffery (1989) identified a variety of factors that may have influenced early Australian shipwrights from the availability of raw materials and the skill of the shipwrights to the intended operating environment. From examination of the three vessels representing locally-built vessels within the survey region, two of these were intended for the overseas trades. The cause of the wreck event for the three is attributable to problems of navigation rather than to the vessel's condition. Such examination of a wreck site resource in a discrete and defined geographical region is an alternative approach to that undertaken by Coroneos (1991) who set out to demonstrate that the

> …relatively short working life of early Australian built vessels in Victoria was not due primarily to deficiencies inherent in their construction but the fact that they served Victoria's secondary ports which were notorious at the time for being exposed and hazardous…Most foreign vessels on direct routes from overseas ports sailed in to the comparatively safer and more established Port Phillip (Coroneos, 1991:8).

Analysis of shipwrecks in the Perth region is restricted because it is based on such a small sample

Figure 167 Frequency of losses for vessels in the survey region

Age when wrecked (years)	Number of vessels total	Overseas built	Locally built
0–5	4	4	0
6–10	7	5	2
11–15	5	4	1
16–20	7	7	0
21–25	2	2	0
26–30	2	2	0
31–35	4	4	0
36–40	0	0	0
40–	2	2	0

Table 9
Age and quantity of vessels when wrecked (five-year increments)

size. Further study on the whole shipwreck resource for Western Australian-built ships and their working life would indicate the validity of the data and add further insights into issues of construction reflected in locally-built vessels.

Steam

The invention of the first efficient steam engine was patented by James Watt in 1769 and subsequent patents culminated in the steam-propelled *Charlotte Dundas* which made its first appearance on the Forth and Clyde Canal. Merchant shipping rapidly made the transition from sail to steam and from wood to iron. Compound engines, one with high and one with low pressure cylinders, were introduced in 1854 by J. Elder. In 1874 A. Kirk fitted the first triple-expansion engine which further increased boiler pressure and decreased fuel consumption (Kemp, 1992:786).

Cheap steel for triple-expansion engines became available by the 1880s and by the early 1890s pressures of 200 lbs per square inch were achieved. Steamers were on a worldwide average making three times as many voyages as sailing ships, during the late nineteenth century (Henderson, 1977: 222).

Steamers first made an appearance in Western Australia in the 1870s, being predominantly of the screw propeller type. The average age of these vessels gradually decreased and displays the opposite trend to the sailing vessel through the colonial shipping period. The size of steamers began to grow in the 1880s as the trade expanded. Those chartered for the Australian trades tended to be powered by

> …compound steam engines rather than the triple-expansion engines…it was not until 1888 that the first (triple) expansion engine was employed (Henderson, 1977:223).

From the shipwreck resource within the survey region only two of the vessels wrecked were steam propelled. The SS *Macedon* was powered by a compound engine of 96 horsepower and the SS *Orizaba* had a triple-expansion engine. The average age of these vessels when wrecked was 16 years.

After the introduction of steam to the overseas and intercolonial trades many of the vessels employed were now inter-changeable with those in the Western Australian coastal trades.

Shipping at Fremantle

Having surveyed the major trends in technological developments it is possible to examine more closely the shipping calling at Fremantle. It may be expected that the requirements of the long overseas trade routes between London and Fremantle would result in a different type of vessel than that employed exclusively in the Western Australian trade. The former were larger vessels capable of carrying plenty of square canvas, while the latter were smaller fore-and-aft rigged vessels easily handled in the inshore waters (Henderson, 1977:216).

The quality of the vessels employed may well have had as much to do with ownership as the original construction. For example, *Charlotte Padbury* was built in 1874 and given an A1 Lloyd's classification for twelve years, yet in fourteen years the vessel was worn out. Henderson suggests that:

> The relatively rapid depreciation of this vessel indicates a lack of sufficient maintenance, perhaps due to insufficient attention from her colonial owners, who were engaged in the merchant business as well as ship owning (Henderson, 1977:218).

Vessels employed in the London to Fremantle trade may have been chartered on a semi-regular basis. When *Mira Flores*, chartered by the Western Australian Shipping Association was wrecked in its approach to Fremantle in 1886, complaints were

Figure 168
Percentage of
vessels corres
ing to age whe
wrecked

made by Perth merchants that the Association was chartering foreign vessels that were not as seaworthy as those that they sent themselves. This vessel did, however, have an A1 Lloyd's classification.

The colonial-built vessels employed in the overseas trades appear to have performed reasonably well in spite of the suspicious attitude taken by the insurers (Henderson, 1977:219).

As outlined above the average age of wrecks for locally-built vessels was significantly lower than those of overseas construction. However, it has been suggested that vessels employed in the timber carrying trades on a tramping basis would have been in poorer condition, due to the nature of the commodity (Henderson, 1977:220).

The vessels involved in the trade with the Afro-Asian ports and the eastern colonies were considerably smaller than those in the trade with London. They varied between 100 and 250 tons and the majority were of wood construction. Coastal traders were the smallest, mainly sailing vessels. Most were listed under 50 tons and traded between Vasse, Bunbury and Champion Bay. Of the Western Australian built vessels

> …the jarrah used by local shipwrights proved to be a lasting material and some coasters remained in use for many years…even though it was not sheathed after sixteen years it remained unaffected by teredo worm (Henderson, 1977:221).

The rate of diffusion of technology for vessels involved in the different trade routes was affected by a number of factors: firstly, the length of the voyage and the need for fuel economy in the voyage out from Europe; secondly, the management of the intercolonial routes over which the Adelaide Steamship Company had the monopoly meant that new vessels were not required to maintain a competitive edge; thirdly, the profitability of the Fremantle to Singapore route whereby the improving trade required that the older vessels should be replaced by new ones.

The technological developments that led to the increasing size of sailing vessels was of great significance. They allowed increased productivity and lower freight rates through faster and safer travel as evidenced in the greater sail areas and increasingly powerful engines used on the vessels. Larger vessels cost more to produce thereby forcing smaller businesses out of the competition, and this was reflected in other organisational changes. It is expected that the vessels employed in the trades to Fremantle reflected changes elsewhere in the world, although perhaps at a slower rate.

Evolution of design

It is useful to

Decade built	Average L:D ratio
1830s	7.18
1840s	8.86
1850s	11.37
1860s	9.93
1870s	9.35
1880s	12.34
1890s	10.45

Table 10 Increasing L:D ratios between the1830s and the 1890s

Figure 169 Average L:D ratio for decade of construction

Table 11
Tonnages and dimensions for shipwrecks in the survey region

examine the shipwreck resource in terms of evolution of design with regard to the basic ratios of construction. This reflects the increasing size of vessels represented in the archaeological resource. By examining the length to depth ratios (L:D) for sailing vessels of a similar type for a given period it could be expected that these ratios would increase. In fact as indicated in Table 10 and Figure 169 the archaeological record displays an increasing length to depth ratio over time, based on the analysis of dimensions in Table 11. This reflects those design changes known to have occurred historically.

The general trends indicated in Table 10 confirm an increasing length to depth ratio that accompanied the technological changes stimulated by the desire to ship larger quantities of trade goods more quickly. Certain environmental and technological parameters, however, would also have operated to constrain design.

Conclusion

The purpose of the above comparisons is to allow the researcher to begin understanding why the archaeological record has formed in the way that it has, and what this indicates about the nature of early shipping into Fremantle. The discrepancy or reinforcement between the historic documents and the archaeological record may reveal ways in which early shipping history can be more fully explored. The restrictions imposed by using only one methodology, whether historical or archaeological, can also be highlighted, prompting greater discussion between the two spheres of research. The potential for further archaeological research and the questions that the sites themselves can answer may also be identified.

