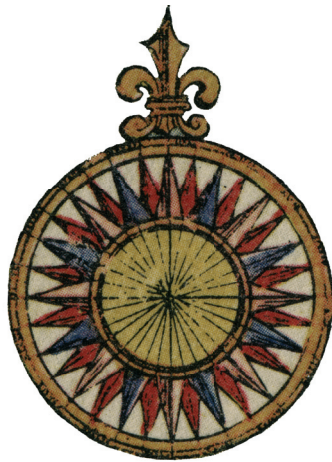


Department of Maritime Archaeology, Western Australian Maritime Museum
A compendium of projects, programmes and publications 1971–2003

Department of Maritime Archaeology, Western Australian Maritime
Museum

A compendium of projects, programmes and publications
1971–2003

Jeremy Green, Matthew Gainsford and Myra Stanbury



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Foreword

I remember well the day in 1971 when, as a fledgling Graduate Assistant at the WA Museum, I was interrupted from my boring task of cleaning shipwreck coins to be introduced to ‘young Oxford graduate Jeremy Green’, brought out from England to establish a Maritime Archaeology Department. With his arrival a marvellous adventure began: exploring shipwrecks in exotic locations and revealing sea histories hitherto completely concealed underwater. Now, in this year of celebrating 175 years of European settlement in Western Australia, we are well aware that the Dutch were exploring Australia 398 years ago. Jeremy had the foresight to think globally, and with the team he gathered around him he developed a uniquely Western Australian world-best product. Some aspects of this product have been fully accessible to the general public for many years—in the Shipwreck Galleries. But this book is the first survey concentrating on a less visible aspect, the underwater and laboratory work on which the public exhibits continue to depend.

The geographical scope of the Maritime Archaeology Department’s work as précised in the book at first sight appears unbelievable. In addition to the whole length of the Western Australian coast projects have included Tasmania, Queensland, Norfolk Island, Kenya, Thailand, China, Japan, Korea, Malaysia, the Philippines, Maldives, Oman, Sri Lanka, Turkey, the United Kingdom, the Netherlands, Scandinavia, Ascension Island and the Falkland Islands. But it is not the Department of Foreign Affairs. How can a curatorial department within a branch (the Maritime Museum) of a relatively small State Museum have such reach of influence? It has not been due to any massive funding: the Department’s operating budget from the State Government (currently \$33 000) is comparable with other curatorial departments within the WA Museum. The answer lies in the Department’s clear sense of direction, product and reputation, and the ability of the team to inspire the interest of various communities in creative ways to manage heritage.

Why was the book written? Visitors to the Shipwreck Galleries have commented to me over the years that ‘the shipwrecks programme is one of the State’s best kept secrets’. Perhaps what they meant to say was that we are better known overseas than we are at home. Our visitation has more than doubled each decade since opening in 1979, but two thirds of the visitation is traditionally from outside the State. And despite the wealth of published material written by staff, the best known popular books have been written by outsiders with staff assistance—Phillip Playford’s *Carpet of Silver* (1996), Philippe Godard’s *The First and the Last Voyage of the Batavia* (1993), and Mike Dash’s *Batavia’s Graveyard* (2002), for example. Although these books draw upon data developed by the Maritime Archaeology Department they only briefly touch upon the wide-ranging field and laboratory work done here.

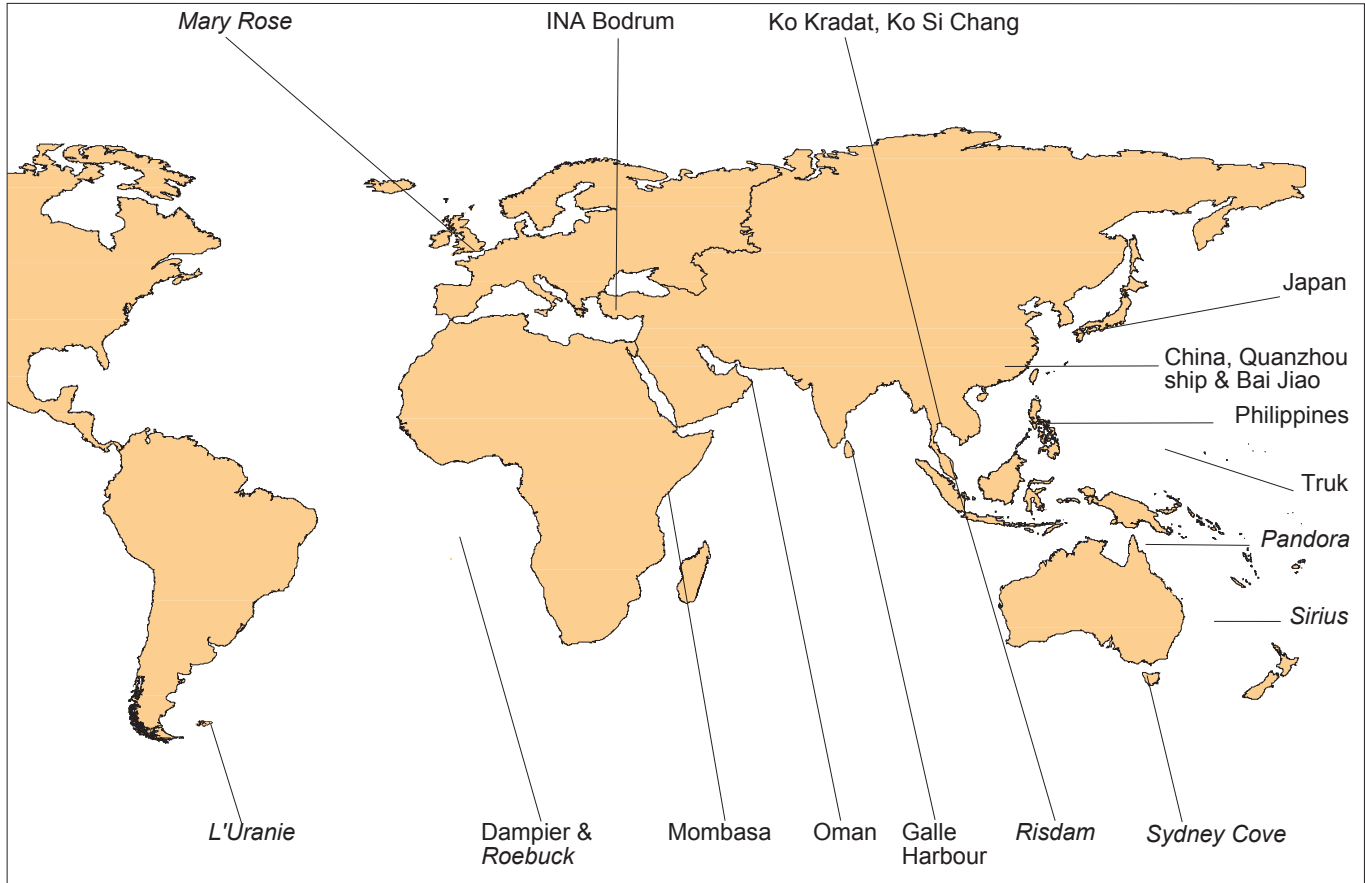
The compendium form—an alphabetical series of project tasters—leaves many questions unanswered. What of the detail of each project, and what of the advances in knowledge from the methodological techniques and historical insights? The committed reader need look no further than the second half of the book for a particularly comprehensive reading guide.

So who should read it? Armchair and academic archaeologists and historians, divers, coastal property developers, politicians, future Maritime Archaeology Department staff—the list goes on.

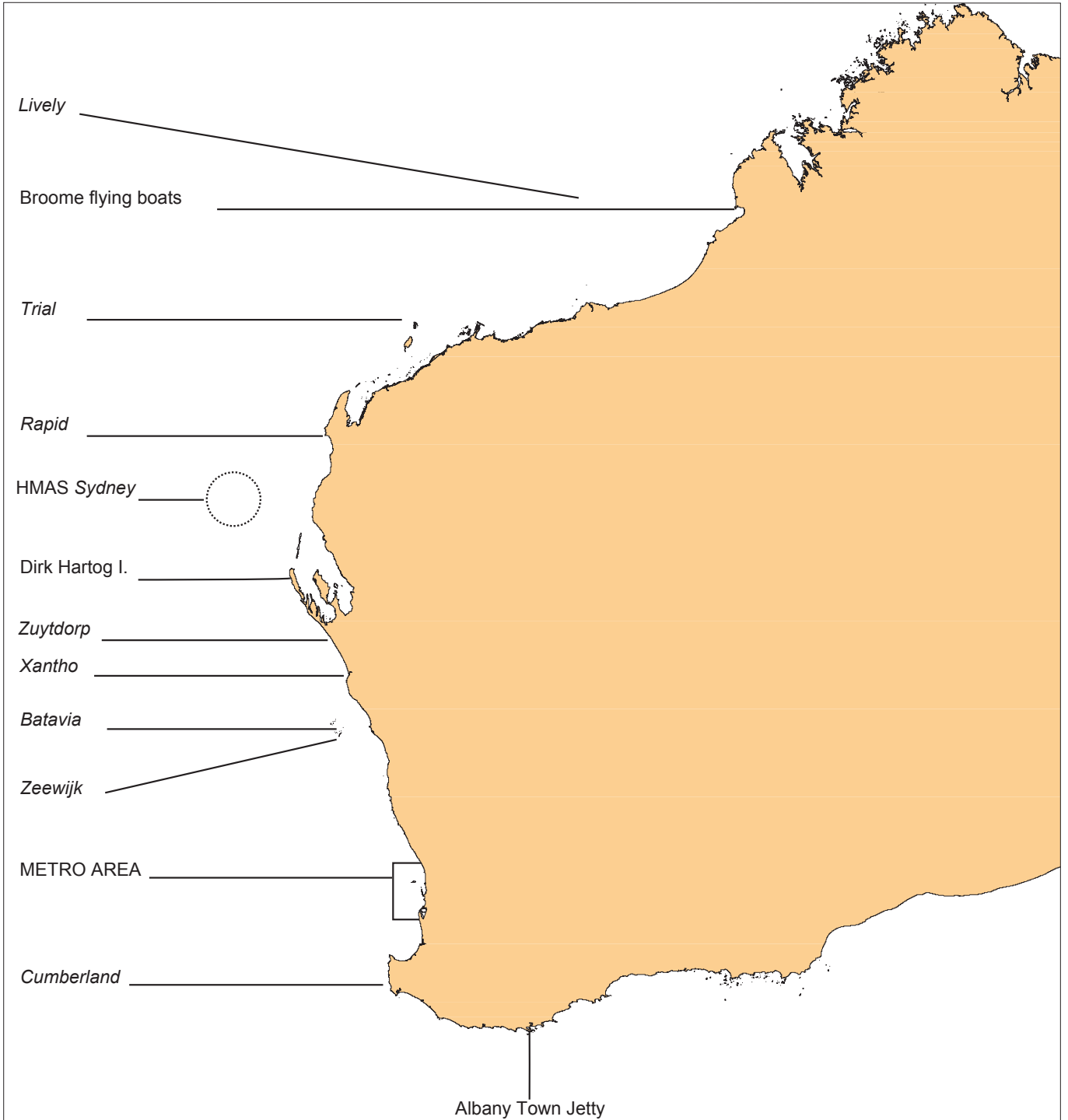
Graeme Henderson
October 2004

Maps

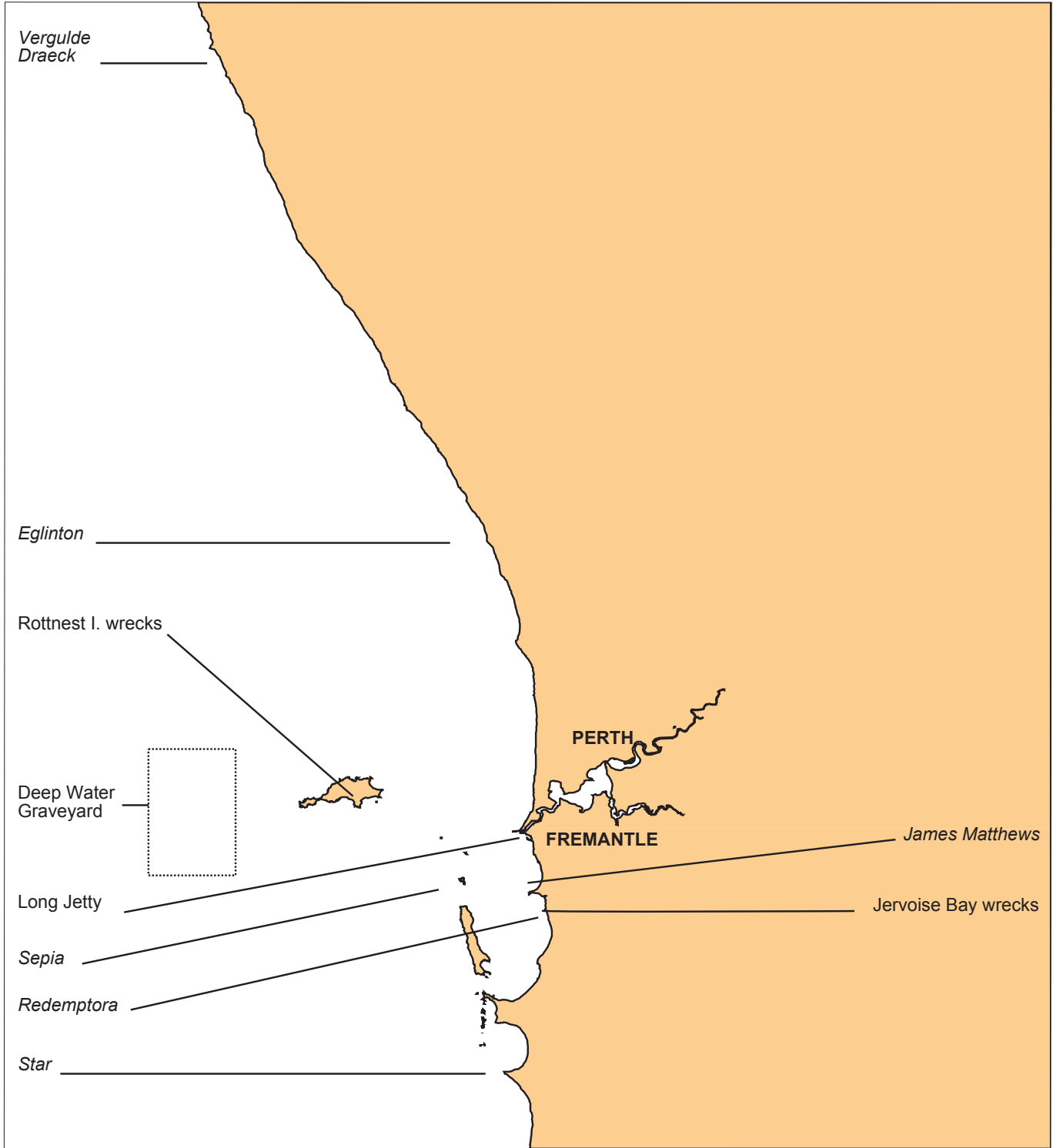
Maps showing locations of Department of Maritime Archaeology projects discussed in the Compendium.