Vessel	Ton	Length	Breadth	Depth	L:B	B:D	L:D
Vergilde Dredge	260	38,70	9,10	3,80	4,25	2,39	10,18
Jason	105			3,60			
Elizabeth	104	23,50	7,70		3,05		
Lascar	285	29,50	7,30		4,04		
Jason Matthews	107	24,50	6,50	3,50	3,77	1,86	7,00
Eglinton	102	66,00	8,20	5,50	8,05	1,49	12,00
Robertson	213	26,30	6,20	4,60	4,24	1,35	5,72
Chaloner		40,10	9,10	6,20	4,41	1,47	6,47
Candour	188	30,00		3,30			9,09
Contest	322	36,60	8,60	3,90	4,26	2,21	9,39
Zephyr	209	35,90	7,60	4,50	4,72	1,69	7,98
Bess	52	20,10	4,80	2,80	4,19	1,71	7,18
Bess of the Nile	356	38,40	7,60	5,20	5,05	1,46	7,38
Lady Elizabeth	658	48,70	9,30	5,50	5,24	1,69	8,85
Chase	223	33,60	7,20	5,50	4,67	1,31	6,11
Jason Service	455	46,70	8,60	4,60	5,43	1,87	10,15
Star	70	24,10	5,30	2,30	4,55	2,30	10,48
SS Macedon	532	67,20	9,00	4,70	7,47	1,91	14,30
Miss Plaice	400	40,20	8,30	5,30	5,98	1,57	9,28
Belle of Bunbury	42	16,40	4,00	2,10	3,35	2,33	7,81
Day Dawn	355	36,90	8,50	4,40	4,34	1,93	8,39
Janet	211	33,60	7,00	3,00	4,80	2,33	11,20
Acorn	236	33,50	7,40	3,60	4,53	2,06	9,31
Denton Bolton	208						
Raven	343	46,90	8,40	5,20	5,58	1,62	9,02
Cuddie	2405	91,40	12,80	7,40	7,14	1,73	12,35
Fidentino Dredge							
Ocean	788	64,90	9,27	5,10	7,00	1,82	12,73
Delta	498	40,60	9,60	5,10	4,23	1,88	7,96
Villalta	806						
Eagle	715	53,90	8,80	5,80	6,13	1,52	9,29
City of York	1167	67,90	10,90	6,60	6,23	1,65	10,29
Carlisle Castle	1484	70,00	11,50	6,90	6,09	1,67	10,14
Highland Forest	1040	73,90	10,40	6,00	7,11	1,73	12,32
Ville de Rouen	1303	66,87	10,50	6,40	6,37	1,64	10,45
Conference	921	50,20	8,00	4,80	6,28	1,67	10,46
SS Orlando	6077	140,20	15,00	5,90	9,35	2,54	23,76
Others	118	37,00	7,30	2,00	5,07	3,65	18,50

3.3.2: Shipwreck distribution and the wreck event

Introduction

Sailing in the open sea is the ship's safest environment, where it is easily manoeuvrable. However, in open channels and along the coast the hazards of navigation become more evident. The vessel must approach land to port and the shipwreck resource of the Fremantle area represents a cluster of sites that are a result of this process. It has been suggested (Garrison, 1989) that improvements in navigation, ship design and sea-keeping do not prevent losses in areas of channels. Similarly, high-loss probabilities exist for coastal routes where the mariner may have been lulled into a false sense of security nearly having reached an intended destination, only to encounter shoals, shifting shallows, reefs and other hazards associated within impending landfall.

It is possible to describe the shipwreck resource of the Perth survey region as one which is concentrated primarily in an area described by the trade routes of vessels and their approaches to the Port of Fremantle. Within this discrete region there are various clusters of wreck sites concentrated on the outer-lying reefs and offshore islands, and onshore adjacent to historically used mooring areas. Some sites are the result of deliberate sinking or scuttling.

Trade routes

Although this analysis concentrates on a discrete region the wreck site locations can be seen as a result of the voyages along certain trade routes to a node of the network, such as a port.

> The distribution of shipwrecks and the location of sailing routes for a given period are linked to variables in that they can predict the behaviour of either to a finite and measurable degree (Garrison, 1989:13).

A break-down of the shipwreck resource into the various trade routes (Table 12) on which each was employed shows the highest number of vessels were visiting or returning from local Western Australian ports when wrecked. The second largest group was those vessels bound for, or from, Europe. Only two vessels were trading from America.

Europe	Afro-Asian	Intercolonial	Coastal/lightering
Vergulde Draeck	*Elizabeth*	*Robertina*	*Centaur*
James	*Lancier*	*Hero of the Nile*	*Contest*
James Matthews	*Chalmers*		*Gem*
Eglinton	*Zedora*		*Diana*
Mira Flores	*Lady Elizabeth*		*Star*
Denton Holme	*James Service*		*SS Macedon*
Ulidia	*Janet*		*Belle of Bunbury*
Sepia	*Villalta*		*Day Dawn*
City of York			*Raven*
Carlisle Castle			*Priestman Dredge*
Highland Forest			*Omeo*
Ville de Rouen			*Dato*
SS Orizaba			*Conference*
			Amur
			Uribes
13	**8**	**2**	**15**

Table 12
The principal trade routes for vessels en route to *the Port of Fremantle*

The wreck event

Ports

Shipping enters ports for obvious reasons such as trade, supplies and refits. The distribution of shipwrecks indicates that these places are associated with a corresponding concentration of wreck sites. With increasing levels of shipping there is a rise in the number of wreckings. However, wreck events stimulated improvements in navigational aids and increased the identification of hazards. This could be expected to stabilise the number of shipwrecks. Changes in hull design also helped to reduce the incidence of wrecking through increased vessel maenouverability.

Shoals, reefs, sand bars and islands

While shoals, reefs and islands become well-known over time and marked on charts, they are obvious natural features which may be used to predict the locations of historic shipwrecks. Sand bars can shift location dramatically. The principal areas of the wrecking of vessels associated with these submerged or semi-submerged landforms within the survey region are Rottnest Island, Murray Reef, Mewstone Reef, Stragglers Rocks and Five Fathom Bank.

Prevailing weather patterns

Weather plays a significant part in any wreck event. Factors range from adverse winds and storms to haze lying over the coastline obscuring its location. The weather patterns of the Western Australian coast are more fully discussed earlier in the Appendix under 3.2. Storms in particular were responsible for the stranding of many of the vessels moored in the Owen Anchorage area (refer to PART 2, Map 3). The majority of these vessels were not underway when the wreck event occurred.

Other

Equipment failure, human error, lack of port facilities and technological development are all documented as playing a part in the various wreck events associated with sites in the survey region. These factors give rise to the observed pattern or distribution of shipwreck sites.

Analysis of the wreck event

In Table 13 each wreck site has been analysed according to a range of criteria for the vessel's foundering. In many cases the summary has been based on the findings of the court of inquiry held into the wreck event. In instances where this finding has been disputed or other mitigating factors were also commonly held to be responsible, these too have been collated. Many wreck events are the result of a number of causal factors.

A break-down of the criteria involved in wreck events include the following:

Human factors:

- unfamiliarity with Western Australian coastline or approaches to the Port of Fremantle;
- fatigue of captain and crew;
- intoxication;
- inexperienced captain or crew;
- incorrect decisions;
- neglect of duties;
- incorrect navigational procedures;
- crew mutiny.

Equipment:

- failure of navigational equipment (e.g. chronometer);
- failure of ship's fittings;
- structural problems;
- pump failure.

Environmental conditions:

- adverse winds;
- time of day (e.g. dawn and dusk);
- storms, gales, problems associated with haze and fog;
- currents.

Lack of adequate port facilities:

- no lights;
- no buoys;
- bad charts.

Technological development:

- inaccurate charts;
- no chronometer.

En route:

- shifting cargo;
- ballast problems.

It is clear from this analysis that the principal cause of the wreck events in the approaches to Fremantle occurred through human negligence and the problems encountered with adverse weather conditions. Equipment failure also contributed to a high proportion of the losses. What is interesting is the relatively low proportion of wreck events attributable to the inadequacies of port facilities. This challenges the assumptions often cited in

Vessel	Human	Equipment	Environmental	Port facilities	Technology	Resource	Scuttled
Vergulde Draeck					◆		
James			◆				
Elizabeth			◆				
Leander	◆			◆			
James Matthews		◆					
Eglinton		◆	◆				
Robertson					◆		
Challenger	◆						
Condeur	◆						
Content			◆				
Zeehaen				◆			
Dove	◆	◆					
Dove of the Nile					◆		
Lady Elizabeth			◆				
Diana		◆	◆				
James Service							
Star	◆						
SS Macedon			◆				
Miss Flora	◆						
Belle of Bunbury	◆						
Day Dawn						◆	
Janet	◆		◆	◆			
Amur				◆			
Clanton Bolton	◆			◆	◆		
Rowe	◆						
Challa	◆	◆					
Fremantle Dredge			◆				
Dove		◆	◆				
Data							◆
Villalta	◆						
Eagle	◆			◆			
City of York			◆	◆			
Carlisle Castle			◆				
Highland Forest	◆						
Ville de Rouen	◆		◆				
Conference							◆
SS Orizaba	◆		◆				
Others		◆					
Totals	16	7	14	7	4	1	2

Table 13
Factors contributing to the wreck event for each vessel in the survey region

historical sources that the port facilities, and the lighthouse and signals system at Rottnest Island were inadequate, and the primary cause of wrecking.

It is important to point out that the above analysis was based on the official historical documentation and court inquiries into each wreck event. In relation to the frequency with which human factors were held attributable to the cause of wreck, court findings may reflect a desire by the early colonists to present the port in a favourable way. By apportioning blame to captains' negligence it was possible to play down the natural hazards associated with the approaches to Fremantle, and/or the perceived lack of port facilities.

As indicated in PART 1 it was essential for the survival of the colony to attract as much trade as possible. Wrecking would have been detrimental to this effort to encourage visiting vessels. It would have increased the insurance rates and, therefore, increased the cost of imports and the overheads associated with exports.

There is historical evidence which indicates that the communities of the time were often in disagreement with the court findings. There are several incidents where local groups had paid, on behalf of the captain, the fines imposed by the courts. Sentences and the suspension of the masters' certificate were often petitioned by the parties involved. Sentences were frequently reduced by more than half, or cancelled altogether. Contemporary newspapers also record general dissatisfaction with apportioning blame to captains

and crew that died during the wreck event and, therefore, could not provide evidence in their own defense.