National and International



Western Australia



Metropolitan

Abbreviations

ABC	Australian Broadcasting Corporation
AD	<i>Anno Domini</i>
AIMA	The Australasian Institute for Maritime Archaeology Inc. (formerly 'Australian')
ANCODS	Australia Netherlands Committee on Old Dutch Shipwrecks
ARC	Australian Research Council
ARGC	Australian Research Grants Committee
ASEAN	Association of Southeast Asian Nations
BC	Before Christ
BP	Before Present
CoE	The Australian National Centre of Excellence for Maritime Archaeology
EEIC	English East India Company
FSM	Federated States of Micronesia
GEOTIFF	Georeferenced TIFF file
GIS	Geographical Information System
HPASS	High Precision Acoustic Surveying System
ICOMOS	International Council on Monuments and Sites
ICUCH	International Committee on the Underwater Cultural Heritage
INA	Institute of Nautical Archaeology
JPEG	Joint Photographic Experts Group file format
MAAV	Maritime Archaeology Association of Victoria
MAAWA	Maritime Archaeological Association of Western Australia
MOU	Memorandum of Understanding
NAS	The Nautical Archaeology Society (UK)
NEI	Netherlands East Indies
NEGP	National Estate Grants Programme
RAAF	Royal Australian Air Force
RAF	Royal Air Force
RAN	Royal Australian Navy
SEAMEO	Southeast Asian Ministers of Education Organisation
SPAFA	SEAMO Project in Archaeology and Fine Arts
SUHR	Society for Underwater Historical Research Inc.
TAFE	Technical and Further Education
TIFF	Tagged Image File Format
UEC	Underwater Explorers' Club
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
USAF	United States Air Force
USN	United States Navy
UWA	University of Western Australia
VOC	<i>Verenigde Oostindische Compagnie</i> (the United Dutch East India Company)
WA	Western Australia
WAMM	Western Australian Maritime Museum
WINC	Wreck Inspection North Coast
WWW	World Wide Web

Measurements		Khz	kiloherz
cm	centimetre	km	kilometre
ft	feet	m	metre
hp	horse power	mm	millimetre
in	inch	nT	Nano Tesla

List of abbreviations for personnel

AW	WOLFE, Adam	MAAWA	Maritime Archaeological Association of WA
BH	HUNNEYBUN, Bernie	MG	GIBBS, Martin
CIS	INGLEMAN-SUNDBERG, Catherina	MMcC	McCARTHY, Michael
CS	SOUTER, Corioli	MPG	GAINSFORD, Matthew
Dept	Department of Maritime Archaeology	MS	STANBURY, Myra
DG	GARRATT, Dena	PEB	BAKER, Patrick
GJH	HENDERSON, Graeme	PH	HUNDLEY, Paul
GK	KIMPTON, Geoff	Prosp	Prospero Films
IMcL	MACLEOD, Ian	RAJ	RICHARDS, Bob
J.Mc	MACILROY, Jack	RH	HARPER, Rosemary
JNG	GREEN, Jeremy	RH (2)	HARRISON, Rodney
JP(1)	POTTS, Jenni	RP	PARTHESIUS, Robert
JP(2)	PASVEER, Juliette	RS	SUTCLIFFE, Ray
KM	MILLAR, Karen	SS	SLEDGE, Scott
LK	KIRKHAM, Leah	SS(2)	STRACHEN, Shirley
		VR	RICHARDS, Vicki

Introduction

This book is a compendium of the work of the Department of Maritime Archaeology carried out over the period since the Department's formation in the 1970s up to the end of 2003. This introduction provides a brief history of the Department, describing the contentious events that led to its establishment and giving an overview of what the Department has achieved over the last thirty years. The *Compendium* then presents a series of brief reports or abstracts of the key projects in which the Department has been involved, with references to publications providing more detailed information. Following, there is a chronological list of every project that has been carried out by the Department over this period, with an associated bibliography. The *Compendium* concludes with a complete list of publications produced by members of staff, volunteers or people associated with the Department since its beginning. Designed as a resource that can be used in a number of different ways, the *Compendium* aims to provide access to the huge body of research that has been undertaken and published by the Department. The publication has had a long gestation. Starting as an initiative to commemorate the new millennium, the project took much longer than anticipated as the scope of the publication expanded.

LEGISLATION

The history of the Western Australian Museum's involvement in maritime archaeology starts in 1964. It was then that the Western Australian Government passed an amendment to the *Museum Act 1959* (WA) giving to the Museum responsibility for shipwrecks that were dated prior to 1900, and were lying below the low-water mark in the territorial waters of the State. This legislation came about, firstly, as a result of an initiative of the finders of the *Vergulde Draeck*, who passed their rights, as finders, to the Government; and, secondly, because these sites were being looted and vandalised, causing a public outcry. The Act gave the Museum authority to control and administer the wreck sites on the Western Australian coast. At that time, the concerns were purely for the Dutch shipwrecks and interest in the post-settlement wreck sites was to come later. Significantly, the amended legislation included a provision to reward the finders of shipwrecks but this was not made retrospective; thus, the finders of wrecks already discovered, including the *Batavia*, *Vergulde Draeck*, *Zeewijk*, *Zuytdorp* and the Cottesloe Wreck (*Elizabeth*), were not eligible for such a reward. This proved to be a highly contentious and ongoing issue, both for the finders and in the perception of the general public, and the matter was only finally resolved in 1994 by the findings and recommendations of the Western Australian Government Select Committee on Ancient Shipwrecks (Pendal, 1994). The Committee recommended that any person who reported their discovery of a wreck site should be rewarded; and that the early finders of wreck sites, who had been deprived of rewards, should be properly acknowledged and rewarded.

The legislative pathway was complex and without precedent. Remember that this was the first legislation anywhere in the world to protect underwater cultural heritage and it was being applied at a time when there were conflicting issues between the States and the Commonwealth on sea bed rights. The enactment of the new *Museum Act 1969* (WA) saw the incorporation of the 1964 amendments with some modifications. In 1972, after negotiations between the governments of the Netherlands, the Commonwealth and the State, the Australia Netherlands Committee on Old Dutch Shipwrecks (ANCODS) Agreement was signed. Under this Agreement the Netherlands Government, as heir to the United Dutch East India Company (VOC), agreed to transfer to the Australian Government any rights of claim the Netherlands might have to the VOC shipwrecks. The Agreement required that a committee be formed that

would oversee the operations of the Museum and that representative collections would be selected for the Netherlands and Commonwealth Governments, with the understanding that the bulk of the collection would remain in the Western Australian Museum (Bolton, 1977). In 1973, there was a further legislative change and the historic wreck provisions were removed from the *Museum Act* and incorporated into a new *Maritime Archaeology Act 1973* (WA).

Meanwhile, concern was being expressed in legal circles about the validity of the State Act, which came to a head finally, in 1977, following a challenge in the case of *Robinson v. Western Australian Museum*, when the High Court of Australia ruled that the State Act was invalid (Kennedy, 1998). As a result of this decision the Commonwealth's *Historic Shipwrecks Act 1976*, which had been prepared before the High Court challenge was heard, was proclaimed to apply in the waters of Western Australia. In fact, there were a few days between the High Court decision and the proclamation of the new Act when the wrecks in Western Australian waters were not protected under any form of legislation. Ironically, this hiatus occurred in the middle of the First Southern Hemisphere Conference on Maritime Archaeology, which was being held in Perth. Following this landmark decision, the *Historic Shipwrecks Act* proclaimed in the Commonwealth Waters off the Western Australian coast had jurisdiction from the low-water mark to the edge of the Exclusive Economic Zone. Western Australia's *Maritime Archaeology Act* applied in State waters, which included rivers and enclosed bays and sites above the low-water mark. The complexity of the dual jurisdiction, as it applies in Western Australian waters, lies in the fact that the concept of State waters still exists, extending out three nautical miles from the coast. While the State legislation does not apply to things on or below the sea bed, it does apply to things in the water column such as fish. Other Australian States followed a similar process of proclamation, but as they did not have specific legislation covering underwater cultural heritage they enacted 'mirror' legislation to apply to their State waters (legislation that was essentially the same as the Commonwealth Act). In Western Australia, the State Act is vastly different from the Commonwealth legislation.

The protection provided by the *Historic Shipwrecks Act 1976* for underwater cultural heritage differed markedly from that offered by the *Maritime Archaeology Act*. Whereas the State Act protected archaeological sites, the Federal legislation was directed towards protecting shipwrecks and associated relics. Initially, the *Historic Shipwrecks Act* gave no specified date to define 'historic' in relation to a shipwreck. To gain protection for a wreck, it was necessary to provide a justification to the Minister as to why the site should be protected. This proved to be unwieldy in implementation, particularly as it caused delays between the discovery and the gazettal, during which period the site was not protected. A number of amendments have been made to the Federal Act since its enactment, including one that introduced a rolling date, so that sites 75 years old or more are automatically protected. The differences between the State and Federal legislation still create mind-bending anomalies though, as in the case where a wreck lies partially in Commonwealth waters and partially in State waters. The Commonwealth section (i.e. the part below the low-water mark) is protected if it is more than 75 years old, but the other part, above the low-water mark, will not be protected under the State Act unless its date is earlier than 1900.

While the legislation is undergoing review at both State and Federal levels, another important development has been the UNESCO Convention on Underwater Cultural Heritage. This international Convention was adopted in November 2001, with WA Maritime Museum Director Graeme Henderson in the role of chair of the ICOMOS International Committee on the Underwater Cultural Heritage (ICUCH) which instigated the Convention. The Convention requires that countries enact enabling legislation, which, in the case of Australia, will require all States and the Commonwealth to rewrite their respective Acts. It is, however, a landmark decision in that it clearly indicates that underwater cultural heritage should be

protected, reaffirming the position taken in the early Western Australian initiative to protect sites.

THE 1960S AND THE EARLY BEGINNINGS

Following the enactment of the State legislation, the Museum began to establish an administrative structure to look after the shipwrecks under its jurisdiction. Since there was no similar situation elsewhere in the world that could be used as a model, the Museum initially adopted a holding operation on the sites, rather than starting excavation or salvage. Additionally, there were no trained maritime archaeologists and only a few European countries that had experience in this area, hence there was absolutely no precedent for establishing a maritime archaeological programme. In what was acknowledged to be an unsatisfactory situation, the general public complained that nothing was happening, while amateur divers felt that they could, and therefore should, do the work. The Museum came under growing criticism over the lack of action (Crawford, 1977). In 1967, Dr Colin Jack-Hinton was appointed as the head of a newly created Division of Human Studies at the Museum; under his direction, resources were acquired and staff recruited. A watch-keeping operation was established on the two most important threatened sites, the *Batavia* and the *Vergulde Draeck*, providing accommodation facilities, boats and diving equipment.

The Museum also sought advice on how a maritime archaeological programme should be run. In the late 1960s, an Historic Wrecks Advisory Committee was established to help advise on the direction of the programme and counter some of the criticism the Museum was attracting. This Committee, in its various manifestations, exists today as the Maritime Archaeology Advisory Committee and still meets regularly. Also in the late 1960s, Mr G. van der Heide from the IJsselmeerpolder Museum in the Netherlands came to Perth at the invitation of the Museum. He made suggestions on how to manage the sites and two museum staff went to the Netherlands for training. This was the beginning of a long and fruitful cooperation between the Museum and scholars in the Netherlands. In 1969, Dr Ian Crawford took over as Head of Division. By that time, a limited excavation had started on the *Vergulde Draeck* and, in 1970, a joint Museum and University of Western Australia expedition carried out a limited excavation of the *Batavia* wreck site.

In 1970, Dr David Ride, the Director of the Museum, made a submission to the Western Australian Government that it provide appropriate support for the maritime archaeological programme. The support was forthcoming and resulted in the appointment of Dr Colin Pearson as Head of the Conservation Laboratory, and the writer's appointment, in 1971, as Head of the Department of Maritime Archaeology.

THE 1970S: THE DEPARTMENT IS ESTABLISHED

With proper conservation facilities and the resources to carry out major excavation projects, the scene was set for a new initiative in maritime archaeology. A custom-built 12 m work-boat, the *Henrietta*, was built and new curatorial staff were recruited to complement the existing technical staff. By 1972, the Department numbered about fifteen people. They had a new office in the Weick Gallery at Fremantle, alongside the Conservation Laboratory, and there were field stations on Beacon Island, in the Houtman Abrolhos, and at Ledge Point, north of Perth.

The first project was a survey of the *Trial* wreck site (more detail on all the projects discussed here can be found in the Compendium Projects List) after which an excavation of the *Vergulde Draeck* site was undertaken. By the end of the *Vergulde Draeck* excavation, the departmental team was experienced enough in shallow water surf-zone excavation to start work on the *Batavia*. The *Vergulde Draeck* was chosen first for excavation, because of its proximity to Perth and the

likelihood that the site was under greater threat than the *Batavia*. The *Batavia*, however, was a much bigger project; not only was the site a lot larger and more complex, but the logistics of working in the remote Houtman Abrolhos was extremely demanding. Work started on the *Batavia* site in December 1972, the first of four excavation seasons. In total, approximately 450 days of field-work were logged on the *Batavia* project.

During the course of the excavation, it became clear that a large intact section of the ship had survived and it was decided to raise this section for conservation. This inevitably led to the question of where the raised section (measuring some 30 m x 10 m x 6 m) could be housed. Fortunately, Fremantle in the late 1970s was fruitful ground for such a quest. There was a large, derelict heritage building—the Commissariat Building—that was found to have rooms of suitable size to house the reconstruction. Indeed, it was spacious enough to house a large number of massive exhibition galleries as well as the respective Departments of Maritime Archaeology and Materials Conservation. The refurbishment of the Commissariat Building was carried out by the Public Works Department and won numerous heritage awards for the quality of the restoration. The building was officially opened in 1979, housing the restored *Batavia* hull and portico façade and exhibitions of material from the wreck sites investigated by the Department.

At the end of the *Batavia* project, work started on a post-settlement maritime archaeological programme under the direction of Graeme Henderson, who was then a curator in the Department. Initially, when the Museum started its programme in maritime archaeology, the current thinking was that the Dutch wrecks were the most important sites. The later, early 19th century and post-settlement sites were thought to be relatively insignificant at the time. The Department became increasingly concerned, however, at the public perception that the Museum was not interested in these sites, which was leading to widespread looting of many of them. It was recognized that these sites would prove immensely important to the early European history of Western Australia and of Australia, and a programme of work was developed for them. This commenced with excavations by Graeme Henderson on the *Eglinton*, followed by the *James Matthews*, *Rapid* and *Lively*.

In 1974, Scott Sledge became responsible for the wreck inspection programme that monitored reports of wrecks and inspected the sites. In 1978 he led the very successful Wreck Inspection North Coast (WINC) expedition, which examined sites in the far north of the State. The wreck inspection programme was later taken over by Michael McCarthy.

INTO THE 1980s: DEVELOPMENT AND DIVERSIFICATION

The Department's Dutch wrecks programme did not finish with the excavation, conservation and reconstruction of the *Batavia*. It continued with work on the *Zeewijk* site, where several seasons of excavation and survey were carried out under the direction of Catherina Ingleman-Sundberg. Later, the Dutch wreck programme turned to the *Zuytdorp*, an incredibly difficult site to work.

On another front, McCarthy initiated a programme looking at iron and steam shipwrecks. This led to the First Australian Seminar on the *Management of Iron Vessels and Steam Shipwrecks*, which was held in 1988. McCarthy's important excavation of the steamship *Xantho*, with the subsequent recovery of the vessel's engine, started yet another interesting and exciting initiative for the Department. The dismantling of the concreted and corroded engine, and its subsequent conservation process, has provided new insights into the study of iron shipwrecks and their conservation.

Land archaeological work associated with maritime activities is another branch of research within the Department. Myra Stanbury has undertaken research of the guano industry in the

Abrolhos, as well as studying the whaling industry, particularly at the Norwegian Bay Whaling Station at Point Cloates and pearling in the Monte Bello Islands. Myra's main responsibility has been the management of the Department's artefact collection and research, and publication of sites that the Department has previously worked on. The Department has been involved in numerous land archaeological projects, particularly where they interface with the maritime milieu.

In 1981 Michael McCarthy initiated Australia's first wreck access programme, which has since developed into an outreach programme. The objective of such programmes is to provide information for the public as well as opportunities for them to look at and enjoy shipwrecks. Through public involvement and introducing the concepts of an 'Underwater' Museum where the wreck sites are the 'show cases' and the ethos is 'please enjoy—look but don't touch', the Department encourages the concept of protecting sites for future generations. Other avenues for public involvement in maritime archaeology include the Maritime Archaeological Association of Western Australia (MAAWA), an amateur organization founded in 1974 (Robinson, 1977). This Association assists the Department in projects and played a particularly important role in the excavation of the *Batavia* and the other early departmental projects. It also conducts its own projects and has a long and impressive publications record. Another relatively new initiative targeting the public, managed by Corioli Souter, is the Australasian Institute for Maritime Archaeology (AIMA)/Nautical Archaeology Society (NAS) training courses. As well as providing technical training in maritime archaeology, these courses raise awareness about shipwrecks and the issues relating to the preservation of underwater cultural heritage.