Further analysis shows that the wreckings that occurred due to environmental factors are divided into two distinct groups: those that are associated with the physical topography and those associated with the oceanic climate and the prevailing weather patterns.

As already noted, the physical topography is closely related to the areal distribution of wreck sites in that they most often occur on the reefs or island fringes. The wreck site distribution patterns indicate that the characteristic of topography (low-lying and semi-submerged reefs and island fringes) are significant in the wreck events occurring for sites located in the survey area especially those on location Map 2, Map 4 and Map 5.

Examination of the sites confirms the hypothesis proposed by Muckelroy (1978) that the degree of site preservation is directly related to the maximum sea horizon and exposure to the prevailing wind conditions. How storm activity affects sites that are protected in a reef type environment where the number of disturbing forces acting on the site are limited, is further discussed in 3.3.3 later in the Appendix.

The importance of technology in the pattern of shipwreck distribution is well demonstrated by the earliest shipwreck site in the survey region, *Vergulde Draeck*, which belonged to a period of exploration when routes were often defined by trial and error. Without the benefit of a chronometer it was difficult for early navigators to establish longitude. Using the routes outbound to the Afro-China region, Dutch vessels after rounding the Cape of Good Hope made across the Indian Ocean along the Brouwer Route. This enabled vessels to take advantage of the trade winds crossing to the west coast of Australia before turning north. Failure to accurately establish the longitude was the primary reason for the unintentional landfall of *Vergulde Draeck*.

The low correlation between technological developments (such as the invention of the chronometer or accurate mapping) as causal factors in wreck events reflects, in part, the period or chronological parameters of this study. The loss of *Vergulde Draeck* lies on the extreme end of the date range distribution for the wreck sites in the region. The lack of accurate charts were often cited by early mariners during the historic period to be a source of aggravation in navigation. The immediate approaches to Fremantle were, however, reasonably well documented after the initial period of survey.

Storms, gales and haze tend to be the prevalent environmental characteristics for the wrecks occurring close to the coastline. The sites from the survey that were wrecked as a result of natural factors are located in Map 1 and Map 3. All sites located in the Map 3 region were the result of either being blown onshore from a position of anchorage, or caused by this in combination with equipment failures such as parted cables or the failure of the anchors to hold together in severe storms.

An examination of the non-fatal stranding of vessels visiting the Port of Fremantle would help to broaden the basis of interpretation for the causes of maritime accidents.

3.3.3 Shipwrecks and their environments

Introduction

> The shipwreck is the event by which a highly organised and dynamic assemblage of artefacts are transformed into a static and disorganised state with long-term stability (Muckelroy, 1978:157)

The long-term survival of a sunken vessel is dependent on the nature of the hydro-environment. It is, however, difficult to be definitive about the variety of factors that contribute to and influence the preservation of the sites. It was originally thought that deep water and/or soft sediments were vital necessities in the preservation of sites, but there has been an increasing number of discoveries of shallow water sites in recent years. The remains of vessels in apparently hostile environments such as the coral reefs of Western Australia has indicated that environmental factors involved in wreck site deterioration are more complicated than originally thought.

The observations of maritime archaeologists and the collation of *in situ* conservation data has indicated that the state of preservation of a shipwreck is dependent on several basic factors. These are the condition of the vessel before wrecking, the nature of the wreck event itself and the preliminary exposure to wind and water movement. All are significant in the initial stabilising process. As a wreck site ages features of the burial environment increase in importance.

In recent years wreck site environmental assessment has been recognised as vital to effective programmes of cultural resource management. Obtaining information about wreck sites is fundamental to their future protection, and conservation assessments should be routinely carried out as part of the wreck inspection programmes. The following analysis attempts to identify the prevalent environmental parameters that affect the shipwreck resource within the survey region. By doing so it is hoped that some important indicators to the research of these vessels may be identified, and the state of preservation of vessels and associated artefacts in similar environments or involved in similar wrecking processes can be compared.

Site formation processes

Classification models have been based on levels of preservation of sites or the zonation of the sea-bed into areas of specific environmental conditions thought to have affected the particular preservation of artefact types (Oxley, 1992:105). If processes between two states (that is, the ship and the shipwreck) can be identified and described then the researcher can begin to unravel the evidence which they are investigating.

The nature of the burial environment is also fundamental in determining what evidence survives and its position and location on the sea-bed. Certain specific conditions promote the survival of particular material types. Studying the nature and impact of the environment on a site gives vital understanding of the quality of evidence that is likely to remain and the potential of the archaeological evidence for future research. The environment of sites also dictates the techniques and methods that will be most effective throughout the archaeological investigation from initial survey through to post excavation analysis (Oxley, 1992:105). The objective data collected at the pre-disturbance level is therefore of vital importance, and an understanding of the *in situ* condition of a wreck is fundamental to its long term preservation.

Muckelroy (1978) concluded that there are several types of site that are neither largely intact nor fully disintegrated. The majority of sites in the Perth survey region represent this type of 'intermediate site', on which the remains are neither perfectly preserved nor a group of randomly distributed pieces. Muckelroy has further demonstrated the importance of the variety of forces in the characteristics of the wreck sites and their survival. The data for this analysis has been reflected in the high correlation found between the survival of material and factors related to the sites' location and position (Muckelroy, 1978).

The way in which Muckelroy has conceived the wrecking process starts with the ship itself, as illustrated in Figure 170. The concepts of extractive filters and scrambling devices have been used to distinguish between the effects of natural processes and cultural ones that begin to act on a vessel from the moment of the wreck event until it disintegrates entirely or becomes buried in sand, mud or coral.

It is possible to divide Muckelroy's system into three parts: the natural environment; extracting filters; and, scrambling devices. Each is briefly discussed below.

Natural environment

Muckelroy identified eleven environmental

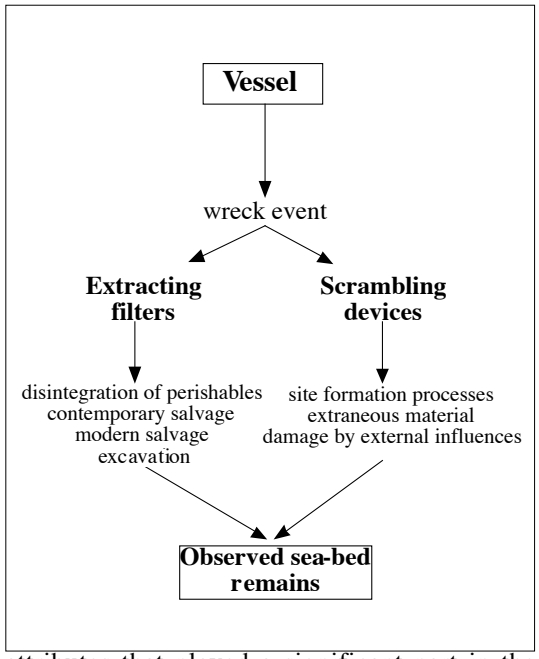


Figure 170 Elements in the wrecking process (adapted from Muckelroy, 1978)

attributes that played a significant part in the preservation and deterioration of shipwreck material. These included such features as offshore fetch, sea horizon, winds, depths, tidal streams deposits on site, slope of the sea-bed, underwater topography, and the nature of coarse and fine materials found on the sites.

Of the environmental attributes described, those related to the nature of the sea-bed deposit are considered the main determining factors in the survival of archaeological remains. These are:

- underwater topography (that is, the proportion of the sea-bed consisting of geologically recent sedimentary deposits);
- the nature of the coarsest material in these deposits;
- the nature of the finest material within these deposits (Muckelroy, 1978:163).

As mentioned above, Muckelroy maintains that 'intermediate' types of sea-bed deposits represent 'intermediate' types of sites, and that there are many gradations between the totally rocky sea bottom and the totally sandy substrate. Most of the wreck sites in the survey region when classified within this system, fall into the 'intermediate' type of sites. The author, therefore, recommends a revision of the terminology used to describe sites in Western Australia and Australia in general. This would allow for the differentiation between site types to be more fully described and enable analysis of the wreck resource on a comparative basis.

Muckelroy has also indicated that the attribute of 'slope' has shown to be a significant factor in preservation. 'Sea horizon' describing the amount to which a site is open to external forces coming in different directions, also has an influence. Analysis of this attribute suggests that the variety of these forces acting in different directions was more important than their actual strength. Once concentrated in gullies and holes of reef structure wreck sites in these sheltered situations are only disturbed by forces acting in totally new directions. This implies that the fewer the number of these possible forces the higher the chance of survival of wreck material. A restricted sea horizon also reduces the movement of the sediments that make up the substrate around the wreck site.

Muckelroy's analysis suggests that depth plays a lesser role in determining the preservation of sites than was originally expected. Other environmental attributes appear to contribute little to wreck site deterioration after the initial deposition has been made. The colonising flora and fauna, however, can play a role in providing protective coatings to wreck materials. Within the survey region, the causal factors that contribute to wreck site deterioration, that are the same for all sites, are the frequency of storm activity and tidal movements.

Once the nature of the environment has been assessed then any potential alteration to the site must be considered. These provide the key to understanding how the sites develop and include:

- introduction of new material;
- transformation;
- translocation;
- sequestration; and,
- dissipation (Oxley, 1992:108).

Within each site, after initial deposition, there are a number of environmental indicators that can be collected which determine the rates of deterioration of that site. Conservation data on salinity, corrosion potential, temperatures, dissolved oxygen etc. are site specific and have not yet been collated for all the sites in the survey region. Continuing collection of this data and its eventual analysis through correlation of site types and environment will give further insights into the long-term preservation of sites and the expected conditions of remains.

What is evident from the above discussion is the variety and complexity of archaeological site environments even within an 'intermediate' site type description. Their assessment requires input from a number of scientific disciplines including conservationists, marine scientists and

oceanographers. A co-ordinated approach to the investigation of wreck sites is essential for long-term preservation.

Extracting filters

The processes that lead to loss of material from the wreck site are those of wrecking, salvage operations and the disintegration of perishables. The process of wrecking can act as both a filtering device and a scrambling device (the latter will be discussed further below). As a filtering device, the wreck event and immediate period following are a time when the main structure of the vessel acts to form a site on the sea-bed. While metal objects tend to remain at the initial site of deposition this does not necessarily apply especially if a wooden or composite vessel is involved. Parts of the vessel are subject to immediate environmental factors such as storms and currents and it is not until the timbers become waterlogged and otherwise stabilised that the settlement period begins. The process of wrecking then involves a description of how elements came to be held on the sea bottom long enough to become stabilised on the site. Simplified examples range from vessels that sink to the bottom intact with ballast and cargo protecting the hull structure to ones where all the cargo is spilt at the surface, leaving little opportunity for lighter items to reach the sea-bed together with the majority of the vessel.

Salvage operations are often described in some detail in historical sources. Modern salvage and illegal removal of material also directly affects the nature of the evidence found on the sea floor. The extent of salvage operations is often limited due to the hazardous location of wreck sites. The removal of material can be restricted to that which is easily removable or of high monetary value. In the case of illegal interference on sites the artefacts removed will reflect those which appeal to divers and collectors. Many objects represented in collections removed from sites are those that are more resistant to the conditions imposed by marine environments (Kenderdine, 1991).

Scrambling devices

> A ship floating or sailing on the surface of the sea is a complex machine containing a large number of constituent parts arranged in a specific order to ensure seaworthiness, ease of handling and other desirable qualities. From the moment of impact, however, that high degree of organisation begins to break down, until the remains are assimilated into the sea-bed (Muckelroy, 1978:169).

The nature of the sea-bed, currents and sand movements are all determining factors in the survival of archaeological material underwater. The impact of the natural environment has been referred to above. The sequence of events that result in the observed remains on the sea-bed begins with a vessel that fills with water and sinks intact. A slower assimilation into the sea-bed could involve the hull accommodating itself to the topography, the cargo spilling over to one side and acting as a trap for water-borne sediments. Vessels can remain relatively intact in the sandy substrate creating shallow depressions within which the keel, floor timbers and other structure become buried while the rest of the vessel is broken-up or eaten away. Others have had their hulls torn open on reef tops or have been driven on beyond the point of impact shedding material in its wake.

Other scrambling devices include the processes of movement within the sea-bed, sediment disturbance, and the action of currents and waves. The size of particles and the currents also have an affect on the pattern of the archaeological deposit. Shifting sands are responsible for exposure or re-burial of sites. The sand level may rise or fall on a seasonal basis or after a storm, although the hull may have settled well into the substratum and remains at a constant depth below the water's surface. The deck beams and decks usually collapse, followed by the unsupported hull sides. The stern and bow of composite and iron vessels are documented as remaining intact longer than the amidships section because of the extra reinforcing that is used in their construction (Riley, 1985).

Post deposition rearrangement of the vessel occurs on sites that are relatively open to a number of different forces from wind and current. Another element to be considered is the impact of extraneous material deposited on the site and the effects of divers, fishing industry nets and boat anchors on site integrity. Deposit of sediments, dredging and changes in water quality due to coastal development also have an impact. The 'booming' associated with seismic survey along the coast can have a detrimental effect on the structure of submerged vessels due to the sound waves created underwater and the rise time associated with these.

Excavation of sites has particular extracting

and scrambling consequences for the remaining distribution of material, through removing hull structure and artefacts and altering micro-environments.

Site types

It is a combination of the processes of wrecking involving both scrambling and filtering devices and the effects of the natural environment that determine the state of a wreck site observed on the sea bottom. The sites have been described as 'continuous' (where the remains are concentrated in a single area) through to 'discontinuous' sites (where the distribution of material is interrupted by sterile areas). 'Intermediate' sites allow some interpretation of the distribution of remains and location analysis. The ability to reconstruct a hull or to examine methods of cargo storage for instance, relies on recording of the stratigraphy of sites.

An understanding of the correlation between the distortion of stratigraphy as a result of the processes of scrambling and filtering devices in operation can lead to reinterpretation of the previously held notions on vessel design. Using the simple methods of aggregating distributions of material found on the wreck can be extremely useful especially where the orientation of the site is not necessarily discernible.

Examples

Possible processes of wrecking have been advanced for sites within the survey region using interpretation of contemporary accounts and the observed remains on the sea-bed. Figure 171 shows how *Sepia* may have settled. This interpretation would explain the conglomeration of barrels on the port side and the way they lie below the deck, and the superstructure on the starboard side (Murphy, 1990). *Lady Elizabeth* may have disintegrated as illustrated in Figure 172. The cross section of the *Chalmers* site plan (PART 2, Map 5) shows how the ballast lies across the site indicating a level of protection to the underlying remains.

Conclusion

The disintegration of perishables is constrained by the preservation characteristics of different materials in the marine environment. It is by collating and analysing data such as corrosion potential measurements for metal objects, pH for wooden artefacts, and salinity, temperature, dissolved oxygen and turbidity, that the rates of deterioration of these articles can be assessed. Monitoring wreck site structure leads to an understanding of the possibilities of *in situ* preservation and provides strategies for the most effective removal of material from sites. Certain objects reach an equilibrium within the micro-environments that occur on one wreck site. The interaction between different material types can accelerate or diminish rates of deterioration. An example of this is the electrolytic protection provided by a base metal to preferentially corrode and provide protection for an element with a lower corrosion potential. Marine organisms form conglomerations of calcareous material to produce concretions that can also provide protective layers to materials. Increasingly, conservation techniques are able to successfully convert corroded metals to their base by electrolysis and to stabilise wooden artefacts by impregnating water-logged cells with polymers. The advances made in the field of conservation are outside the scope of this book and the reader is referred to Pearson (1987) as a basic text.

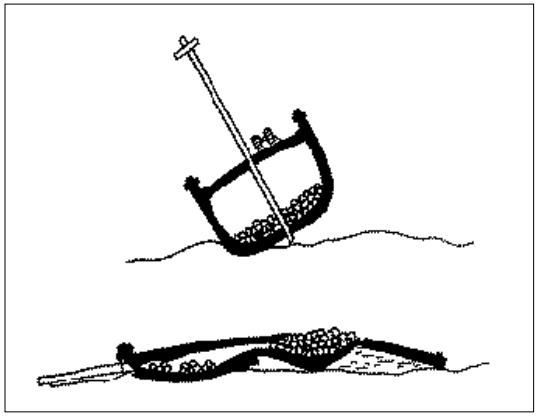


Figure 171
The wrecking process proposed for Sepia *(from Murphy, 1990)*

It is by examining the material excavated from the wreck sites within the survey that the significance of the disintegration of materials within different environments can be assessed. For instance, excavation of *James Matthews* revealed several organic items including an umbrella, shoes, part of a chair and birch brooms all of which were in an excellent state of preservation. Their survival depended on burial in mud and sand. Models for other sites that have not been excavated can begin to be explored using the correlation between wreck environments, extracting filters and scrambling devices.