The Department has played an important role in the Australasian Institute of Maritime Archaeology (AIMA) since it was first established at the Second Southern Hemisphere Conference on Maritime Archaeology in Adelaide in 1983. Taking a leading role in the formative years of the Institute, the Department still regularly produces and edits the annual *AIMA Bulletin*, now in its 27th year of publication.

In Australia the Department has taken part in and assisted with numerous projects. In the Northern Territory work was carried out on the aircraft wrecks in Darwin harbour. In Queensland, some of the early work on the *Pandora* (see below) was carried out by staff members, and we had a continuing involvement with the Museum of Tropical Queensland in this project over the years. In New South Wales we have assisted the NSW Heritage Office with equipment and training. In Victoria, we have assisted Heritage Victoria with the *City of Launceston* project in Port Phillip Bay and the *Cheviot* at Wilsons Promontory. In Tasmania we have been involved with the Tasmanian Parks and Wildlife Service on the *Sydney Cove* (see below) and the Port Arthur Historic Site Management Authority surveying Carnarvon Bay. In South Australia we have worked with Heritage South Australia surveying the Murray River. Also, we have been involved in the HMS *Sirius* project on Norfolk Island (see below).

From the study of maritime archaeology, the Department's research interests spread into other areas. Developing out of the post-settlement programme, a maritime history programme was started that included the study and collection of historic boats of significance to Western Australia. This programme eventually separated from the Maritime Archaeology Department to become an independent Department of Maritime History. Graeme Henderson was appointed Director of the Maritime Museum in 1994 and, in 2002, a spectacular new Maritime Museum was opened on Victoria Quay, complementing the museum in the Commissariat Building. The new Maritime Museum, evolving from the work of the Department, is largely devoted to maritime history, and the Commissariat Building has become a shipwrecks museum devoted to maritime archaeology and conservation.

NEW INITIATIVES

The year 1977 saw the first of three expeditions taking departmental staff to Mombasa, Kenya, to assist the Institute of Nautical Archaeology (INA) with the excavation of the *Santo António de Tanna*. Staff from the Department began to be increasingly involved in overseas projects, with the objective of gaining experience and expertise in the field. In 1979, a series of training and research projects was undertaken in Thailand. Staff from the Department helped the Department of Fine Arts in Bangkok (who were responsible for underwater sites) to train their archaeologists. This programme was expanded into a Southeast Asian regional programme under SPAFA (SEAMO Project in Archaeology and Fine Arts) and nine seasons of work were carried out with the Fine Arts Department. Other initiatives included the first archaeological programme in the People's Republic of China as well as projects in Japan, Korea, Malaysia, Philippines, Maldives, Oman and Sri Lanka. Departmental staff have also been involved in work in Turkey, the United Kingdom, the United States of America, the Netherlands, Scandinavia, New Zealand, Truk Lagoon, Kenya, Italy, Israel and Panama. A particularly interesting development has been the projects relating to Dampier and de Freycinet undertaken by Michael McCarthy in the Ascension Island and the Falkland Islands, respectively.

In 1981, in conjunction with Curtin University of Technology, the Department ran the first post-graduate diploma course in maritime archaeology in Australia. The Department's involvement in tertiary education reflects its perceived need for trained maritime archaeologists to help establish maritime archaeology as an academic discipline. In 1994, as part of the Keating Government's Creative Nation initiative, the Western Australian Maritime Museum was established as a National Centre of Excellence for Maritime Archaeology. In 2001, the Department was involved with Prospero Productions in a three-part television documentary series called *The Shipwreck Detectives* which, when shown on ABC television, had over a million viewers per episode, a record for an ABC documentary series. A second series is currently underway. This initiative not only paid for three projects that would not normally be funded, but also provided enormous coverage for the Department and the Museum, both in Australia and overseas, and promoting maritime archaeology.

THE FUTURE

At the beginning of the 21st century, the future of the Department promises to be exciting and challenging. There are some dangers lying ahead, but on the whole, one can be optimistic. No doubt there will be some major changes in the next decade. Many of the old staff will have retired and there is an important challenge to manage the transition from the 'old' to the 'new' in a careful and considered manner. Funding is, and always has been, an uncertainty. The Commonwealth Historic Shipwrecks Program supports the work of the Department in managing the 1600 known shipwrecks on the Western Australian coast. However, this funding alone is not adequate to support a comprehensive programme. The various initiatives in which the staff has been involved have brought resources and funding to the Department. Strategic alliances with other government agencies and businesses also help to expand the ability of the Department to protect and preserve our underwater cultural heritage.

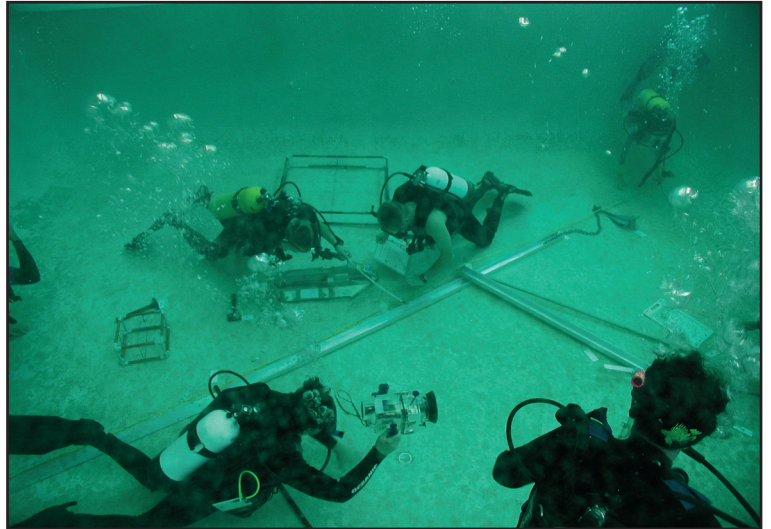
One only has to look through the pages of this *Compendium* to see what has been achieved over the past thirty or more years. This has been a cooperative and collaborative achievement, not only through the dedication of the departmental staff but also through the work of countless volunteers. I look forward to seeing where the Department will go in the future.

Jeremy Green
1 October 2004

An alphabetical list of significant projects
undertaken by the Department of Maritime
Archaeology 1971–2003

AIMA/NAS Maritime Archaeology Training Course

The Australasian Institute for Maritime Archaeology Inc. (AIMA), in conjunction with the Nautical Archaeology Society (NAS—United Kingdom), teaches a four-part course on maritime archaeology. This internationally accredited course is currently being run in the United Kingdom (UK), Europe, South Africa, Sri Lanka, Canada and the United States of America (USA). The NAS programme was adopted by the Australasian Institute of Maritime



Archaeology (AIMA) in 1998. The general philosophies behind the course—to introduce the methods and procedures employed in underwater archaeology, as well as to generate awareness regarding shipwreck preservation—were already part of AIMA's constitution. The success of the programme in the UK had been noted for some time so it was a case of adapting the syllabus for Australian conditions, in regards to both physical and legislative parameters.

The NAS is an international society based in the UK. One of the stated aims of the Society is to advance education in maritime archaeology at all levels. The NAS has put this into practice by introducing a structured training scheme open to both divers and non-divers. It was designed and developed by archaeologists and recreational divers, and has proved to be an effective way to teach basic archaeological skills for use underwater. On completion of each part of the course, students are awarded an AIMA/NAS certificate that is internationally recognized.

The AIMA/NAS programme is the first international, accredited and, most importantly, on-going system of archaeological avocational training in Australia, and draws in a large cross-section of the community. The AIMA/NAS programme provides the training for avocational groups to initiate their own survey projects. Similarly, as such community groups operate on a fairly small scale, the public interest generated by the AIMA/NAS programme ensures their continuation.

The Department of Maritime Archaeology runs courses on a regular basis. Specific reference is made during the course to projects undertaken by the Museum and the Maritime Archaeological Association of Western Australia (MAAWA) over the years. AIMA/NAS training has also been incorporated into undergraduate and post-graduate programmes while still maintaining its public face and emphasis on community involvement. The University of Western Australia along with Flinders University of South Australia and James Cook University of North Queensland offers Part I–III courses as part of the archaeology curriculum. The courses are also being promoted to heritage professionals including terrestrial archaeologists.

References: Dean, 1992.



Albany Town Jetty

A concept plan for the redevelopment of the Albany foreshore in 1988 involved the dredging of an area adjacent to the Town Jetty. Because the jetty site could have material dating prior to 1900 it is protected under the State *Maritime Archaeology Act 1973*, and the Department decided to examine the sea bed and evaluate the cultural resource.

In 1988, the Department conducted a surface survey and test excavation of a small area under one part of the jetty. Materials raised were collected and conserved by the Museum. In 1989, following reports of looting in scour pits formed by the propeller-wash of a large tug boat, the Department conducted another series of test excavations. These initiatives, the involvement of the local dive club, the resultant press and exhibitions all served to draw attention to the need to protect this maritime heritage.

In 1994, the Museum received funds from the development agency, Landcorp, to conduct an archaeological assessment of the areas identified for dredging and land reclamation.

Surface searches along a series of transect lines were conducted throughout the affected area. Then a series of 'test pits' were dug at selected locations along those transects. A number of deep 'test trenches' were excavated within the sloping walls of existing scour pits. One of these scours was in excess of 5 m deep and over 10 m wide at the surface. While the test pits suffered from the usual 'coning' effect that serves to make a controlled underwater excavation difficult on an open sea bed, the test trenches were excavated in the steeply-sloping walls of the scours using traditional 3D grids for control. As these progressed, layers became evident in the walls, hence the coining of the term 'step trench' to describe them. In one excavation, six distinct strata were identified and recorded. These comprised (variously) silts, cockle shell, sand, fine shell and a layer of large oyster shells. Cultural material was evident in two of these layers. Shells removed from a variety of levels in a number of test pits and in one trench were sent for radiocarbon dating. Three samples returned ages ranging, from 1730BP (± 80) to 2670BP (± 60) and 5070BP (± 80).

The Albany Town Jetty excavation provided further evidence that, in suitable sediments, with favourable circumstances and a sharply sloping, but firm sea bed, the identification, recording and dating of layers on underwater sites can be done. This contrasted with the situation at the Fremantle Long Jetty, where an attempt to examine the same phenomenon had earlier proved unsuccessful.

The Departmental report deals with excavations, the legal situation and the 1994 excavation itself, including methodology. An artefact catalogue, details of a comprehensive pre-disturbance survey, conclusions and recommendations appear. The history and significance of the jetty itself is also discussed, as are a number of post-excavation strategies.

References: McCarthy, *et al.*, 2002; Garratt, *et al.*, 1994.

The Australia Netherlands Committee on Old Dutch Shipwrecks—ANCODS

In 1972, the Australia Netherlands Committee on Old Dutch Shipwrecks (ANCODS) was set up to advise the Commonwealth Government on policy relating to 17th and 18th-century Dutch shipwrecks off the Western Australian coast. The principal objectives were to safeguard the legal position of the wrecks and to protect the Western Australian Museum's programme of recovery and treatment of the artefacts. The Committee worked for many decades, advising on the management of the sites, and on the equitable disbursement of conserved artefacts to museums and repositories in Australia and the Netherlands. The ANCODS Agreement forms Schedule 1 of the Commonwealth *Historic Shipwrecks Act 1976*.



The Tricentenary of Willem de Vlamingh's voyage and the laying of the *Duyfken* 1606 replica's keel, created an opportunity to re-invigorate the Agreement. The Netherlands Ministry of Foreign Affairs provided subsidies for travel so that a number of Dutch experts could come to Australia and attend the Australia–Netherlands Colloquium on Maritime Archaeology and Maritime History, held at the Western Australian Maritime Museum on 7–9 January 1997.

At this meeting the Committee recommended that a new schedule in the bilateral agreement should be included acknowledging the need for research and dissemination of information relating to the collection and sites covered by the Agreement. They recommended that archaeological and research reports be published relating to this work together with full excavation reports and publications for the general public of all the sites be encouraged. It also acknowledged the interests of both the Western Australian Museum and a number of Netherlands research institutes in the Asian region, and suggested that in the long term, this Committee could foster trilateral research programmes. It also recommended that conservation of the collection be given a high priority and, in particular, techniques be investigated to help treat some of the more difficult and complex material. Finally, it confirmed that the original objectives of the Agreement be maintained; that is, that the collections should not be fragmented and that the material will be available for scholarly research.

The Agreement is widely recognized as a successful template for similar situations.

References: Bolton, 1977; Green, *et al.*, 1998.



Bai Jiao

The Bai Jiao 1 excavation was the result of China–Australia relations built up over a number of years (see China below). The Song Dynasty Bai Jiao 1 wreck is located adjacent to the village of Dinghai, Fujian Province, in the south-east of China. During the late 1970s fishermen at Dinghai began dredging the shell sea bed for lime to be used in the building industry of Zhejiang and Jiangsu Province. Ceramic material is often brought to the surface by the dredges; most of the material dates

from AD 960 and earlier. In November 1989, a maritime archaeological survey was undertaken to identify a shipwreck site that could be used for the China–Australian training programme. The Bai Jiao 1 site was located with the help of local fisherman. The training programme, under the direction of the Department of Maritime Archaeology, was directed by Paul Clark and was designed to help reduce the impact of the dredging on the site. Excavation revealed ceramic artefacts—mainly of the ‘black glaze’ and the *tuhao zhan* (‘rabbits fur’) bowl type, with a total of 475 ceramic items recovered during the surface collection and small excavation. The bowls were often found stacked one inside another. These stacks had fallen in random fashion, as a result of wreck site formation processes. As the excavation neared completion, the recovery of material was stopped. Limited facilities for adequate care and conservation were the main reasons for this, coupled with the Chinese team’s plan to reinvestigate the site in 1996. An expedition in 1995 by Chinese and Australian archaeologists from the Department of Maritime Archaeology under the direction of Sarah Kenderdine expanded the preliminary work conducted at the site in 1990 and completed the excavation. A full report of the work was published.

Another site, Bai Jiao 2, was also discovered in 1990 and tentatively dated to the Ming Dynasty (AD 1368–1644). This confirmed that the area was a hazard for shipping, and that the reef was an eventful location for shipwrecks in historical times.

References: Green, 1997b; Kenderdine, 1995b.

Batavia

The *Batavia* is Australia's second oldest known shipwreck; the oldest is the English East India Company ship *Trial* lost in 1622 (see *Trial*).

On the morning of 4 June 1629, the VOC ship *Batavia* was wrecked on the Houtman Abrolhos, off the coast of Western Australia. Commander Francisco Pelsaert, all the senior officers, some crew and passengers, 48 in all, deserted 268 people on the wreck and on two waterless islands whilst they went in search of water. Abandoning the search on the mainland coast, they made their way to Batavia (modern Jakarta, Indonesia), to obtain help; the journey took 33 days. On arrival, the Governor General dispatched Pelsaert in the *jacht Sardam* to rescue the survivors. With extraordinary bad luck, it took 63 days to find the wreck site, almost double the time it took the party to get to Batavia. At the Abrolhos, Pelsaert discovered that mutiny had taken place. A small group of mutineers, led by Jeronimus Cornelisz the undermerchant, had massacred 125 men, women and children. Pelsaert arrested the mutineers, tried them according to Dutch law and executed some of them.

When the *Sardam* finally returned to *Batavia*, some of the lesser offenders, who had been flogged, keelhauled and dropped from the yard-arm as punishment on the voyage, were executed. Two people were marooned on the mainland coast as punishment. Out of 316 people aboard the *Batavia*, only 116 survived. Pelsaert died in the following year.

The *Batavia* was found in 1963 by fisherman and divers. In the late 1960s the Museum conducted a holding operation on the site using watch-keepers to ensure the site was not looted. Between 1972 and 1976 the Department of Maritime Archaeology conducted a series of excavations of the *Batavia*. The artefacts from these excavations were treated by the Western Australian Museum's Department of Materials Conservation and may now be seen in the Maritime Museum and Shipwreck Galleries in Fremantle, and in the Western Australian Museum Geraldton. During the excavation, part of the hull of the vessel was uncovered. This was carefully recorded and raised. After a number of years of conservation treatment, the remains were rebuilt in the Shipwreck Galleries. This provides the centre-piece for the *Batavia* Gallery display. The section is the stern quarter of the port side of the ship up to the top of the first gun-deck, and includes the transom and stern-post. Part of a portico façade was found on the site, comprising 97 (of a total of 149) blocks weighing over 36 tonnes. The portico was reconstructed and is on display in the WA Museum Geraldton. From archival research, it was found that the portico was destined for either the Land Port or the Waterport at the Castle at Batavia.