For the shipwreck resource within the survey region, various elements within the wrecking process and the subsequent operation of the natural environment on sites, have been selected

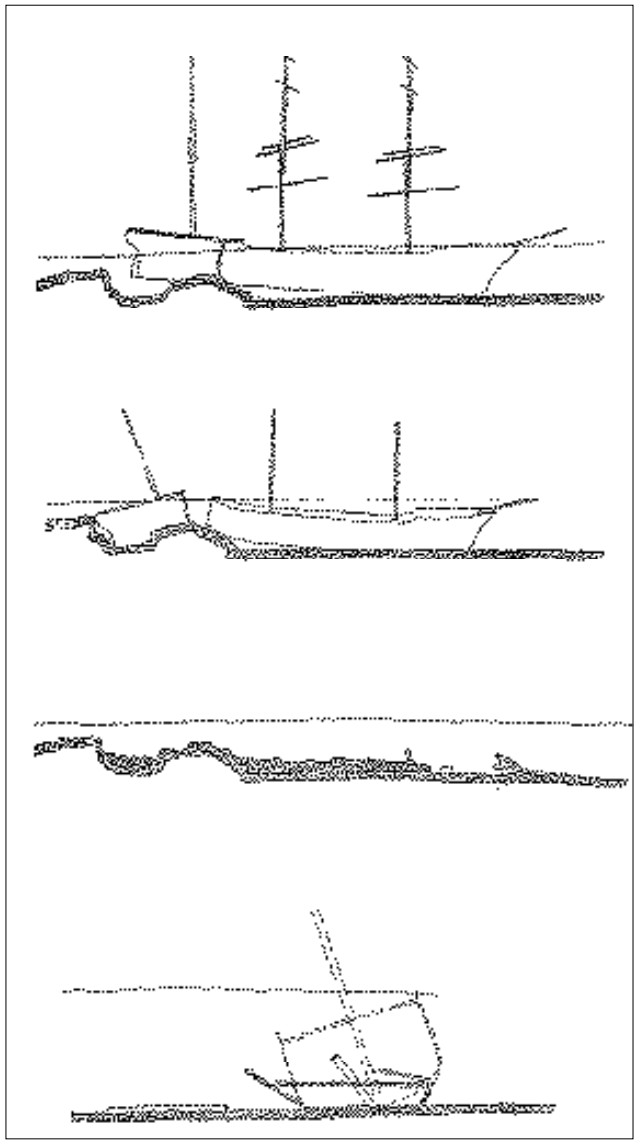


Figure 172
The wrecking process proposed for Lady Elizabeth *(from Cockram,* et al. *1988)*

for analysis. These represent systems that appear to have been important from the formation of sites through to the observed patterns of remains. They are considered to represent the parameters thought to be important in understanding site preservation.

> Modelling an environmental [and archaeological] resource means constructing a map of how various components are interrelated, how a change in one component can instigate a change in another, the conditions that must be met for this change to occur, and the rate at which it occurs (Oxley, 1992:107).

The analysis undertaken by the author is an initial attempt to identify and test hypotheses that may suggest a correlation between vessel, environment, wrecking processes, preservation and the distribution of remains. Analysis is restricted to the available data, therefore investigation of how each element affects another within a single site is largely outside the scope of this book and could be considered an area of future research. Such investigation would involve the examination of the conservation data that will be progressively collected on each site as part of the wreck inspection programme. Environmental assessments are the basis for cultural resource management decisions and may be made up of individual environmental parameters such as those measured by pH or corrosion potential measurements and interactions between the components of a wreck site that interact to contribute to the degradation processes.

Table 14 lists a series of environmental parameters for sites within the survey region that are considered important in the pattern of observed remains on the sea-bed. These parameters act as scrambling devices on the sites.

An examination of the forces acting on each site in terms of exposure to the prevailing winds, currents and swells, has been summarised as 'maximum' (max.) or 'minimum' (min.) exposure. To tabulate each site with specific environmental data is outside the scope of the present analysis. However, as perhaps expected the maximum exposure to winds, wave and surge occurs for those sites located on reef tops. There is a strong correlation between sand environments and the minimal disturbances to which these sites are subjected by the prevailing environment. Those sites in the surf zone obviously experience maximum turbulence due to tidal action and the increasing lacunae occur in sites that undergo stress at the air-water interface.

The majority of sites reside in a depth of less than 6 metres. Scouring and re-burial is a predominant environmental parameter operating on the sites and the winds tend to blow in a north or north-easterly direction. Seagrass is the predominant colonising fauna and this is subject to seasonal variation. Teredo worm affects the wooden structures, while metal hull types appear to have stabilised despite residing in high energy environmental conditions.

Data determining the prevailing wind direction and strengths, the currents and swells that predominate on each site with the overall exposure parameter, will be an area of future research.

Many sites have been subject to human interference and these extracting filters described

Table 14 Scrambling devices operating on wreck sites within the survey region

Vessel	Substrate	Location	Depth	Scouring	Exposure
[illegible]	reef	offshore reef	1–8 m		max
James	sand	inshore sand	4 m	minimal	min
Elizabeth	reef	inshore reef	0–3 m	minimal	max
Lancier	reef	offshore reef	7–8 m		max
James Matthews	sand	inshore sand	2–3 m	minimal	min
[illegible]	reef	offshore reef	5 m		max
[illegible]	sand	offshore reef	7–8 m		max
[illegible]	reef	offshore reef	4–7 m		max
[illegible]	reef	offshore reef	7–9 m		max
[illegible]	sand	inshore sand	1,3 m	minimal	min
[illegible]	reef	offshore reef	8 m		max
[illegible]	sand	sand	10 m		max
Star of the Sea	sand	offshore sand	2–4 m	minimal	max
Lady Elizabeth	sand	inshore sand	7 m		max
[illegible]	sand	inshore reef	3 m	minimal	max
James Service	reef	offshore reef	5–8 m		max
[illegible]	reef	offshore reef	2,7 m		max
SS Macedon	sand	inshore sand	3–8 m	minimal	min
Mira Flores	sand	inshore sand	5–12 m		max
Belle of Bunbury	sand	offshore sand	2–3 m	minimal	max
Day Dawn	sand	inshore sand	3–4 m	minimal	max
[illegible]	reef	inshore reef	3 m		max
[illegible]	sand	reef near sand	< 2 m	minimal	max
Denton Holme	reef	offshore reef	7 m		max
[illegible]	sand	offshore sand	8 m	minimal	max
[illegible]	sand	reef	3–8 m	minimal	max
[illegible]	sand	inshore sand	4 m	minimal	min
[illegible]	sand	reef near sand	< 2 m		max
[illegible]	sand	inshore sand	14,5 m	minimal	min
[illegible]	sand	reef near sand	< 2 m	minimal	max
Eagle	sand	offshore reef	12–14.5 m	minimal	mod
City of York	reef	inshore reef	7 m		max
Carlisle Castle	reef	offshore reef	7,5 m		max
Highland Forest	reef	offshore reef	7,5 m		max
Villa de Rosario	reef	offshore reef	7–9 m		max
[illegible]	reef	offshore reef	12 m		max
SS Orizaba	reef	offshore reef	4–7 m		max
[illegible]	reef	inshore reef	2–3 m	minimal	max

in Table 15 have transformed the site in some way. The terminology employed in describing the filters and resultant remains is broad in definition and application. The term 'salvage' is used to refer to both contemporary and illegal salvage known to have taken place on the site. It is not always possible to determine the extent of the activity from documentary sources. 'Excavation' refers to extensive operations that have been undertaken by the Western Australian Maritime Museum. Where individually significant artefacts have been removed from the site such as cannon, or major pieces of vessel structure this has been recorded below as a 'partial' (excavation). Where artefacts have been removed in the wreck inspection for purposes of identification or for the protection of such items, this has not been recorded as excavation activity and these sites have been listed as 'nil' (Table 16).

Loose artefact material found on the sites tends to be absent or in a scattered and disintegrated state, the distribution of which reflects a site's location on reef tops with artefacts collecting in solution holes where they are protected. The terminology employed here to describe artefact assemblages ranges from those few sites with observable stratigraphy as 'defined', through to a situation where 'minimal' material has been observed *in situ* (Table 17).

Hulls display the most integrity and preservation (Table 17) and where this occurs they have been buried to some degree in sands. While Muckelroy's definition would place the majority of the sites within the wreck resource in the 'intermediate' group between 'continuous' and 'discontinuous'

Vessel	Salvage	Excavation	Observed remains	
			artefacts	hull
Vergulde Draeck	nil	extensive	nil	nil
James	yes	nil	nil	coherent
Elizabeth	yes	partial	scattered	nil
Lancier	nil	nil	scattered	nil
James Matthews	yes	extensive	scattered	coherent
Eglington	yes	extensive	scattered	nil
Robertina	yes	nil	scattered	nil
Chalmers	yes	nil	nil	scattered
Centaur	yes	nil	minimal	scattered
Contest	yes	nil	minimal	coherent
Zedora	yes	nil	minimal	intermediate
Gem	yes	nil	minimal	intermediate
Hero of the Nile	yes	nil	minimal	coherent
Lady Elizabeth	yes	nil	minimal	coherent
Diana	yes	nil	minimal	coherent
James Service	yes	partial	minimal	coherent
Star	yes	nil	minimal	coherent
SS Macedon	yes	partial	minimal	coherent
Mira Flores	yes	nil	defined	coherent
Belle of Bunbury	?	partial	defined	coherent
Day Dawn	yes	extensive	minimal	coherent
Janet	?	nil	minimal	scattered
Amur	yes	nil	minimal	coherent
Denton Holme	yes	nil	minimal	coherent
Raven	yes	nil	minimal	nil
Ulidia	yes	nil	minimal	coherent
Priestman Dredge	?	nil	minimal	nil
Omeo	yes	nil	minimal	coherent
Dato	yes	nil	minimal	coherent
Villalba	?	nil	defined	coherent
Sepia	yes	nil	defined	coherent
City of York	yes	nil	minimal	coherent
Carlisle Castle	?	nil	defined	coherent
Highland Forest	yes	nil	minimal	coherent
Ville de Rouen	?	nil	defined	coherent
Conference	no	nil	minimal	coherent
SS Orizaba	yes	nil	defined	coherent
Uribes	yes	nil	minimal	coherent

Table 15
Extracting filters and the observed integrity of remains for the wreck sites

site types, closer examination of the wreck resource was needed to differentiate between the types observed in Western Australia. The term 'coherent' is used here to describe sites where the remains have stabilised in a relatively discernible pattern.