References: Green, 1989; 1998c.





Broome Flying Boats

In 1942, the Japanese invaded the island of Java, Indonesia. As a result, the allies organized an armada of aircraft to evacuate the allied personnel. Over the course of two weeks, *c.* 8 000 people were flown to Australia's capital cities via Broome in a collection of aircraft flown by RAF, USAAF, USN, RAAF, NEI and Qantas aircrew.

On 3 March 1942, twenty-four aircraft were transiting through Broome, including flying boats, bombers and transports. At 9.30 a.m., nine Japanese Zero fighters attacked and destroyed all but one of the

allied aircraft (including 15 Flying Boats) with cannon and machine-gun fire. Unfortunately, the Japanese commander had no idea that these legitimate military targets contained hundreds of innocent civilians.

For well over a decade after 1988, the Department of Maritime Archaeology helped the Broome Historical Society and the RAAF Aviation Museum manage the wrecks using a loose amalgam of laws and regulations. The advent of Global Positioning System (GPS) and other developments placed the wrecks at risk. However, in a bid to better manage the sites, the Museum commenced remote-sensing searches of Roebuck Bay, the last in mid 2001. An archaeological assessment of the located targets was conducted and shown by way of a television documentary, made in association with Western Australian based film company Prospero Productions, and the National Geographic Channel. As part of the 'Shipwreck Detectives' television series, 'Bay of Fire' deals with the Broome Flying Boat programme. Prospero Productions also organized for the handful of surviving aircrew and eyewitnesses to be in Broome during the filming. Their interviews form the background of the story and provided the opportunity to record detailed oral histories as well as assistance in the identification of the sites and associated material. There is little known about the people on board the flying boats, the items that they were carrying and the exact circumstances of their journey. The objectives of this field-work were to locate the remains of the flying boats in Roebuck Bay and to conduct a series of preliminary excavations on examples of the various types of craft, to identify the range of archaeological material.

As a result of the success of the remote sensing regime and the archaeological assessments the Government of Western Australia issued a conservation order on the site, in 2002, under the *Heritage of Western Australia Act 1990*.

A website was produced that has resulted in the development of a site dealing with practical and theoretical issues relevant to the field of underwater aviation archaeology. An oral history programme commenced during the 2001 excavation was continued culminating in 2004 with an interview with the 104-year-old leader of a WWII salvage operation at the sunken wrecks.

References: Green, 2002b; McCarthy *et al.*, 2002; Souter, 2003.

Centre of Excellence

In 1994, the Federal Government announced in its cultural policy statement *Creative Nation* that the Western Australian Maritime Museum would be established as a National Centre of Excellence for Maritime Archaeology. The Statement identified the *Pandora*, national and overseas programmes in maritime archaeology and maritime archaeological conservation as issues of significance for the Centre. Funding was provided for a three-year period to support a number of projects including the 1996, 1998 and 1999 HMS *Pandora* investigations, and the Galle Harbour Project, Sri Lanka. In addition, the Centre supported the James Cook University's project 'Investigation of historical and archaeological evidence—Pitcairn Island and the *Bounty*', and Flinders University of South Australia's project 'Archaeology of Whaling in Southern Australia'.



At the technical level, the Centre acquired an OmniStar satellite derived Differential Global Positioning System (DGPS). This was an initiative between Fugro Surveying Pty Ltd and the Centre. The system has been used in the Historic Shipwrecks Program in South Australia, Western Australia and the Northern Territory. Major projects include the search for the Portuguese wreck *Correio da Azia*, at Ningaloo; mapping shipwrecks in Port Adelaide; surveying a French site on Dirk Hartog Island; and, surveying in the Galle Harbour Project in Sri Lanka. The Centre has also evaluated two photogrammetric systems: PhotoModeler, StereoMaker/Modeler and Virtual Mapper programs that have applications for underwater archaeology. The evaluation determined the theoretical accuracy of both systems in an ideal underwater environment and then applied the programs to real archeological situations to determine their working limitations. The PhotoModeler system was used on a number of sites including a *J3* submarine site and the *City of Launceston* wreck site in Port Phillip Bay, Victoria, and in New South Wales and South Australia. The StereoMaker/Modeler and Virtual Mapper systems, joint projects with 3D Mapper and DEMS Pty Ltd respectively—both Western Australian photogrammetric companies—were used on the *Pandora* excavation. The Centre initiated the development of a High Precision Acoustic Surveying System (HPASS see below) in conjunction with the Centre for Marine Science and Technology at Curtin University of Technology. The HPASS system was also used on the *Pandora* excavation. This system has enormous potential for underwater surveying and the results have shown that an accuracy of about 5 mm over 30 m is typical. A new side-scan sonar was purchased by the Centre (see Side-scan Sonar below).

References: Green & Souter, 2002; Green & Gainsford, 2003



China

In 1989, in association with Dr Peter Burns of the University of Adelaide, the Department of Maritime Archaeology initiated a maritime archaeological training programme in China. This was conducted in association with the Museum of Chinese History, Beijing. The objective of the programme was to train and develop the skills of eleven Chinese archaeologists in maritime techniques and procedures. Essentially, this was designed to provide the basis for initiating a programme to

promote field-work on underwater archaeological sites in China.

The most effective method for running the course was to have it in China, using lecturers and instructors from Australia. Paul Clark and Karen Millar started the training programme in Qingdao and later, the practical training was located to Dinghai in Fujian Province. The course consisted of two months' diver training and underwater practical work, and a further ten months of theoretical study and practical experience. Students became aware of the problems associated with underwater work through direct experience, and were introduced to methods to overcome these. The main aims were achieved and the final outcome was very encouraging. The amount of work completed in the set time far exceeded expectations and students were able to dive on a shallow site and conduct underwater work.

Out of the training programme arose a three-year research project, under the auspices of the National Museum of Chinese History, co-ordinated by the Cultural Bureau of Fujian province with the assistance of the Fuzhou Museum and Fujian Provincial Museum. This involved the excavation Bai Jiao wreck site (see Bai Jiao above).

In addition to the training programme, studies were made of traditional ship construction and an intensive study was made of the Song dynasty ship in Quanzhou (see Quanzhou ship below). Visits were made to the Museum of Overseas Communication History, Quanzhou; the Fujian Provincial Museum, traditional shipyards in Fujian; the Xiamen Museum; the University of Xiamen; and the reconstruction of the river boat in Nanjing.

References: Atkinson-Millar, 1990; Green, 1997b; Green, Burningham & Museum of Overseas Communication History, 1998.

Cumberland

The British colonial merchant ship *Cumberland* visited the nascent Swan River Settlement in October 1829 during a voyage from its home port, Bombay, to New South Wales with a cargo of wheat. After a few days, the ship departed for Sydney, arriving on 7 November. The *Cumberland* was then chartered to take a cargo of coal, cattle and perhaps other goods to Swan River and India. Sailing from Newcastle, Hunter River, on 2 February 1830, the vessel had a few mishaps due to weather on its voyage south and west before sighting land at Cape Leeuwin on the evening of 4 March 1830. Cape Leeuwin lies at the south-west corner of the Australian continent where a string of reefs divide the Great Southern Ocean from the Indian Ocean. Since its first sighting, in 1622, by the Dutch ship of that name, the Cape has earned the wary respect of mariners.

Unaware of the strong onshore set of the current at Cape Leeuwin from the west during summer months, Captain Steel imagined his vessel to be much further to the west prior to turning north past the Cape in the dark. Making good speed, the ship suddenly struck submerged rocks and efforts to re-float it failed. By morning, the rudder and part of the stern timbers had been broken away by the swell pounding the *Cumberland* against the rocks; there was no chance of saving the ship.

Various contemporary exploration diaries, such as that of J.G. Bussell (1831), reported finding the Jolly Boat of the *Cumberland* with the ship's name on the stern, and other parts of the wreck scattered along the whole shore. In 1969, sections of a wooden hull were found on a beach, and in 1981 wreckage was reported on the sea bed north-west of Cape Leeuwin.

An inspection of the site in 1983 identified it as the wreck of the *Cumberland*, a 444-ton, Indian-built, teak vessel. A brief archaeological excavation in March 1984 recovered an interesting collection of artefacts ranging from ship's fittings—rudder gudgeons, scuttles, pulley sheaves, sounding leads, etc.; grindstones and dripstones; glass bottles; and, various ceramic objects, including a quantity of broken pieces of blue and white transfer-printed dinner ware in the rare Spode 'Indian Sporting' series. An 18-pounder iron cannon stamped with the AVOC mark of the Amsterdam Chamber of the United Dutch East India Company (*Verenigde Oostindische Compagnie*) and Amsterdam proof mark was also raised. Both trunnions had been knocked off, suggesting that the gun was carried as ballast.

Artefacts recovered from the *Cumberland* may be seen at the Augusta Museum, including a dripstone—a early means of purifying water. Analysis of the stone showed that the dripstone had been manufactured from a source at Norfolk Island where the task of quarrying the submerged sandstone beds was a punishment meted to the most incorrigible convicts during the second period of settlement (1825–52). Norfolk Island dripstones were shipped to New South Wales for military and private use. The *Cumberland* dripstones were either acquired for use on board or as a speculative return cargo.

References: Henderson, 1980f; Sledge, 1983a, b; Stanbury & McLeod, 1988.





Dampier and the *Roebuck*

In 1697, William Dampier published his book *A New Voyage Round the World*—an account of his extensive travels with privateers and pirates in the period 1679–91. It contained a large amount of information including draughts (maps) of geographical features, comments on the peoples encountered and the natural history of the places visited. His work was an immediate best seller and throughout the known world he became celebrated as an author and as a ‘pirate and hydrographer’,

thereby fixing his place in history, and as one of Britain’s literary ‘greats’.

After this success, Dampier submitted a plan to the Admiralty to survey the then unexplored east coast of ‘New Holland’ via Cape Horn. Having agreed to his proposal, the Admiralty presented Dampier with HM ship *Roebuck*. However, having received the ship too late for the ‘season’, he had to approach Australia from the Cape of Good Hope. *Roebuck* was not suitable for the long journey and Dampier was forced to turn back only a few nautical miles from the east coast of Australia. During the long voyage home, *Roebuck* sank at an unknown location off Ascension Island on 24 February 1701.

On his return to Britain, Dampier gave an account of the voyage, including details of his observations on New Holland’s west coast. He described and named Shark Bay, and parts of what is now the Kimberley coast. As a result of his detailed recording of the flora and fauna of the west coast, Dampier became widely recognized as ‘Australia’s first natural historian’. In a bid to locate *Roebuck* the Museum visited Ascension Island in March 2001, and followed Dampier’s recorded movements as his ship slowly sank beneath him by fixing his compass bearings and anchoring where he described the event in 1701. This enabled the team to focus its search in shallow water, a maximum of 200 m from the present shore at Long Beach in Clarence Bay.

Partly due to an unprecedented movement of sand, various artefacts were located and subsequently recovered from the wreck site, including a bell with a broad arrow (signifying Royal Navy issue), a clam shell from the Indo-Pacific region and Chinese ceramics dated to the late 17th century. It was concluded on the basis of all the evidence that the assemblage emanated from HM ship *Roebuck*.

References: McCarthy, 2002b.

Dirk Hartog Island

Dirk Hartog Island has played a pivotal role in the discovery and history of Western Australia. Most notably: Dirk Hartog (1616), Willem de Vlamingh (1697), St Aloüarn (1772), Hamelin (1801–3), de Freycinet (1818), and the crew from the French whaler *Perseverant* (1841). The island was also occupied in the mid 19th century by the military, who established a base at Quoin Bluff for the protection of the guano deposits and pearl beds that were in abundance on the island. A large pastoral station was also established in the mid 19th century.



In January 1998, there were reports from the Shark Bay Shire that a French coin and lead seal had been discovered on the northern part of the island, at Turtle Bay, by a team led by Philippe Goddard of Noumea. The coin (an *écu* dated 1766) had been located with a metal detector in the area reputed to have been the site of St Aloüarn's annexation of Western Australia for France in 1772. This discovery prompted an official site inspection by Department of Maritime Archaeology staff of the area in which the coin was found. The coin and lead closure were analysed and conserved. A team, including staff of the Department of Maritime Archaeology, Centre for Archaeology, University of Western Australia, and volunteers, returned in March. Using a combination of remote sensing and traditional archaeological methods they located and then excavated an intact bottle, complete with a lead closure containing another French *écu* dated 1767. Modern metals scattered across the site hampered the investigative progress.

Apart from the French annexation site at Turtle Bay, there is the site at Cape Inscription to the west of Turtle Bay where Dirk Hartog and Willem de Vlamingh both left commemorative plates recording their visits in 1616 and 1697 respectively. The Department has carried out various exploratory trips, historical studies and has produced and installed replicas of the original monuments at the site.

Another site that has been regularly visited is the survivors' camp associated with the wreck of the French whaler *Perseverant* (1841). This site lies to the east of Turtle Bay. Various artefacts of importance have been found in the camp site, including coins, buttons and a pair of dividers. The latest investigation, in 2003, (funded by an Australian Research Council [ARC] Grant from Flinders University) concentrated on a site survey and further magnetometer work, and an assessment of four-wheel drive damage to the site. The signage established earlier marking the site was refurbished and erected on new posts in the hope of diminishing the effects of human impact.

References: Gibbs, 1996a; Goddard & de Kerros, 2002; Robinson, 1988; McCarthy, 1998a; Harrison, 1998; Souter, 2000d.



***Duyfken* 1606 Replica Project**

The *Duyfken* Project was originally conceived as an exercise in ship replication (or reconstruction) to commemorate the Dutch ‘discovery’ of Australia in 1606, and to continue the ship replication expertise developed by the HMB *Endeavour* replica project in Fremantle. Built about 1595 in the Netherlands, the *Duyfken* was a fast, lightly-armed ship probably intended for small valuable cargoes or privateering. The replica was built in part using traditional 17th-century boat-building techniques by

skilled shipwrights and artisans. Selected European oak timbers from the Baltic region were assembled using fire-bending and plank-first technology. The *Duyfken* Village Shipyard was erected in the grounds of the WA Maritime Museum Shipwreck Galleries and the construction of the ship took over two years to complete. The project provided the opportunity to experience traditional shipbuilding and also integrated with the Museum’s exhibition and educational roles

The Maritime Museum’s close association with the project required that it aspire to high standards of authenticity and that it be a well-designed programme of experimental archaeology. In this regard, staff of the Department of Maritime Archaeology acted in an advisory capacity and Nick Burningham was recruited by the Project to assist with the design. Since virtually no original plans of ships built before about 1630 exist, because the great majority were not built from plans, and certainly there are no plans of Dutch ships of the period, information derived from artistic depictions, archival documents and maritime archaeology became the principal means of determining the construction of the *Duyfken* replica. Replicas or reconstructions of several Age of Discovery ships have been built in recent times but very few of them can sail as well as the original ships. From the outset, one of the stated objectives of the *Duyfken* Replica Project was to produce a reconstruction that could sail well enough to emulate the achievements of the original *Duyfken*. The proposed design, a broad-beamed but sleek vessel, was tested by computer modelling (using the Western Australian developed Maxsurf program) and the results were encouraging, showing a design with good stability and able to maintain good average speeds even in light conditions, in keeping with the historical evidence. The *Duyfken* replica sails well, reinforcing archival research which shows that the original ship was exceptional—often out-sailing much larger ships, and manoeuvrable enough to be taken close to unexplored lee shores (shores that winds blow onto) even during the stormy and dangerous monsoon.

Mutual exchange of information between the Department of Maritime Archaeology and the New *Batavia* Project at Lelystad in the Netherlands had previously demonstrated the benefits of such cooperative, comparative approaches.

References: Green & Parthesius, 1989.

Eglinton

The wreck of the 462-ton barque *Eglinton* off the coast of Wanneroo, some 50 km north of Perth, on 3 September 1852, was the sensation of the year. Not only did it add to the list of unfortunate maritime incidents for which the Western Australian coast had become well known, but also deprived a very bare colonial market of a large portion of valuable cargo. The arrival of the ship had been keenly awaited and news of the disaster was beyond belief.



For the Department of Maritime Archaeology the archaeological investigation of the *Eglinton* between 1971 and 1973 was a new departure into the study of shipwrecks: it was one of the first wreck sites the Museum was able to study that had not been disturbed by the looting activity of divers during the 1960s. The site provided maritime archaeologists with the opportunity to develop strategies aimed at solving the practical problems of carrying out archaeological work in Western Australia's high energy, shallow water, reef environments.

The *Eglinton* was built in 1848 at Quebec, Canada, by Scottish shipbuilder John Munn (Jnr). Its first owner was the Liverpool merchant Duncan Gibb who quickly sold the vessel to John Jaffray of London. He had the ship surveyed by Lloyd's, a thorough report providing detailed specifications of the vessel's construction. According to William Felgate, the London agent for the *Eglinton*, it was a 'splendid fast sailing ship'.

Although minimally represented in the archaeological record, artefacts associated with the ship's construction generally confirm the documented specifications for the vessel. They form a useful sample with which to compare contemporary shipbuilding practices in Quebec and Britain.

While much of the *Eglinton's* cargo was salvaged, the artefact collection and associated historical documents provide significant insights into the nature of British–Australian trade in the mid 19th century: the type and quality of goods being imported, marketing strategies and so on. In addition, the integration of historical and archaeological data provides a limited perspective of the state of development of the Swan River Colony in the 1850s.

References: Henderson, 1986b; Henderson & Henderson, 1988; Marcel, 1995; Stanbury, 2003.



Galle Harbour

The Joint Australia–Sri Lanka–Netherlands Maritime Archaeological Project is centred in the World-Heritage-Listed Galle Harbour, Sri Lanka. The harbour is notable for the United Dutch East India Company (VOC) shipwrecks it contains, and the Project has conducted underwater archaeological surveys since 1992. Galle was an operational port and major entrepôt in pre-Christian times with the area coming into prominence in the 12th century. Later, with the arrival of the Portuguese in the 16th century Galle became an important European centre. The Dutch captured Galle from the Portuguese in the 17th century and it soon became the second most important harbour of the VOC, strategically located in terms of trade between the Arabian Peninsula and East Asia. Galle remained the major port in Sri Lanka after the arrival of the British, in

1796, and it was only in 1873, when the present port of Colombo was constructed, that Galle became marginalized.

The surveys in 1992 and 1993 identified 28 archaeological sites, including modern iron and wooden shipwrecks. Two sites were identified as the VOC ships *Avondster* (1659) and the *Hercules* (1661). During this period, Sri Lankan archaeologists seconded from their normal government duties were trained in maritime archaeological techniques.

During 1996, a museum team conducted a side-scan sonar survey combined with diver circular searches. This resulted in the discovery of a complete and broken anchor of Arab–Indian type that date to the period from the 6th to 16th century, in the vicinity of the Black Fort, in a traditional mooring site for vessels lightening cargo to and from Galle.

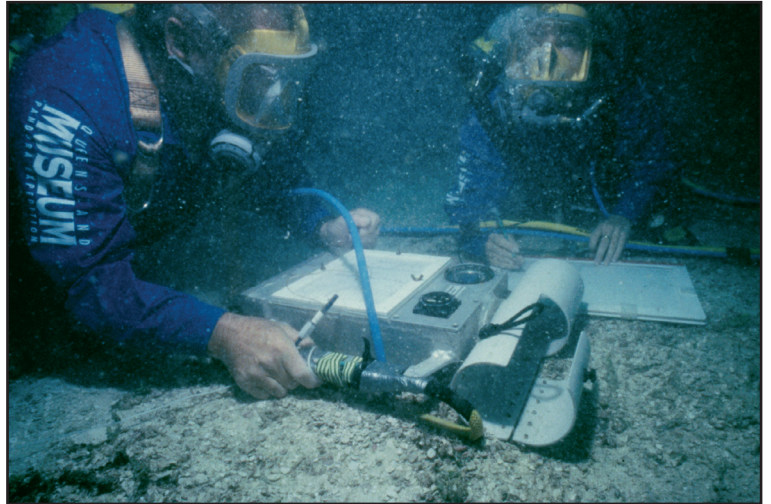
In 1997, diver searches were again employed. The anchors were relocated, and another, of a different type, was discovered. Other anchors were found during subsequent searches in the harbour. Once located and tagged, plans were made to raise the anchors for identification and analysis, and to draw them. The anchor assemblage found in Sri Lanka supplements a burgeoning corpus of stone anchors found in the Indian Ocean. The area containing the anchor site is a formal mooring or lightening site for Galle. The discovery of these various anchor types indicates a continuity of use of this area.

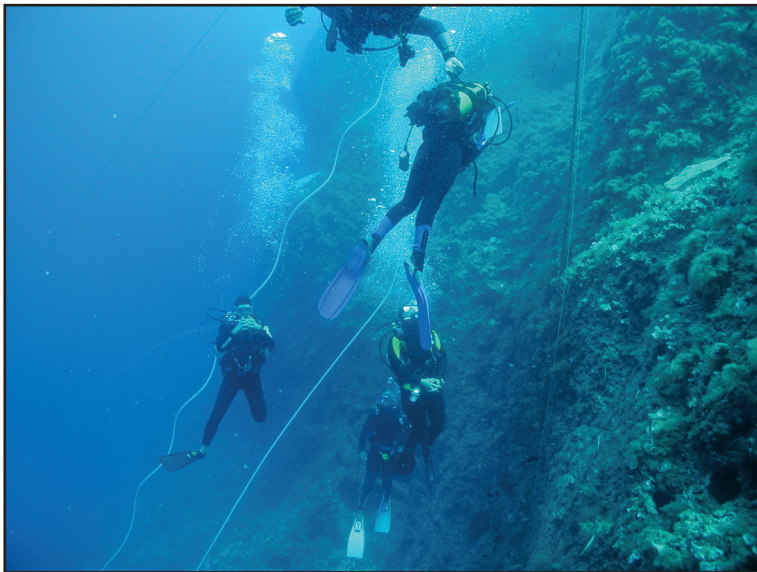
The inter-regional, or coastal, trade used relatively small vessels such as Sri Lankan-built *dhonis*, European sloops or old, worn-out, European *jachts* (yachts) such as the *Avondster*. The vessel was wrecked in the harbour despite fine weather. Slipping anchor during the night the *Avondster* hit the coast north-east of the anchorage, sinking the vessel. Limited excavation work has been conducted on the site. The investigations assisted with identification, site formation processes and revealed the site to be artefact rich. Following the end of the Centre of Excellence funding in 1998 the project was then funded by the Netherlands Government. Since 2000, the project has been directed by Robert Parthesius, with support from the Departments of Maritime Archaeology and Materials Conservation at the Western Australian Maritime Museum.

References: Green & Devendra, 1993a; Green, *et al.*, 1998.

High Precision Acoustic Surveying System (HPASS)

In 1997 the Australian National Centre of Excellence for Maritime Archaeology (CoE) initiated the further development of the HPASS system, a project that had been initially developed in the early 1980s by Curtin University of Technology and the Department of Maritime Archaeology. The project was initially funded by an ARC Grant, but funding dried up in the mid 1980s and the project was mothballed. Re-initiated in 1996 by the CoE, this project aimed to produce an operational underwater acoustic surveying system with sub-centimetre accuracy. The Centre for Marine Science and Technology at Curtin University of Technology started the development work in 1997. This was completed in early January 1998 and the system evaluated in January–February 1998. HPASS has been used on a wide number of national, and one international, projects. Recently, it has been evaluated against a number of different surveying techniques and proved to be a very effective tool for surveying, particularly in poor visibility. The HPASS system consists of a diver unit and up to six transponders. Essentially the system measures the time an acoustic signal takes to get from the diver unit to a transponder and back again, up to operational range of about 50 m (the signal is repeated twenty times to each of the six transponders), thus giving the distance. If all the distances are known it is possible to calculate the three-dimensional position of the diver unit. The diver unit has two components: an electronic unit in an underwater housing and an acoustic and hydrostatic unit or probe that is attached by a cable to the electronics housing. The transponders are mounted on tripods at fixed locations around the area to be surveyed and the operator, after calibrating the system, takes the diver unit to the points that need to be surveyed. The box can store up to 1200 data readings that can then be downloaded to a computer through a data interface accessed through a watertight inspection plate on the diver unit. The data file is then processed to convert the measurements to distances and depths. A second program is then run which provides a data output file in the format for the Site Surveyor program, with direct distance measurements (acoustic) and relative depths (pressure). This output file is then analyzed by the program to provide X, Y and Z co-ordinates of the surveyed points. After a series of tests conducted with the HPASS equipment, the residual error calculated for the underwater site (test frame) was 8 mm. This has to be a considerable improvement on any system that relies on traditional measurements. The system can be used in adverse conditions (low visibility, strong currents, deep water) albeit with the obvious difficulties that these situations present the operator. The system is reasonably portable; all three tests took no longer than three hours to complete (from arriving at the site and deploying the transponders, to departing after recovering the transponders). This suggests that the system could be used in more complex situations.





Institute of Nautical Archaeology, Bodrum, Turkey

In 1999, the Department began a series of joint cooperative projects with the Institute of Nautical Archaeology (INA), Bodrum, Turkey. INA, under the direction of Professor George Bass had a long-standing programme, dating back to the early 1960s, involving the excavation of ancient shipwreck sites on the southern coast of Turkey. Most of these sites were in deep water (*c.* 40 m) and at these depths there are problems conducting efficient surveys. Diving time is limited

to about 20 minutes, so that surveying, using conventional measuring techniques, is extremely inefficient. The project involved a series of tests, conducted during the excavations, initially at Tektash Brunu (1999–2001) and later at Pabuc Brunu (2002–2003) to investigate the potential of photogrammetry as an alternative recording technique. The joint project between the Department and INA worked on these deep water wreck sites to refine and develop a photogrammetric mapping systems. The deep water of the Mediterranean is exceptionally clear, so that photogrammetric techniques offer great advantages in recording. A series of photographs were taken of the site and the data processed using a program called PhotoModeler. The results were exceptional. Using this system, points could be located to within a few millimetres over an area of up to 40 m, reducing the surveying time by several orders of magnitude.

Estimating the accuracy of any underwater surveying technique is notoriously difficult. Comparison between the conventional surveying technique and the PhotoModeler system makes an interesting comparison. The control points on the Tektash Brunu site were surveyed using tape measures on a number of occasions resulting in a large number of measurements. Site Surveyor was then used to process the data, which then provided statistical information on the accuracy of the conventional survey and represented the best possible accuracy achievable on the site using conventional tape measurements. PhotoModeler was also used to survey the control points; the results showed that the accuracy of PhotoModeler is generally better than the manual tape measurements from Site Surveyor.

Two sets of PhotoModeler tests were made using calibrated grid frames of known dimensions. The co-ordinates of the graduations were recorded using PhotoModeler and then compared with known measurements. The average difference in the X, Y and Z co-ordinates between the true position and the PhotoModeler position is $\Delta x=2.3$ mm, $\Delta y=2.6$ mm and $\Delta z=2.9$ mm. This means that the individual accuracy for any single point, using PhotoModeler is exceptionally high.

The project continues, and has resulted in several important papers.

References: Green, *et al.*, 2002d; Green & Gainsford, 2003.

James Matthews

The wreck was located in 1973 on the north side of Woodman Point in Cockburn Sound, by members of the Underwater Explorers Club (UEC) who were conducting an underwater line search as part of their wreck research programme.

Archival research revealed that *James Matthews* was a snow-brig of 107 tons, registered at the Port of London. The vessel was 80.2 ft in length, with a breadth of 21 ft and a depth of 11.5 ft (approximately 24.5 m x 6.5 m x 3.5 m). It had one deck, two masts, a square stern, male bust figurehead and no galleries.

The *James Matthews* was a former slaver that operated under the name *Don Francisco*, owned by Felis de Souza. The slave trade generally consisted of a 'triangular run', with ships travelling from Europe with trade goods, to West Africa where slaves were purchased from local slave traders, to the Americas, where the African slaves were sold. On 25 April 1837, Her Majesty's Brigantine *Griffon* seized one slave-ship, the brig *Don Francisco*, as a prize near the island of Dominica. Once captured, the vessel was repaired and given the name *James Matthews*.

The *James Matthews* left London for Fremantle on 28 March 1841 with a cargo of 7 000 slates, farming implements, general cargo, 3 passengers and a crew of 15. The vessel struck rocks after parting its anchor warp, and sank on 23 July 1841. One of the passengers, Henry de Burgh, left a comprehensive diary covering the voyage to Australia and his later experiences on the land. Much of the cargo belonged to de Burgh, who had been involved in the organization of the enterprise in England and had an interest in the vessel.

Maritime archaeologists and volunteers under the archaeological direction of the Department of Maritime Archaeology carried out four seasons of excavation on the wreck site between 1974 and 1976. Preservation conditions were good on the site and a significant amount of the hull and cargo remained. While research into the ship's rigging and cordage has been published, most of the research and publication has concentrated on the hull, as an important representative of the slave trade. Recently the wreck has been the subject of an *in-situ* preservation study designed to ameliorate the effects of sand movement around the remains. This work has been carried out with staff from the Department of Materials Conservation.

References: Baker & Henderson, 1979; Henderson & Stanbury, 1983.





Japan

For three years during the period 1274–83 archaeologists searched for the remains from the huge invasion fleet, sent by the Mongol Khubilai Khan first in 1274 and later in 1281 to invade Japan. The invasions failed because the fleets were destroyed by typhoons, which, as it saved Japan, became known as the *Kamikaze* or Divine Wind.

For years, fishermen trawling in the Bay of Imari have been discovering relics from the fleet of Khubilai Khan. The most

famous is the Bronze Buddha, now at Shaka-zo on Takashima. This was raised about 130 years ago by fishermen at Hotoke-no-se (Buddha of the Shoal). The statue, now housed in a shrine, stands 1.5 m high. Korean in style and of the Koryo Dynasty (AD 950–1395) it is thought to have been carried on a Korean ship of the Mongol fleet.

In 1980, Torao Mozai, Professor of Merchant Marine at Tokai University, Japan, who has an active interest in maritime archaeology, set out to locate the Mongol fleet and a staff member from the Department of Maritime Archaeology was invited to take part. Takashima seemed a promising place to start with its large numbers of known losses in a limited area. Both Japanese and overseas archaeologists worked side by side to locate what evidence of the battle they could. Since the area was quite large, up-to-date position-fixing techniques were employed with new sonar and sub-bottom profiling systems. Once a survey above water was completed a section of sea bed was searched and excavated by divers, revealing a number of artefacts. Unfortunately, despite a number of underwater searches no actual wreck has been located as yet. There are perhaps more wrecks located in deeper water where preservation would be better. This is strengthened by reports from fishermen who still are recovering artefacts from the sea bed.

The illustrated Japanese scroll *Moko shurai ekotoba*, a work which was commissioned in about 1292 by the Japanese warrior Takezaki who took part in the campaign of 1281. The scroll describes his battle experiences, and at one point shows him boarding a Chinese ship and attacking the enemy. The scroll is full of interesting comparisons with the Quanzhou ship (see below). The axial rudder, overhanging poop and flat transom together with the details of the decks and cabins all provide an exceptional insight into 13th-century Chinese and Japanese ships and ship construction. Elsewhere the scroll shows Takezaki being dismounted by an exploding device of some sort. It is known that the Mongols used stone shot in mangonels, which were a type of gun. A late 13th-century account states ‘when the Mongol retreated, they shot *t’ieh-p’ao* to darken the sky. The noise was so loud it astonished and disheartened the Japanese, blinding and deafening them’. Another account states that ‘Drums rolled and the fighting started, when by the use of what is known as *p’ao* they flung iron balls of the size of a hand ball, two or three thousand at a time which rolled down the hills with the speed of a cartwheel making a noise like thunder’.

References: Green, 1983.