As analysis of the wreck resource continues it may be possible to undertake a re-classification and definition of the model proposed by Muckelroy. A more detailed description of the types of sites that occur within the environmental parameters prevalent along the Western Australian coastline, and the implications of site interference may produce a useful tool for predictions about the preservation of remains for as yet unlocated sites, and the long-term preservation of the resource.

Salvage	Excavation
nil: 2	extensive: 4
?: 6	partial: 5
yes: 30	nil: 29

Table 16
Frequency of extracting filters operating on the wreck sites

Artefacts	Hull structure
scattered: 5	intermediate: 4
defined: 7	nil: 7
min: 26	coherent: 27

Table 17
Frequency of artefact distribution and hull structures (as a definition for observed site types)

3.4 Summary of recommendations

Introduction
The following list of recommendations is based on the examination of the wreck resource as a whole. The recommendations have been made with the realisation that they can only be implemented when sufficient resources become available. The Department of Maritime Archaeology would welcome any suggestions from readers that could enhance or facilitate the greater protection and interpretation of sites within the survey region. With regard to *Shipwrecks 1656–1942: A guide to historic wreck sites of Perth* it is recommended that:

Wreck inspection
- the objectives of the Museum's wreck inspection programme continue to be met with regard to each site;
- conservation data continue to be collected as part of the monitoring programmes already established (*Ville de Rouen, Sepia* etc.) for the comparative analysis of the deterioration and preservation of shipwrecks;
- further sites be identified for conservation assessments that will enhance the research into site protection mechanisms;

Legislation
- an amendment to the *Maritime Archaeology Act 1973* (Western Australia) be discussed to include a provision for blanket protection of all sites over 75 years from the date of wrecking.

Interpretation
- wreck trail pamphlets be produced for the north and south Perth regions including those sites located from Ledge Point to Pt Peron and the Moore River area;
- underwater plaques be placed on those sites where they do not already exist (and where site conditions allow). These are *Belle of Bunbury, Centaur, Contest, Dato, Day Dawn, Diana, Eglinton, Hero of the Nile, James, James Matthews, Omeo,* Priestman Dredge, *Sepia,* SS *Orizaba, Ulidia, Uribes, Vergulde Draeck, Villalta, Ville de Rouen* and *Zedora;*
- a series of land-based markers be established for those sites where they do not already exist. These are *Belle of Bunbury, Contest, Dato, Day Dawn, Diana, Eglinton, Hero of the Nile, James, James Matthews, Lancier, Omeo, Sepia,* SS *Orizaba, Ulidia, Vergulde Draeck, Villalta, Ville de Rouen* and *Zedora;*
- land-based interpretive plaques identifying adjacent wreck sites be considered in conjunction with terrestrial historical archaeological sites (that are part of an historic maritime cultural landscape of the Perth region);
- a programme of diving tours be established in conjunction with the Museum that interpret the wreck sites;
- a video be produced that promotes the shipwrecks of the region;
- interactive multimedia computer displays are considered for the Museum displays that give access to details on the wreck sites in Western Australia. It may be possible to present the wrecking process or the deterioration of wreck sites on the sea-bed, where the user controls the variables;
- the wreck sites of this book be presented in a multimedia interactive;
- moorings be provided at wreck sites where appropriate, to avoid anchor damage at sites;
- fishing on wreck sites be discouraged to protect the aesthetic appeal of these sites for divers and other recreational users.

Publication
- an artefact catalogue be produced from the material held by the Museum with respect to shipwrecks in the region;
- a full excavation book be prepared for *Eglinton* (in progress), *Elizabeth* and *James Matthews;*
- this book be made available on CD Rom or online through the World Wide Web.

Research
- comparative analyses of the artefacts from colonial shipwrecks be undertaken (which may lead to a reinterpretation of historical assumptions about the historic shipping period);
- further analyses of the shipwreck resource be carried out to explore the environmental and cultural factors involved in the wrecking process and site deterioration. This may include a revision of terminology that currently exists to describe these processes;
- the attributes of shipwrecks in the survey region be analysed in comparison to the Western Australian, and Australia-wide wreck resource in terms of distribution, vessel type, average age etc. to give insights into the maritime technology, development of the Port of Fremantle as part of historic shipping, and the international transport networks;

- the Australian Shipwrecks Database be updated to include the new information collected with regard to sites in the survey region;
- an area for the next regional survey be identified and funding sought to implement this survey;
- a regional study identifying the wrecks sites in the Swan River be considered and implemented by the MAD, WAMM.

Liaison

- cooperation be continued with the appropriate government authorities and agencies for the joint protection and interpretation of the wreck sites. Memoranda of understanding between the Museum and others should be pursued where appropriate;
- the participation of dive charter operators and volunteer organisations be sought with regard to the monitoring of sites.

Figure 173
Diver retrieving the astrolabe from the wreck site of Vergulde Draeck *(GD A 334)*

References

Published and unpublished material

Appleyard, R.T. & Manford, T., 1979, *The beginning: European discovery and early settlement of Swan River Western Australia*, University of Western Australia Press, Nedlands, Western Australia.

Anderton, G., 1972, Department of Maritime Archaeology, Western Australian Maritime Museum File No. 19/73.

Anderton, G., 1975, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. 1995/75.

Australian Cultural Development Office, n.d., *Historic shipwrecks: public access guidelines,* Department of the Arts and Administrative Services, Canberra, Australian Capital Territory.

Australian Institute for Maritime Archaeology Inc. & the Australian Cultural Development Office, 1994, *Guidelines for the management of Australia's shipwrecks,* Canberra, Australian Capital Territory.

Bathgate, D., 1979, Site survey of the barque *Contest*, unpub. MAAWA Report, Department of Maritime Archaeology, Western Australian Maritime Museum File No. MA 5/79.

Boocock, A., 1990, The loss of the *Janet*, Rottnest 1887, Graduate Diploma Course in Maritime Archaeology Report, Department of Maritime Archaeology, Western Australian Maritime Museum.

Broeze, F., 1981 & 1982, 'Western Australia until 1869: The maritime perspective', *Early Days: Journal of the Royal Western Australian Historical Society,* 8.5 & 6.

Broeze, F., & Henderson, G., 1986, *Western Australia and the sea: our maritime heritage*, Western Australian Maritime Museum, Fremantle, Western Australia.

Buhgiar, C., 1984, Site plan for *Gem,* for MAAWA, unpub. Department of Maritime Archaeology, Western Australian Maritime Museum.

Buhagiar, C. & Murphy, M., 1990, The *Sepia*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990: 2–11.

Burningham, N., 1992, Rig types poster designed for the Northern Territory Museums and Art Galleries.

Cairns, L. & Henderson, G. 1995, *Unfinished voyages: Western Australian shipwrecks 1881–1900,* University of Western Australia Press, Western Australia.

Carpenter, J., 1984, 'Early development in the Port of Fremantle, Bather's Bay and the Long Jetty', *Port of Fremantle Quarterly*, 7.10: 14–16.

Carpenter, J. & Richards, V., 1994, Conservation in Galle, Report, Department of Materials Conservation, Western Australian Museum.

Clark, P., 1990, *Shipwreck sites in the south-east of South Australia 1838–1915*, South Australian Maritime Archaeology Series No. 1, Department of Environment and Planning, South Australia, Australian Institute for Maritime Archaeology Inc., Special publication No. 5., Fremantle, Western Australia.

Cockram, C., 1988a, Isometric drawing of the *Uribes*, Maritime Archaeological Association of Western Australia Reports 1987–1988.

Cockram, C., 1988b, The *Lady Elizabeth*: isometrics produce results, Maritime Archaeological Association of Western Australia Reports Vol. 2, July–December, 1988: 3–9.

Cockram, C., 1989a, The *Lady Elizabeth*: a clearer picture emerges, Maritime Archaeological Association of Western Australia Reports, Vol. 3, December 1988–June 1989.

Cockram, C., 1989b, The *Ulidia*: more detail added to earlier drawing, Maritime Archaeological Association of Western Australia Reports, Vol. 3, December 1988–June 1989: 13.

Cockram, C., 1990, The *Macedon* and the *Denton Home*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990: 18–21.

Corlett, E., 1970, *The iron ship*, Moonraker Press, London.

Coroneos, C., 1991, 'One interpretation of the short working lives of early Australian wooden sailing ships in Victorian waters', *Bulletin of the Australian Institute for Maritime Archaeology*, 15.2: 7–14.

D'Adamo, N., 1991, Hydrodynamics and recommendations for further studies in Cockburn Sound and adjacent waters, Technical series 41, Environmental Protection Authority of Western Australia, Perth, Western Australia.