Jervoise Bay Wrecks

Jervoise Bay, lying in the lee of Woodman Point south of Fremantle was one of the best-known ships' graveyards in Western Australia, being in use between 1890 and 1910. It also was the scene of three shipwrecks, where ageing vessels that were temporarily anchored in its sheltered waters blew ashore in fierce storms. Over the years, MAAWA members, notably the late Mike Pollard, discovered various shipwrecks and undertook archival research and site studies.



In 1978, it was announced that shipbuilding in the area was to expand. The wrecks in Jervoise Bay were considered to be 'at risk' and a grant was provided by the State Department of Conservation for the Department of Maritime Archaeology to study the sites in the area.

As it was considered unlikely that vessels would have been wrecked or scuttled in deep waters, survey methods were confined to swim-line searches and the analysis of aerial photographs.

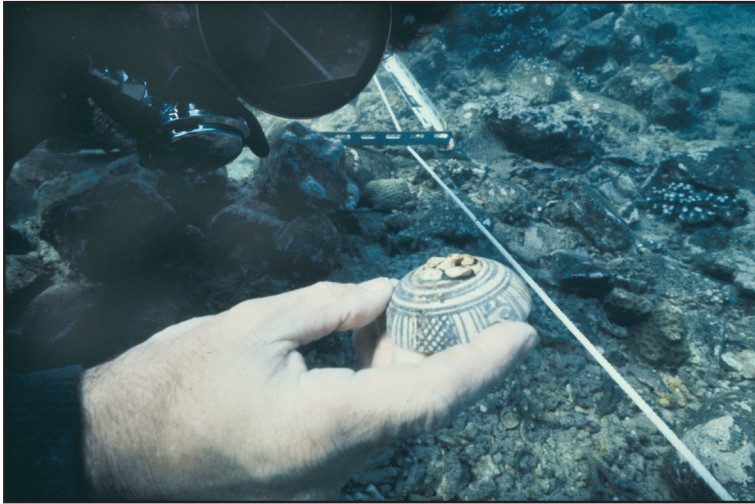
Each of the wrecks was located, photographed, measured and fully assessed. A comprehensive research programme was then undertaken and positive identification was made of the following vessels:

1. *KVIII*, the 64 m-long Dutch submarine, an obsolete vessel belonging to the Royal Netherlands Navy, built in 1922 and later based at Surabaya. It was recommissioned there in 1942 and, after sailing to Fremantle, was decommissioned in the same year; and run aground and sold for scrap;
2. *SS Alacrity*, a former French tug;
3. *Redemptora*, a 44 m-long, 1235-ton Brazilian ship, that was condemned, converted into a coal hulk and sunk between 1892–1910 (see *Redemptora* below);
4. *Abemama*, a 40 m-long, three-masted schooner built in America in 1918 that blew ashore in 1927; and
5. *SS Egmont*, a 61m-long, ex-Adelaide Steamship Company vessel, that was converted into a coal hulk and abandoned in 1910.

Tentative identification was made of the hulks *Ellen*, *Gemma* and *Camilla*, all wooden sailing vessels of various size and all scuttled after acting as hulks or lighters.

At the time it was believed that the State *Maritime Archaeology Act 1973* applied. With its 1900 cut-off date, none of these wrecks could be protected either because of their post-1900 date or a failure to positively identify them. The management strategy relied heavily on goodwill and the results reflected that. *Abemama* and *Alacrity* remained popular dive and snorkel sites until recently when they were buried under landfill. All wrecks in Jervoise Bay and Cockburn Sound are covered under the *Historic Shipwrecks Act 1976* provided they sunk at least 75 years ago.

References: Garrett & Souter, 1997; McCarthy, 1981b.



Ko Kradat

In January 1979, the Department of Maritime Archaeology was invited to conduct a three-week training programme in maritime archaeology at Silpakorn University, Bangkok. Part of the training was to conduct a two-week excavation of the Ko Kradat wreck site in the south-eastern part of Thailand.

The island of Ko Kradat off the province of Trat, in south-east Thailand, is *c.* 2.5 km long, rising to a height of *c.* 35 m. Bordering the island is a shallow reef about 500 m

wide and about 2–5 m deep, extending about 5 km, where the Ko Kradat site is located. The wreck site lies about 1 km north of the northern end of the island of Ko Kradat, some 200 m in from the fringing reef. The depth of water on the site is about 1.5 m at low water spring, with some nearby shallows that dry at low water. The sea bed in the area is essentially living coral. The site is distinguished by a mound of boulders about 15 m across, standing about a metre above the sea bed and a scatter of sherds of large stoneware storage jars around the site at distances up to 50 m from the centre of the site. The boulders (up to 500 mm in diameter) are clearly ballast, being river-washed and of a dark-grey, fine-grained granite. Some signs of previous activity were noted on the site: two roughly rectangular cleared areas were noted, possibly the result of the 1977 exploratory survey of the Thai–Danish expedition.

The excavation was conducted by first setting a baseline across the site followed by a trilateration survey of the extent of the ballast. Once this was completed a second baseline was set up perpendicular to the first. Excavation was then carried out through the use of 2 m x 2 m squares. The excavated material consisted of various types of ceramics and ballast stones.

In view of the interesting and encouraging results of the 1979 expedition, a further and more ambitious ten-day expedition was carried out in 1980. Two additional 2 m trenches were excavated adjacent to the north and parallel to the 1979 trench; in this case, back-filling was carried out directly from the new trench to the old one, rather than from grid square to grid square. Similar 2 m squares were used as before and the old baseline was re-established. During the expedition 15 grid squares were excavated and a total of 250 man-hours were spent diving on the site.

The wreck was interesting as it remains relatively intact in and around the ballast that would delineate the approximate size of the vessel. The 35 tonnes or so of ballast suggests that the vessel was either empty or carrying little cargo, which has subsequently disappeared, or that the site was heavily salvaged after its loss. One of the main items found on the site was ceramics from the Sawankhalok kiln site in north central Thailand. Also with this material was Chinese porcelain including a plate with the Jia Jing reign date, which dated the site to the mid 16th century (Jia Jing reigned from 1522 to 1566). This proved that the Sawankhalok kilns were in operation much later than was previously thought.

References: Green & Harper, 1982b.

Ko Si Chang

The Thai–Australian Underwater Archaeological Research Project was started in 1982 with the object of investigating wreck sites in the Gulf of Thailand in order to learn more about trade patterns and methods of shipbuilding within Southeast Asia. In 1982, two important wreck sites were located off the island of Ko Si Chang, with a further site located in 1985. All three wrecks are located off the island’s west coast, away from the mainland.

In 1982, a survey of the Ko Si Chang One site was undertaken, with the aim of excavation the following year. This took place in conjunction with the Fine Arts Department of Thailand, utilizing around 10–15 people over a six-week period. Material from the site was a combination of both Chinese and Thai porcelain with other unidentified material. Also, there was evidence that a substantial part of the hull was preserved. The initial inspection of the site indicated that the site dated from the late 16th or early 17th century. Excavation proved interesting as the vessel was not typical of Southeast Asian building techniques; the cargo was unusual also as it consisted of Chinese, Thai and ceramics of unknown provenance.

In 1987, site Ko Si Chang Three was excavated by a museum team, staff from the Underwater Division of the Fine Arts Department of Thailand and trainees of the SEAMEO (Southeast Asian Ministers of Education Organisation) Project in Archaeology and Fine Arts. The duration of the excavation from 11 January to 11 March 1986 totalled 825 dive hours on the site. This was an important site as there was no evidence for looting since it was buried by sediment. Large storage jars and concretions, extending over an area of 20 m x 10 m, cover the site. From the material excavated it is clear that it is of Thai origin as only a small amount of the material is Chinese. Most likely, the Ko Si Chang Three ship was a small coastal trader, the presence of eggs, resin and ivory suggesting that it was dealing in agricultural goods.

The Ko Si Chang Two site was briefly investigated. Ceramics recovered included floral motif painted bowls. Although the decoration and nature of the slipped material hints of a Sukhothai origin, it would appear that at least some of the material comes from an unknown source, almost certainly in Thailand. An interesting, large stoneware jar with a dark grey body was recovered. The jar has a flared and ridged mouth-rim, with four small, vestigial lug-eared handles below the neck. Under these are two bands of impressed *sayma* (bodhi leaf) design medallions and ridges. Earthenware lids and pressed rice pot sherds were also found. Of more exotic nature, there were the remains of ivory tusks, a bronze lime container and a coin. This site is remarkable for the Gulf of Thailand because it is the first vessel that has been found that is not edge-joined with dowels. It is possible, therefore, that this ship may have been constructed outside Southeast Asia, although it was carrying a cargo of Thai ceramic wares.

References: Green, *et al.*, 1987a, b.





Lighthouses and port-related structures studies

With funds provided by the National Estate Grants Program, the Department of Maritime Archaeology employed part-time staff and external consultants to undertake two surveys, one of lighthouses and navigational aids and the other of port-related structures, on the coast of Western Australia. These practitioners were assisted by many others, including local historical societies, historians, volunteers and schoolchildren. The

project commenced in June 1994 and aimed to complete the following tasks under departmental supervision:

1. Document the historic lighthouses, navigational aids and port-related structures on the coast of Western Australia and research their individual and collective history;
2. Develop a system for establishing the relative significance of the structures and sites;
3. Assess the structures and sites through physical survey; and
4. Publish results and make nominations to the Register(s) of the National Estate, the Heritage Council of Western Australia and Municipal Heritage Inventories.

Unfortunately the chief consultant, a noted retired engineer and heritage specialist, Denis Cumming, died mid-project. However, under the leadership of departmental staff, the programme was completed.

An attempt was made to provide a 'contextual' approach to the project by conducting research and field-work for the two studies concurrently. Copious data was compiled on 72 individual lights, navigation aids or port-related structures ranging from the Northern Territory border through to the South Australian border. This information was then compiled and published in a series of working files and précis reports for each study. These provided a chronological account of significant engineering events in Western Australia, including the commencement of the various lights and light-stations, and port structures. Where possible, the details of the facilities were linked to shore-based infrastructure as was Cumming's original intention. There followed a geographical and an alphabetical list of sites on the coast with historical details, site surveys and nominations to municipal, state and national heritage registers.

Where possible the projects were also linked to other regional maritime heritage studies in order to provide an holistic overview. One, the Albany Maritime Heritage Study, was being run concurrently and it provided site descriptions, historical and economic context and data for a very wide range of maritime endeavours in the Albany area. By including lights, port-related structures, warehouses, boats and shipyards, maritime industries and an analysis of the history of the maritime trades generally, including shipwrecks, the Albany study can also be considered one of the first truly 'holistic' maritime heritage studies.

References: Cumming, *et al.*, 1995a, b; Wolfe, 1994; McCarthy, 2004.

Lively

Identifying a shipwreck is crucial if the site is to be placed precisely in its historical context. Wreckage found in 1979 on the exposed rim of Mermaid Atoll, Rowley Shoals, proved a problematic case. Located some 300 km west of the port of Broome, inspection of the site suggested an early European whaler, wrecked before the first settlement was founded in Western Australia in 1829.

A clue to the possible identity of the wreck is the presence of the words 'Coral Reef on which the *Lively* was lost' on a British Admiralty chart of 1829. Similar information was given in the journal of Phillip Parker King, who examined the area between 1818 and 1822. Many vessels, particularly English and American, were given that name during the early 19th century. Most of these were small ships, and few of them are known to have operated south of the equator. Only two vessels carrying the name *Lively* are known to have visited the southern whale fishery during the early 19th century, but so far no records have been found that indicate which *Lively* was lost in the area.

To find out more about the wreck at Mermaid Atoll, expeditions were sent to the site in July 1982, August 1983 and July 1986, when the weather was most favourable, for periods of four weeks. Assistance was provided by the American organization Earthwatch. Excavation was necessary due to the limited historical information available on the area and circumstances of wrecking. During the first season, surveys were completed of the site but the retrieval of large objects postponed until the following year. Smaller artefacts were retrieved, catalogued, drawn and taken to the Museum for further analysis. Further excavation and recovery was carried out in 1986.

Two anchors, some 3.5 m in length, lie together on the reef top, identifying the location of the site. The main sections of the wreck lay in a turbulent underwater gully. Material examined on the site—including two whaler's try-pots for boiling down whale blubber to produce oil; five iron cannon; a third anchor; a rudder gudgeon from the stern-post; copper sheathing; hull fastenings; etc.—appeared to conform with a 240-ton ship owned by the British South Seas whaling firm of Daniel Bennett. This vessel, armed with 10 guns, is reported in *Lloyd's Register* 1808–1809 as having left on a voyage to the Southern Fishery, and is not listed in subsequent years of the Register as having returned.

This is an important site as it provides an insight into early shipping and whaling activity off the Western Australian coast in the period leading up to settlement—1780s to 1829—about which little is known. Whilst documentary evidence can provide answers in some cases, this is a situation that has required archaeological excavation to conclude the questions asked.

References: Henderson & McCarthy, 1981 & 1982; Henderson, 1983b, 1984a, 1986d.





Long Jetty

The Long Jetty in Bathers Bay, Fremantle, was a focal point of maritime activities in Western Australia from the 1870s to the 1920s. Until the jetty was built, large vessels visiting Fremantle could only be loaded and unloaded by fleets of lighters (small sailing barges), a risky and time-consuming business. The new jetty was completed in 1873 and was originally named the Ocean Jetty. It extended out to sea in a south-westerly direction for 228.6 m (750 ft).

When an addition was built onto the original structure in 1887, Ocean Jetty became known as the Long Jetty. It was at its busiest during the gold-rush days of the early 1890s. A final extension was built in 1896, making the total length of the jetty 1 004 m (3 294 ft).

By the turn of the century, the jetty had fallen into disuse, but rather than have it demolished, the Fremantle City Council converted it into a promenade for recreation. By 1910, the jetty had become unsafe and was closed in 1912; all but the original Ocean Jetty was finally demolished in 1921. This rickety structure played host to hardy fishermen for many years, succumbing to the elements and leaving little structure.

In July 1984, plans for the new Challenger Harbour (as it was named) were made public whereupon it became apparent that some of the last remains (piles) of the Long Jetty would be covered by a new groyne. As a response to this, the Department of Maritime Archaeology decided to make an immediate assessment of the impact that the marina would have on the jetty site. A team of museum staff and volunteer divers were gathered with the following aims: to assess the extent of material in the area; to raise, catalogue and conserve a representative sample of artefacts for public display; and, to undertake research on the historical importance of the jetty.

Firstly, a search for historical documentation was undertaken. At the same time, volunteer divers from the MAAWA conducted a search for any artefacts lying on the sea bed. With only one month to complete a survey of such a large area, and with the groyne already affecting visibility (see picture above) the underwater team had to work swiftly. Hence, the 'propeller wash' system was chosen as the means of exposing large areas of buried artefacts in a short time.

The excavation was proof of the wealth of historical material to be found in an area that was once considered to be of little archaeological value. In October 1984, the Department of Maritime Archaeology opened a display of the Long Jetty artefacts.

As a result of this work, and the realization of the historical significance of the area (as it can be linked to historic ship use from the artefacts remaining), the area of sea bed in the vicinity of the Long Jetty was declared a maritime archaeological site, in 1988, under the State *Maritime Archaeology Act 1973*, and is now protected under that Act.

References: Garratt, 1990, 1994; McCarthy, 2002c.

MAAWA

The Maritime Archaeological Association of Western Australia (MAAWA) was founded following a series of public lectures entitled 'Introduction to Maritime Archaeology', given by staff from the Department of Maritime Archaeology at the University of Western Australia. The course created such enthusiasm that a group of people with wide and varied diving and historical interests, formed the Association on 24 October 1974 with a total membership of 23. MAAWA was Australia's first community-based maritime archaeology interest group. Similar groups formed in the other States



including the Society for Underwater Historical Research (SUHR) in South Australia and Maritime Archaeological Association of Victoria (MAAV).

The Association became the 'Amateur Wing' of the Maritime Archaeology Department of the Museum, and offered a source of skilled voluntary labour and expertise for the Department's maritime archaeology programme. This relationship has worked well over the years, with many benefits for both the Association and the Museum, and has enabled MAAWA members to participate in numerous local and overseas projects.

Over recent years, however, budget restraints have curtailed most excavation expeditions requiring pools of volunteers. The Association, therefore, has initiated a number of its own survey and research projects. MAAWA have adopted the AIMA/NAS Part I Maritime Archaeological Training Programme (see above) as a prerequisite for survey projects. As a result, the Association boasts a membership of skilled underwater surveyors. The public interest generated by the AIMA/NAS programme has also ensured that MAAWA continues to attract new membership. MAAWA members regularly present the results of their projects at the AIMA conference held annually in Australia as well as at related archaeology conferences around the world. The diverse academic backgrounds and experiences of some of the members has proved useful to both the Association and the Museum and a number of collaborative projects, such as stabilization of the *James Matthews* wreck site; reconstruction of the *Xantho* engine; and, survey of the *Day Dawn* and the Swan River wreck sites, have been initiated.

MAAWA holds regular meetings on the third Tuesday of every month at the WA Maritime Museum Shipwreck Galleries and new members are always welcome. The meetings usually have an invited speaker who lectures on various aspects of maritime archaeology and history. They conduct a number of surveys and report every year on wreck sites around the State. A monthly newsletter informs members of forthcoming events and meetings, including the annual trip to Rottnest Island to clean underwater plaques on the Rottnest Wreck Access Trail.

References: Robinson, 1977; Warne, 1994; MAAWA *Messenger*, 2003–4.



Mary Rose

King Henry VIII's warship *Mary Rose* sank in 1545. It was excavated and subsequently raised in 1982. The ship was built in Portsmouth, Hampshire, England in 1509–1510. Documentary evidence indicates that it was a successful vessel engaged for 35 years in policing the English Channel, keeping this vital sea passage clear of French warships and maintaining communications with Calais, then an English town. It was lost, with disastrous loss of life, while engaging a

French invasion fleet in the Solent channel between Portsmouth and the Isle of Wight. Over the next few years, several guns were recovered, and the ship then abandoned. The wreck was rediscovered briefly in 1836 and pioneer salvage divers explored the site recovering guns, longbows and isolated structural timbers.

The modern search was initiated in 1965 by Alexander McKee, who carried out a series of exploratory dives in the general area of the wreck site. In 1967, the late professor Harold Edgerton of the Massachusetts Institute of Technology located an acoustic anomaly, thought to be the wreck. The vessel lay totally buried in the sea bed until 1971, when a combination of equinoctial spring tides and severe gales removed 1 m of the light, modern sea bed sediments. A staff member from the Department of Maritime Archaeology was involved with the project as an underwater photographer, to record the site and to establish its dimensions using a calibrated square. Underwater photomosaics were produced of the surviving stern castle structure, the transom, mast step area and a section of main deck

The *Mary Rose* Trust, a registered charity and limited company, was formed in 1979 to manage a full-time programme of work to excavate, survey, empty the hull and, if feasible, to bring the empty hull ashore for study, conservation and display. The first essential requirement was to design and fabricate a steel cradle that conformed to the shape of the hull.

Over 22 000 registered artefacts have been analysed and prepared for publication. Many of the finds and the ship workshop are on display to the public in the *Mary Rose* Museum, Portsmouth Historic Dockyard, Hampshire, UK. The work of conservation and interpretation continues, and the Trust is heavily dependent on public support.

References: Delgado, 1997; Jones, 2003; Marsden, 2003; Redknap, 1997; Rule, 1983.

Mombasa

During field seasons between 1976 and 1981, the Institute for Nautical Archaeology (INA) and the National Museums of Kenya jointly excavated a shipwreck in the old harbour of Mombasa, Kenya.

The wreck has been identified as that of a Portuguese frigate, the *Santo António de Tanna*, which sank in 1697. The vessel was built at Bassein, near Goa on the west coast of India, and commissioned in 1681. Fort Jesus, in Mombasa, on the East African coast was besieged during the Great Siege of Fort Jesus by the Omani Arabs (1696–1698). Several attempts were made to supply and relieve the fort. In 1696, *Santo António de Tanna* was sent out to the relief of the Portuguese stronghold, but was sunk outside the walls of the fort, just before the fort itself fell to the Omanis. This was disastrous for the Portuguese who could ill afford the loss of the vessel or the fort.



During the course of four excavation seasons (1977–1980) and two study seasons that took place in 1981 and 1982, more than 6000 objects were recorded on the sea bed, and subsequently raised, catalogued and conserved. All were taken to the newly established conservation laboratory in Fort Jesus for storage and treatment. However, due to limitations of space, time and funding, only recently has all conservation been completed.

The excavation uncovered the hull remains of a large wooden vessel that was carefully recorded. The whole of the inside structure was documented using 35 mm black and white photographs. In most cases the photography was made using stereo pairs. The cameras were mounted on a stereo-bar on a photo tower. The base of the tower was a 2 m-square grid frame which was graduated with black and white marks at 200 mm intervals. The cameras were accurately aligned on the stereo-bar and then levelled in relation to the grid frame. Thus the grid frame, which appeared in each photograph could be used to establish orientation control if necessary. Currently (2004), a research programme studying the hull structure is under way, using the stereophotographs to create a three dimensional model of the internal surface of the hull.

At the end of the excavation the hull was re-buried to preserve it. Excavations were conducted during the field seasons with the help of staff from the Department of Maritime Archaeology.

References: Green, 1991; Piercy, 1981.



Numismatic Collection

The first major numismatic discovery of a shipwreck off the Western Australian coast was that of the *Batavia*, which was wrecked in the Abrolhos Islands in 1629. The some 10 000 coins recovered from the vessel included currency of the Holy Roman Empire and the United Netherlands. Other discoveries with numismatic collections include the *Zeewijk* (wrecked 1727), the *Zuytdorp* (wrecked 1712), the *Vergulde Draeck* (wrecked 1656) and the

Rapid (wrecked 1811).

Much of the numismatic analysis was carried out over a period of 35 years by Mr Stan Wilson, who held various positions at the Museum, namely Honorary Associate (1964–1971), part-time Assistant Curator in History (1971–1988) and then two four-year periods as an Honorary Associate, from 1 January 1991 through to the end of 1998.

It is remarkable that the identification of the *Zuytdorp* was based largely on the coins found on the wreck, in particular the two *stuiver* and *schellingen* (six *stuiver*) pieces of 1711 from the Middelburg Mint in Zeeland. Indeed, the entire minting was thought to have been on this and another ship (*Beloliet*) en route to Batavia (now known as Jakarta) in the Dutch East Indies. This is just one instance where the coins recovered have played an important role in the identification of aspects of the shipwreck site.

The *Rapid* was reported in the *Columbian Sentinel* dated 3 August 1811 to have had \$280 000 in specie on its outward journey from Boston. All but about 19 000 coins were salvaged in the months following the wrecking, and of these the Maritime Museum has recovered 18 548 dollar size coins.

The last 35 years of numismatic investigation by the Maritime Museum commenced with the study of the *Batavia*'s coinage, and has progressed with the registering of over 50 000 coins. Of course there are many others in groups (concretions) that have not been separately identified. The painstaking analysis of the coins, which has involved recording physical characteristics, identification and chemical analysis, has led to research in metallurgy, history, currency movements and a range of related areas.

There is still much work to be done in this area, with a detailed study of the numismatic data once these have been stored electronically. At this stage all the registered coins on the *Batavia*, *Vergulde Draeck*, *Zeewijk* and *Zuytdorp* have been entered on the Department's database, and those of the *Rapid* will complete this stage.

Not all of the numismatic collection is made up of pieces from shipwrecks. The most interesting is the French *écu* coins found in the lead seal caps of French wine bottles (see Dirk Hartog Island), dated 1766 and 1767 respectively, and both of the Bayonne Mint. These are thought to date from the annexation of this part of Western Australia by Louis-François-Marie Aleno de Saint-Aloüarn in 1772.

References: Bloom, 1998, 2000a, b, c; Wilson, 1964, 1985a, b, 1989.

Oman

Placed astride maritime trade routes linking Mesopotamia, Southern Asia, the Far East, the Mediterranean and East Africa, Oman has enjoyed a commanding position in the shipping world of the Middle East for centuries. The 1 700 km coastline with its numerous harbours, and the difficulty of travel inland through rugged mountains or harsh desert encouraged the development of a vigorous and dynamic maritime tradition, which saw the evolution of a number of vessel designs. These distinct yet related designs display features influenced by use, local conditions, culture, external influences and personal taste. Archaeological evidence points directly to a maritime tradition using some present-day features, which were already well established by the third millennium BC. Some of those vessels that exist today are probably direct descendants of the early craft.



Staff of the Department of Maritime Archaeology, over the course of four years, in association with Earthwatch, the Royal Navy of Oman, the Ministry of National Heritage and Culture, the Australian Research Council and several Omani businesses, conducted research into indigenous vessels of the Sultanate. This included the measurement and taking of lines of Omani vessels.

Once all data had been collected it was concluded that all traditional Omani boats share common design heritage and construction methodology. Particular constructional practices, such as the use of through-beams are widespread in Oman. Judging by the slow pace of evolutionary development, and the evidence of rock art and maritime graffiti, the extant vessels are probably closely related to their ancient ancestors.

From 1997 the principle investigator, Tom Vosmer, has overseen work at the site of the old city of Qalhat. This city was a major port until the early 16th century, when it was destroyed by Portuguese attack and earthquake. The city site is perched spectacularly on coastal cliffs. With the exception of surviving city wall sections, especially on the eastern boundary, the only still recognisable structures are a small, partially ruined mosque known as the Tomb of Bibi Miriam, a roofed reservoir and several graves

Qalhat's important history as a port gave an expectation of sea bed structure and wreck sites. However, extensive visual searches revealed only stone anchors. These were of diverse design and size, some broken and some complete. Most lay in shallow water, close to the shore, indicating use as moorings. The largest anchors found were of the Arab-Indian columnar style. By coincidence a similar anchor raised from Galle Harbour, Sri Lanka, was identified as being made from Omani rock.

In 2003 and 2004 researches from the University of Hamilton, Ontario, carried out extensive side-scan sonar, magnetometer and sub-bottom profile surveys, again with no location of obvious sites.

References: Kenderdine & Vosmer, 1994; Souter, 1998; Vosmer, 1997a & b; Vosmer, *et al.*, 1998.



Outreach and 'Wreck Access' Programmes

The Department's 'outreach' programme is a multi-faceted element of the overall shipwreck management strategy. One element is the 'Wreck Access Programme'. 'Wreck Trails' have been in place since 1981 with the marking of the wrecks at popular Rottnest Island for educational and recreational purposes. In the Rottnest case, divers and non-divers alike were catered for, as were walkers, cyclists, the aged and the infirm. Each site is marked

both above and below water with an information plaque. The interested public can also obtain an information pamphlet on the wrecks of the area from tourist outlets and from the local museum, which features a display on the shipwrecks. After a period of assessment, the idea was extended elsewhere with the aim of producing a state-wide facility catering for the needs and nature of each particular community or region. Albany, Hamelin Bay, Gingin, Wanneroo and Mandurah have underwater and above-water markers, pamphlets and maps. Exmouth, Bunbury, Rockingham, Shark Bay, Geraldton and the Abrolhos Islands are in the first stages of completion, with some elements already complete. School groups (under the work experience scheme), disadvantaged young adults and academic extension groups are closely involved, making the project broad based and relevant to the general community. The maps and pamphlets produced, carry the Museum and the school's logo, and the names of the children involved. In this way, a sense of 'ownership' of the maritime heritage is provided to the local community, helping to increase appreciation of the sites and to ensure that they are better managed. One of the highlights of the programme was the production of a pamphlet entitled 'Access to maritime sites for people with disabilities'. Produced with charter operators, architects and planners in mind this work was produced by wheel-chair bound students from Rocky Bay Village. Another project was a dualistic approach that saw the involvement of 'street kids', and their support staff from the Albany region, in the production of interpretive material alongside gifted students from a local high school to produce information pamphlets. Both were award winning programmes.

Before it became a major tourism development strategy in recent times, involving many other stakeholders, the Department was also a major driving force in Western Australia's shipwreck scuttling programme, assisting in the provision of alternative dive sites to the public.

Under the 'outreach' programme provision is made for the Department to involve individuals and the local community in its work in the laboratory and in the field, and for it to involve the community through lectures, films, seminars and the like held both in the Museum and in external venues, some in association with the Museum's visitor service staff. One highlight has been a series of lectures for the visually impaired.

References: McCarthy, 1980a, i, 1981, 1982c, 1983; McCarthy & Garratt, 1998.

HMS *Pandora*

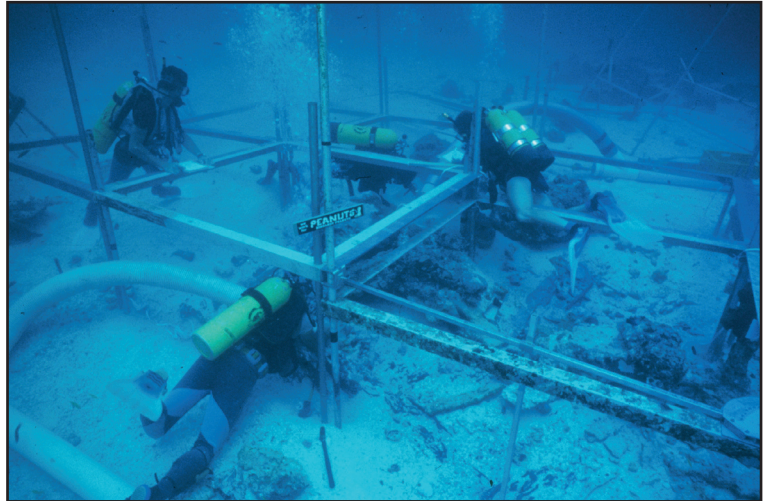
The *Pandora* frigate was sent by the British Admiralty to the South Pacific in 1790 to recapture *Bounty* and bring to justice the men who had seized it. Arriving in Tahiti on 23 March 1791, *Pandora* spent five weeks at anchor in Matavai Bay. During this time, fourteen of *Bounty*'s crew were taken prisoner. *Pandora* then spent nearly four months searching the South Pacific for the leader of the mutiny, Fletcher Christian, and his followers. The search was unsuccessful and on 29 August 1791

Pandora was wrecked on the Great Barrier Reef, while searching for a passage through the reef to Torres Strait. Four of the prisoners and 31 of *Pandora*'s crew died when their ship sank.

The wreck was rediscovered in November 1977. It was then inspected and assessed by Department of Maritime Archaeology staff in association with local stakeholders. The wreck was subsequently proclaimed a protected site under Australia's Commonwealth *Historic Shipwrecks Act 1976*. Since 1982, the day-to-day management of the wreck has been the Queensland Museum's responsibility. Archaeological excavations on the wreck have been carried out by the Queensland Museum with assistance, on a number of occasions, from the Department of Maritime Archaeology. Personnel helped on site to excavate and to conserve recovered materials. The project was part-funded under the Commonwealth Historic Shipwrecks Program. It has established that an extremely important collection of artefacts, and a substantial portion of the wrecked hull, were buried in the sea bed in an excellent state of preservation; approximately 80 per cent of the site has yet to be excavated.

As such, *Pandora* offers archaeologists a unique opportunity to retrieve from its functional context a precisely datable assemblage of late 18th-century British material culture and nautical technology, as well as cultural objects collected from Pacific island communities. Archaeological excavation of *Pandora* has already provided material evidence that has generated new understanding and interpretations of life aboard a late 18th-century British exploratory ship; new hypotheses concerning the degradation processes of wooden vessels in particular marine environments; and, answers to a host of other questions relating to this period of maritime discovery.

References: Campbell, 1997; Fallowfield, 2001; Gesner, 2000; Henderson, 1984d, 1986a; Illidge, 2002.





Philippines

To date, nine ancient wooden boats have been discovered by locals searching for alluvial gold on land near the Masao River, west of Butuan City, Libertad District, Mindanao. Of the nine vessels recorded, three (one, two and five) have been excavated by the National Museum and are at present preserved. The Butuan Boat One, discovered in 1976 has been radiocarbon dated to AD 320. The Butuan Boat Two has been dated to AD 1250. The Butuan Boat Five has been dated to AD

1215 and was the subject of a joint ASEAN National Museums Conservators 3rd International Archaeological Excavation and Conservation Conference in 1986.