Delgado, J., 1988, Historical Overview, in Murphy, J. (ed.), *Historic shipwrecks: issues in management*, Partners for Livable Places & National Trust for Historic Preservation Maritime Department, Washington, D.C.

Dickson, R., 1994, They kept this state afloat: shipbuilders, boatbuilders and shipwrights of Western Australia 1829–1929, Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 89.

Engineering, October 8, 1886.

Fall, V., 1972, *The sea and the forest*, University of Western Australia Press, Nedlands, Western Australia.

Findlay, A., 1876, *A directory for navigation in the Indian Ocean*, Laurie, London, 3rd edition.

Foster, L., 1987, *Port Phillip Bay shipwrecks. A historical survey of vessels lost within a radius of 10 nautical miles of the Heads inside Port Phillip Bay*. Vol. 1, unpub. Report, Victorian Archaeological Survey, Melbourne, Victoria.

Foster, L., 1988, *Port Phillip Bay shipwrecks. A historical survey of vessels lost within a radius*

of 10 nautical miles of the Heads inside Port Phillip Bay. Vol. 2, unpub. Report, Victorian Archaeological Survey, Melbourne, Victoria.

Foster, L., 1989, *Port Phillip Bay Shipwrecks, An historical survey of vessels lost in the area of Indented Head and Point Cook on the west side and between Rye and Ricketts Point, Beaumaris on the east side of Port Phillip Bay,* unpub. Report, Victorian Archaeological Survey, Melbourne, Victoria.

Garratt, D., 1994a, Management plan for the historic shipwreck SS M*acedon* 1870–1883, Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 61.

Garratt, D., 1994b, The Long Jetty Excavation Report, Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 78.

Garrison, E., 1989, 'A diachronic study of historical and natural factors linked to shipwreck patterns in the northern Gulf of Mexico', in J. Barto Arnold III, (ed.), *Underwater archaeological proceedings from the Society for Historical Archaeology Conference,* Society for Historical Archaeology, Baltimore, Maryland, United States, pp. 12–18.

Gauntlett, M. & Punchard, E., 1990, *Sepia*, unpub. Wreck Inspection Report, Graduate Diploma Course in Maritime Archaeology Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 4.

Green, J.N., 1973, 'The wreck of the Dutch East Indiaman the *Vergulde Draeck* 1656', *International Journal of Nautical Archaeology,* 2.2: 267–89.

Green, J.N., 1977, *The AVOC Jacht* Vergulde Draeck *wrecked off Western Australia 1656*, British Archaeological Reports, Supplementary Series 36, Oxford.

Green, J.N., 1983, 'The *Vergulde Draeck* excavation 1981 & 1983', *Bulletin of the Australian Institute for Maritime Archaeology,* 7.2: 1–8.

Green, J.N., 1985, *Treasures from the* Vergulde Draeck, Western Australian Museum, Perth.

Green, J. & Henderson, G., (file report) Preliminary report of the discovery and work on the *Eglinton*, unpub. Report, Department of Maritime Archaeology, Western Australian Maritime Museum.

Green, J., Henderson, G. & North, N. 1981, 'The carronade from the brig *James*: its history, conservation and gun carriage reconstruction', *International Journal of Nautical Archaeology,* 10.2: 101–8.

Halls, C., 1965, 'Colonial shipbuilding in Western Australia', *Port of Fremantle Quarterly*, Winter, pp. 25–7.

Halls, C. 1979, 'Saga of the *Omeo', Port of Fremantle Magazine*, Winter, pp. 18–19.

Hayes, K., 1976, 'Wreck of the Brig *Centaur:* pioneer trader of the WA coast', *Port of Fremantle Magazine*, Spring, pp. 12–15.

Hearn, C. J., 1991, A review of past studies of the hydrodynamics of Cockburn Sound and surrounding waters with an appraisal of physical processes and recommendations for future data collection and modelling, May, Department of Geography and Oceanography, Australian Defence Force Academy, Australian Capital Territory, A contribution to Southern Metropolitan coastal waters study (1991–1994).

Henderson, G., 1971, Problems encountered by shipping at the port of Fremantle 1829 to 1850, diss. as part of the requirements for the MA course, Department of History, University of Western Australia, Western Australia.

Henderson, G., 1973, 'The wreck of the *Elizabeth', Studies in Historical Archaeology*, Vol. 1, Australian Society for Historical Research, Sydney, New South Wales.

Henderson, G., 1975a, *'James Matthews* excavation summer 1974–75', *Australian Archaeology*, 3: 40–5.

Henderson, G., 1975b, 'Post settlement sites: *James Matthews* excavation', *International Journal of Nautical Archaeology,* 4.2: 371.

Henderson, G., 1976, *'James Matthews* excavation, summer 1974', interim report, *International Journal of Nautical Archaeology*, 5.3: 245–51.

Henderson, G., 1977, From sail to steam, unpub. MA thesis, Department of History, Vols 1 & 2, University of Western Australia, Western Australia.

Henderson, G., 1978, 'Four seasons of excavation on the *James Matthews* wreck', in J.N., Green (ed.), *Papers from the First Southern Hemisphere Conference on Maritime Archaeology*, Oceans Society, Melbourne, Victoria, pp. 73–9.

Henderson, G., 1980, *Unfinished voyages: Western Australian shipwrecks 1622–1850*, University of Western Australia Press, Nedlands, Western Australia.

Henderson, G., 1986, *Maritime Archaeology in Australia*, University of Western Australia Press, Nedlands, Western Australia.

Henderson, G. & Baker, P., 1979, *'James Matthews* excavation, a second interim report', *International Journal of Nautical Archaeology,* 8.3: 225–44.

Henderson, G. & Henderson, K.J., 1988, *Unfinished voyages: Western Australian shipwrecks 1851–1880*, University of Western Australia Press, Nedlands, Western Australia.

Henderson, G. & Millar, K., 1994, *Eglinton* site report, Department of Maritime Archaeology, Western Australia Maritime Museum, in process.

Historic Environment, 1992, Underwater cultural heritage, principles and practice, 9.3.

Hunt, H. A. (ed) 1929, *Results of rainfall observations made in Western Australia*, H.J. Green,

Government Printer, Melbourne, Victoria.
Hutchins, B., 1994, 'A survey of the near shore reef fish fauna of Western Australia's West and South coasts: the Leeuwin province', *Records of the Western Australian Museum*, Supplement No. 46.
ICOMOS Burra Charter (1984), The Burra Charter.
Jacob, T. & Vellios, J., 1987, *Southland, The maritime exploration of Australia*, Ministry of Education, Western Australia.
Jacobs, E., 1991, *In pursuit of pepper and tea, The story of the Dutch East India Company*, Netherlands Maritime Museum, Walburg Pers, Zutphen.
Jeffery, W., 1992, 'Maritime archaeological investigations into Australian-built vessels wrecked in South Australia', *The International Journal of Nautical Archaeology*, 21.3: 209–19.
Keith, D. H. & Carrell, T. L., (eds) 1992, *Underwater archaeology proceedings from the Society of Historical Archaeology conference,* Society for Historical Archaeology, Kingston, Jamaica.
Kemp, P., (ed.) 1976, *The Oxford companion to ships and the sea*, Oxford University Press, Oxford.
Kenderdine, S., 1991, *Artefacts from shipwrecks in the South East of South Australia*, Department of Environment and Land Management, South Australia.
Kenderdine, S., 1993, *Historic shipping on the River Murray: a guide to the terrestrial and submerged archaeological resources*, Department of Environment and Land Management, South Australia.
Kenderdine, S., 1994a, *Centaur*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 116.
Kenderdine, S., 1994b, *Highland Forest*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 114.
Kenderdine, S., 1994c, *Lancier*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 111.
Kenderdine, S., 1994d, *Robertina*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 112.
Kenderdine, S., 1994e, *Ville de Rouen* (1891–1901), unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 113.
Kenderdine, S. 1995, *Historic shipping on the River Murray, New South Wales and Victorian regions*, Heritage Branch, Department of Planning, New South Wales.
Kimpton, G. & Henderson, G., 1991, 'The last voyage of the *Day Dawn* wreck', *Bulletin of the Australian Institute of Maritime Archaeology*, 15.2: 25–8.
Lubbock, B., 1922, *The Blackwall frigates*, Charles E. Lauriat, Boston.
Lubbock, B., 1975, *The colonial clippers,* Brown, Son and Ferguson, Glasgow.
MacIntyre, M., 1992, Introduction, *Historic Environment,* 9.3: 1–4.
MacLeod, I., 1982, 'The use of barnacles to establish past temperatures on historic shipwrecks', *International Journal of Nautical Archaeology,* 11.3: 249–51.
MacLeod, I., 1986, Preventive measures during excavation and site protection, *ICCROM*, Rome.
MacLeod, I., 1989, 'The application of corrosion science to the management of maritime archaeological sites', *Bulletin of the Australian Institute for Maritime Archaeology*, 13.2: 7–16.
Maritime Archaeological Association of Western Australia Reports 1990–1992: 6–11.
McCarthy, M., 1979, *Jervoise Bay Shipwrecks*, Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 15.
McCarthy, M., 1980a, *Denton Holme*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 63.
McCarthy, M., 1980b, *Excavation of the barque* Day Dawn, Western Australian Maritime Museum, Perth.
McCarthy, M., 1980c, *Janet*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 59.
McCarthy, M., 1980d, *Macedon*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 81.
McCarthy, M., 1980e, SS *Orizaba*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, no report number.
McCarthy, M., 1980f, *Uribes*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 60.
McCarthy, M., 1982a, 'A wreck inspection programme as an aid to the co-ordinated management of a large number of wreck sites', *The International Journal of Nautical Archaeology,* 11.1: 47–52.
McCarthy, M., 1982b, *Koombana Bay wrecks: an investigation of the wrecks in the Bay for the State Energy Commission of Western Australia,* Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 18.
McCarthy, M., 1982c, Colonial wrecks in the Abrolhos Islands, Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 19.
McCarthy, M. (ed.)1985, *Iron ships and steam shipwrecks: papers from the first Australian seminar on the management of iron vessels and steam shipwrecks,* Western Australian Maritime

Museum, Western Australia.
McCarthy, M., 1986, *City of York*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 66.
McCarthy, M., 1991a, The *Conference*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 94.
McCarthy, M., 1991b, The wreck *Ville de Rouen* (1901): a re-submission to DASETT on its historic status, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. MA 14/86/2.
McCarthy, M. & Robinson, D., 1989, *Amur* notes, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. MA 10/87.
McKenna, R., 1988, History of the *Uribes*, wrecked off Rottnest, Maritime Archaeological Association of Western Australia Reports 1987–1988.
McKenna, R., 1990, The *Ville de Rouen*, Maritime Archaeological Association Reports, Vol. 4, July 1989–June 1990.
McKinnon, M., 1993, *Shipwreck sites of Kangaroo Island*, Department of Environment and Land Management, South Australia.
Moynihan, J., 1988, *All the news in a flash*: *Rottnest communications 1829–1979,* Telecom Australia and the Institute of Engineers, Australia, Western Australian Division.
Muckelroy, K., 1978, *Maritime archaeology*, Cambridge University Press, Cambridge, United Kingdom.
Murphy, M. & Wells, S., 1989, The *James Service* site revisited, Maritime Archaeological Association of Western Australia Reports, Vol. 3, December 1988–June 1989: 18–22.
Murphy, M., 1990a, The story of the *Mira Flores*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990: 27–8.
Murphy, M., 1990b, The *Raven*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990: 25–6.
Murphy, M., 1992a, The *Conference*, Maritime Archaeological Association Reports Vol. 5, 1990–1992: 15–18.
Murphy, M., 1992b, The *Macedon*, Maritime Archaeological Association of Western Australia Reports, Vol. 5, July 1990–March 1992: 22.
Murphy, M., 1992c, The *Mira Flores*, Maritime Archaeological Association of Western Australia Reports, Vol. 5, 1990–1992: 3–5.
Nash, M., 1988, *A maritime archaeological survey of the South East of Tasmania (Cape Raoul to South East Cape),* Occasional paper No. 17, Department of Lands, Parks and Wildlife, Hobart, Tasmania.
Nayton, G., 1989, The *City of York*, Maritime Archaeological Association of Western Australia Reports, Vol. 3, December 1988–June 1989.
Oxley, I., 1992, 'The investigation of factors which affect the preservation of underwater archaeological sites', in Keith, D. H., & Carrell, T. L. (eds), *Underwater archaeology proceedings from the Society of Historical Archaeology conference,* Society for Historical Archaeology, Kingston, Jamaica.
Passmore, N., Letherbridge, R. & Hansen, R., 1984, 'The loss of the *Gem'*, *Bulletin of the Australian Institute for Maritime Archaeology*, 8.1: 5–12.
Pearce, A.F., 1983, A bibliography of Physical Oceanography in Southwest Australian waters, CSIRO Marine Laboratories, Report No. 157.
Pearson, C., (ed.) 1987, *Conservation of marine archaeological objects,* Butterworths Series in Conservation and Museology, London.
Pobar, G., Orr, K., Cavana, M. & Osmond, M., 1992, *Marmion Marine Park management plan 1992–2002*, Department of Conservation and Land Management for the National Parks and Nature Conservation Authority, Perth, Western Australia.
Pollard, M., n.d., *Ulidia*, Department of Maritime Archaeology, Western Australian Maritime Museum, File No. MA 187/76.
Riley, J., 1985, 'Iron ship disintegration: the waterline theory', in McCarthy, M., (ed.), *Iron ships and steam shipwrecks, papers from the first Australian seminar on the management of iron vessels and steam shipwrecks*, Western Australian Maritime Museum, Western Australia, pp. 191–9.
Russell, Capt., 1893, Letter to the Under Treasurer dated 3 June, *Harbour Masters Letterbook*, 6: 401.
Senden, D.C., van, 1991, Review of the physical oceanography of Perth metropolitan waters, November, Report to the Water Authority of Western Australia, Environmental Sciences and Engineering Pty. Ltd.
Sledge, S., 1974a, *Hero of the Nile*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 9.
Sledge, S., 1974b, *'James Service* wreck', *Port of Fremantle Quarterly*, 5.2: 14–17.
Sledge, S., 1975a, *Belle of Bunbury*, unpub. Wreck Inspection Report, Department of Maritime Archaeology Department, Western Australian Maritime Museum, No. 22.
Sledge, S., 1975b, *Chalmers,* unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 21.
Sledge, S., 1978a, *Contest*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 32.
Sledge, S., 1978b, *Villalta*, unpub. Wreck Inspection Report, Department of Maritime Archaeology,

Western Australian Maritime Museum, No. 34.
Sledge, S., 1979, *Wreck inspection of the north coast (WINC) expedition 1978*, Department of Maritime Archaeology, Western Australian Maritime Museum, Report No. 11.
Sledge, S., 1984, *Carlisle Castle*, unpub. Wreck Inspection Report, Department of Maritime Archaeology, Western Australian Maritime Museum, No. 81.
Staniforth, S., 1985, *A maritime archaeological survey of the coast of Wilsons Promontory National Park,* Victorian Archaeological Survey, Occasional Report Series No. 21, Ministry for Environment and Planning, Melbourne, Victoria.
Steedman, R. & Craig, P.D., 1983, 'Wind driven circulation of Cockburn Sound', *Australian Journal of Marine and Freshwater Reserves,* 34: 187–212.
Strachan, S., 1987, *The Port Fairy shipwreck resource (1836–1878). History, archaeology and management,* unpub. Report, Victorian Archaeological Survey, Melbourne, Victoria.
The Institute of Engineers, Australia, 1989, *National historic engineering landmark nomination, Construction of Fremantle Harbour: 1892–1901*, Western Australia Division and Fremantle Port Authority, November.
Wells, F., Walker, D., Kirkman, H. & Lethbridge, R., 1993, 'The marine flora and fauna of Rottnest Island, Western Australia', *Proceedings of the Fifth International Marine Biological Workshop, 1.*
Wells, P., 1990, The *Mira Flores*, Maritime Archaeological Association of Western Australia Reports, Vol. 4, July 1989–June 1990: 26.
Wells, S., 1988a, The *Ulidia*: a picture emerges, Maritime Archaeologcial Assocation of Western Australia Reports, Vol. 2, July 1988–December 1988: 10–12.
Wells, S., 1988b, The *Zedora*: a history and photographic study, Maritime Archaeological Association of Western Australia Reports, Vol. 2, July 1988–December 1988: 13–17.
Wells, S., 1989, The *Ulidia*, Maritime Archaeology Association of Western Australia Reports, Vol. 4, July 1989–June 1990: 12–17.
Wilson, B., Kendrick, G. & Brearley, A., 1978, The Benthic fauna of Cockburn Sound, Western Australia, unpub. Report submitted to the Western Australian Department of Conservation and Environment, Western Australian Museum, Perth, Western Australia.
Wolfe, A., 1986, SS *Orizaba*, Graduate Diploma Course in Maritime Archaeology Report, Department of Maritime Archaeology, Western Australian Maritime Museum.
Wolfe, A., 1988, Management of the historic shipwrecks *Day Dawn* and *Dato* at Careening Bay, Garden Island, Western Australia, unpub. Consultant's Report, HMAS *Stirling* Environmental Working Paper No. 6.

Legislation

Beaches Fishing Ground and Sea Routes Protection Act 1932
Coastal Waters (State Powers) Act 1980 (Commonwealth)
Heritage Act 1990 (Western Australia)
Historic Shipwrecks Act 1976 (Commonwealth)
Maritime Archaeology Act 1973 (Western Australia)
Museums Amendment Act 1964 (Western Australia)
Seas and Submerged Lands Act 1973 (Commonwealth)

Newspapers

Inquirer and Commercial News, 10 July, 1878.
Inquirer and Commercial News, 5 March 1897: 11a & b.
Western Australian, 1 May 1901, p. 5f.

Index