The Butuan Boats represent an important part of the understanding of Southeast Asian shipbuilding technology. The lashed lugs have parallels in other parts of Southeast Asia, particularly in Malaysia and Sumatra, but also have parallels in Europe. The first project in 1988 studied the Butuan Two boat, resulting in a better understanding of the construction process of this type of vessel. The two other extant Butuan boats, located in museums in Butuan and Libertad on the island of Mindanao, were examined in 1992. Prior to visiting Butuan, the team spent a short period in Tawi Tawi, southern Sulu, recording local boat construction. After completing the field-work in Butuan, a *lepa* (Bajao 'houseboat') in the anthropology and ethnography collection of the National Museum in Manila was also recorded.

Through the use both of traditional survey techniques and photography enough data was collected to determine much of the building and construction methods. Progress has been made in determining the original shape and construction of the Butuan Two boat, but questions still remain unanswered. Information gathered allowed the construction of a partial model of the wreck. This further enabled archaeologists to delve into the construction of the vessel, techniques used and possibilities that are not well evident in the archaeological record.

The Butuan Five boat comprises a keel, a wing stem, two strakes on one side, one strake on the other and some fragments. The dowels are counter-pegged at every alternate dowel, except at the wing stem where they are pegged at every dowel. The strakes are broad at the centre and the overall length of the remains is about 13 m. The keel plank is interesting because, except at the narrow end, it has lugs in sets (transversely) in threes, the outer two have been drilled to take the lashings, the middle one apparently to act as a support. All the other strakes have single lugs. There are three lashing holes on nearly all of the lugs, two of the holes are equidistant from the ends of the lug, the third hole (possibly having been drilled later) is spaced at an equal distance to the separation of the symmetrically placed holes.

References: Clark, *et al.*, 1993; Green, *et al.*, 1995.

Patrick Baker free-swimming a stereoscopic photomosaic of the *Star* wreck site (Photo: Scott Sledge)

Photography, photogrammetry, film and video

Photography is used in maritime archaeology to produce images for technical and scientific records including map making, display, publications, and as a source of visual information for the present and the future. Conventional photographic cameras, film and darkroom techniques have been adopted, adapted and used throughout the history of maritime archaeology. Many existing cameras have been housed for underwater use, although the amphibious Nikonos camera with the 15 mm wide angle lens is the standard for maritime archaeological work. Recently, high quality digital cameras with comprehensive underwater housings and water-corrected, wide angle lenses have become available. Digital site recording, with the user's ability to view results immediately and to download image data direct into photogrammetric programs is rapidly replacing most conventional film-based photography.



Photogrammetry is the process of making measurements from photographs, usually with the aim of producing maps and plans. Maritime archaeology has been a long-time user of photogrammetric mapping, modifying aerial mapping techniques and plotting equipment for wreck site recording. Stereoscopic (twin camera) and analytical (single camera, multiple view) photogrammetry is now available as user-friendly, desktop systems (e.g. Virtual Mapper and PhotoModeler).

Photomosaics continue to be an excellent method of site recording. A series of overlapping photographs are taken of a site. These are then mosaiced together to produce an overall view of the site. Photoshop (or similar image editing programs) may be used for this process, replacing the previous technique of cutting and pasting. Stereoscopic photography, using a pair of cameras mounted with optical axes parallel and fired simultaneously, is recommended for all site recording as it allows three-dimensional viewing of site details at any time in the future.

Documentary films have had a widespread influence on the public dissemination of maritime archaeology knowledge. Most underwater documentary films were made using 16 mm film camera. The smaller 8 mm film format was commonly used by amateurs. These two camera types, although capable of high quality results, could only hold four minutes of film, a serious restriction.

From the early 1980s compact video camera systems began to appear. It has taken twenty years for video tape systems to reach the quality of film but the major advantages of a standard recording time of an hour, of instant viewing of results, ease of editing and convenience of viewing have had video tape cameras almost completely replace film cameras for documentary and domestic use.

References: Baker & Green, 1976; Baker & Henderson, 1979.



Post Graduate Diploma

The most recent Graduate Diploma course in Maritime Archaeology was held in 2002 with students coming to Western Australia from both Flinders University of South Australia and James Cook University of North Queensland.

The Graduate Diploma has been run intermittently since 1981. The 2002 diploma was a one-year course consisting of a semester at either Flinders or James Cook University and a practicum semester

held at the Department of Maritime Archaeology. The practicum taught both theory and practical aspects of maritime archaeology, giving students an introduction to a variety of techniques, tools and ideas. Seven students, two from Flinders and five from James Cook, attended the course in 2002.

Towards the end of the 2002 practicum, field-work was scheduled for Rottnest Island. The field-work allowed the students to put into practice what they had learned and to compile a management plan for the Rottnest Island wreck trail. This was a two-week exercise in which students conducted site inspections, surveys and pre-disturbance surveys of the wrecks around Rottnest Island. In addition, shipwreck anchors on open exhibit and the Museum's collection were examined, with recommendations made concerning their condition and management.

Two new graduate degrees, the Graduate Diploma and Master of Applied Maritime Archaeology are to be taught by the Department in conjunction with the University of Western Australia from 2005 onwards. The units for the programme are:

1. Marine Science: Including oceanography, currents, swell, tides and tidal predictions, weather forecasting, properties of the sea. *In situ* conservation, including methods and techniques of monitoring and sampling sites.
2. Maritime Archaeology in Context: Includes the theoretical basis, outline of general terrestrial and historical archaeology. Historical background to maritime archaeology with case studies of various projects and excavations. Historical research and archival studies. Shipwreck databases.
3. Artefact Studies: Topics include artefact studies, management of collections, museology, cataloguing, registration and recording techniques. Construction of web sites and web pages.
4. Maritime Archaeology Techniques: Techniques of underwater surveying, photography, photogrammetry. Design of surveys, expedition and field-work planning. Diving techniques and technology. Techniques, land and marine surveying (including magnetometer, side-scan sonar, GPS; application of computer-based GIS, databases and statistics; application of Internet, web and file transfer.
5. Cultural Heritage: Including legislation (Historic shipwrecks legislation, ICOMOS, Burra Charter, Heritage Acts, Law of the Sea, UNESCO Convention on Underwater Cultural Heritage, Protection of Movable Cultural Heritage). Management of heritage, different types of heritage. Underwater heritage including: examples of international heritage management, Australian examples. Examination of *Historic Shipwrecks Act 1976*, various State Acts, the implications of the 1993 Amnesty. Heritage management in Australia, with examples and discussion.
6. Professional Practice : Analysis of artefacts, critical writing, critical reading.

References: Anderson, *et al.*, 1995, 1996; Gainsford, 2003a; Green & Gainsford, 2003.

Publications

The Department of Maritime Archaeology is responsible for the management of Western Australia's historic shipwrecks, and the dissemination of information to gain the support of an informed public for historic shipwrecks as a cultural resource. Maritime archaeologists have legal and ethical responsibilities to comply with the requirements of various international treaties concerning the conduct of their profession, and must adhere to the standards of relevant professional bodies. A principal requirement is that the results of all maritime archaeological research—field investigations, excavation, *in situ* preservation, archival and oral history, etc.—is presented in professional reports as well as non-technical popular publications such as magazines, books (including children's books), brochures, exhibits, television and radio shows, videos and slide shows. The objective is to interpret material on shipwrecks and associated relics for all interest groups—including divers and non-divers of all age groups; the general public; primary, secondary and tertiary educational institutions; and, professional practitioners.

Importantly, the literature produced should be readily accessible to interested readers, allowing both the public and the academic community to keep up to date with advances and ideas that the Museum has developed, and for independent researchers to avail themselves of the resource. Published and unpublished literature is available through various outlets:

- WA Maritime Museum bookshop. (Titles and purchasing available on-line: see: <http://www.museum.wa.gov.au>; see also *Maritime Log* and *Tracks* magazines.)
- Shipwreck Galleries bookshop. (Titles and purchasing details available on-line: see: <http://www.mm.wa.gov.au>; see also *Maritime Log* and *Tracks* magazines.)
- Retail bookshops/newsagencies. (Published books/magazine articles ...)
- Regional museums. (Wreck Trail Pamphlets/Maps, books of area interest.)
- Tourist Information Centres. (Wreck Trail Pamphlets/Maps, books of area interest.)
- State Library of Western Australia. (Copies of Department of Maritime Archaeology Series Reports and Special Publications are lodged with Library Information Services of Western Australia.)
- Public Libraries.
- University Libraries and bookshops. (UWA Press Publications, e.g. *Unfinished Voyages*; *Maritime Archaeology in Australia*.)
- WA Maritime Museum Library (by appointment only). (For titles see on-line bibliographic database on Department of Maritime Archaeology web site: <<http://www.museum.wa.gov.au>>)
- The Australasian Institute for Maritime Archaeology Inc. (Bulletins and Special Publications are on sale at the Shipwreck Galleries, Fremantle, and/or from AIMA Publications, c/- WA Maritime Museum, Cliff Street, Fremantle WA 6160. Titles and purchase order forms available on-line: see AIMA web site <http://aima.iinet.net.au>)
- The Australian National Centre of Excellence for Maritime Archaeology. (Publications available through Shipwreck Galleries bookshop or Department of Maritime Archaeology.)





Quanzhou Ship

The Quanzhou ship was a large wooden vessel excavated in August 1974 from the shore of Hou-Zhu Harbour, Quanzhou Bay, Fujian Province, China. The vessel is datable from the coins uncovered at the site. These date the vessel to the last decade of the Song Dynasty (AD 960–1279). The only surviving structure from the vessel is from the water-line and below: the superstructure and decking has all been degraded over time. The remaining structure is significant (24 m x 9 m) and

estimates made by archaeologists have placed the original size of the vessel at 35 m in length and 10 m in width. The hull was a deep V-shaped bottom, two-part keel, pointed bow, rectangular stern, and a hold divided into thirteen sections.

Cargo aboard the vessel consisted of betel nuts, cowries, peppercorns, aromatic wood and turtle shell. This cargo provides evidence of the trade route the vessel followed, which was most likely between the central coast of China and Southeast Asia. From 1984, staff from the Department of Maritime Archaeology and the Museum of Overseas Communication History, Quanzhou, Fujian Province, studied the vessel and published the results in 1998.

It is interesting to compare the Quanzhou ship with Marco Polo's account of his travels. He resided in China between 1275 and 1292 and wrote on Chinese river shipping and also on sea-going vessels of Guangdong and Fujian. He wrote:

This then I would have you know, is how they are made. They are built of a wood called spruce or fir. They have one deck; and above this deck, in most ships, are at least sixty cabins, each of which can comfortably accommodate one merchant. They have one steering oar and four masts.

Much of what Marco Polo says here can be related to the Quanzhou ship. However, the statements about the watertight bulkheads are of considerable interest and present an apparent conflict with the archaeological record. Marco Polo is the origin of the theory that Chinese ships had bulkhead compartments that were completely watertight. Later writers followed this suggestion. However, every Asian vessel with bulkheads that has been excavated by archaeologists, shows evidence that the bulkheads, although sealed with luting (a watertight substance that was applied to seams, unlike caulking that was driven into seams with a mallet), had limbers or waterways alongside the keelson to allow water to flow between the compartments. Additionally, in all the wreck sites there has been no evidence of stoppers or bungs in the limbers, indicating at the time of sinking the limbers were open. The statement about the several layers of planking is also of great interest, since it provides historical evidence for a technique that would be hard to understand from the archaeological evidence alone.

References: Green, *et al.*, 1998.

Rapid

The *Rapid* was an early 19th-century American China trader wrecked on the north-west coast of Western Australia in 1811. China traders were the pride of the American fleet: they had to be large, well-founded, speedy vessels for this rich but highly competitive and rigorous trade. *Rapid* is the first example of an outward-bound American China trader to be given archaeological attention, so aspects of that trade can now be re-examined from the archaeological perspective.



Rapid departed Boston for Canton on 28 September 1810. After rounding the Cape of Good Hope the vessel sailed across the southern Indian Ocean and then north-east towards North-West Cape on the Australian coast. It looked like being a fast voyage, but disaster struck on the 98th day when *Rapid* hit a reef at Point Cloates. The next day, a storm was raging and the crew set fire to the ship, sacrificing everything so that the wreck would not appear above water and attract other ships to the scene before the Captain could return to save the 280 000 American dollars being carried on board.

A spear-fishing group, in 1978, discovered the wreck. During three seasons of excavation between 1979 and 1982 archaeologists from the Department of Maritime Archaeology, surveyed the ship's timbers and removed the artefacts from within the hull, including some 20 000 remaining Spanish silver dollars. The excavation provided a picture of the life on board one of these fast ships. Ship's fittings, provisions and the personal possessions of crew members had survived in reasonable condition on the site. The hull survey provided sufficiently comprehensive data for the lines of the vessel to be reconstructed, giving information about a vessel type often referred to in the literature but never comprehensively described.

The entire crew of the *Rapid* reached Java alive, though a number died afterwards. Captain Henry Dorr, his clerk and three sailors survived 37 days of deprivation in the 16-foot, very leaky jolly boat with only limited rations. They found rats and crabs to eat on Christmas Island en route to Bencoolen, but no water other than rainwater that they collected in the sails. Six weeks after arriving in Batavia (Jakarta) the opportunity of a passage home presented itself. The American schooner *General Greene* had lost its captain and most of its crew at Batavia, so Henry Dorr and part of the *Rapid*'s crew offered to navigate the schooner to America, arriving in Philadelphia on 27 July 1811.

Salvage of the specie was a matter of immediacy for the owners of the *Rapid*. The town of Boston was already suffering commercial distress, added to which were the deteriorating relations between America and Britain that eventuated in war in 1812. Most of the specie was salvaged during the months after the wreck, the ship *Meridian* transporting c. \$91 000 to Canton in 1813, with more held by the salvagers at Madras and Java.

References: Henderson, 1981; Kirkman & Henderson, 1985; Lefroy & Baker, 1999.



Redemptora

The *Redemptora* was a Brazilian, fully-rigged vessel constructed in *c.* 1853 weighing approximately 1250 tons. *Redemptora* sailed under the Brazilian flag from Rio de Janeiro to Eastern Australia. The master was Captain Caseveccia who commanded a crew of 23 men. Their cargo consisted of 233 tons sugar, 200 tons of coffee and 600 tons of ballast. On the trip, the *Redemptora* was caught in a storm and lost its mainmast, fore topgallant mast, and had one side of the copper sheathing stripped away. In great distress the vessel reached Fremantle on 16 October 1888, where it was considered uneconomical to repair, and along with the cargo, was sold by auction for a total of £2 070. The hull was then knocked down to another buyer, a Mr Lilly, for £315. Subsequently Mr Lilly used the vessel as a hulk, operating it out of Careening Bay, Garden Island. The *Redemptora's* bell was given to the Fremantle Fire Department in 1928. After serving time as a hulk at Garden Island, *Redemptora* ended

its career and was laid up in Jervoise Bay, Cockburn Sound.

The vessel now lies about 25 m from the shore in a depth of 2.9 to 4 m. The site has been surveyed and excavated by the Underwater Explorers Club and the Department of Maritime Archaeology. In September 2002 it was reported that some of the ballast, that originally covered the site, had been removed and the hull timbers of the vessel partially exposed. An assessment by the Department showed that the ballast appeared to have been removed a few years earlier and that the timbers were degrading. After the initial inspection, it was decided to make an accurate plan of the hull structure and develop a management plan for the site. The High Precision Acoustic Surveying System (HPASS, see above) was used for the survey which was carried out by students in the 2002 Post-Graduate Diploma course. The HPASS produced a detailed three-dimensional plan of the site that was then tied to the local mapping datum, possibly the first time in Australia that a wreck survey has been co-ordinated to a mapping datum. In addition, a Global Positioning System (GPS) survey was conducted to delineate the approximate total area of the site and the uncovered portion. A trilateration survey using tape measures was also used to further define points of interest. All of these surveys were then processed and transferred to a Geographical Information System (GIS) program, so that positions could be globally referenced. After the survey work was concluded, the ballast that had been removed from the site was replaced, helping to stabilise the wreck. Because the site had been partially uncovered, the removal of the ballast had caused the sand and sediment that originally covered the timbers to disperse, therefore, increasing the water and oxygen movement around the site. The replacement of the ballast was conducted over an eight-day period, the ballast being lifted, moved across and redeposited on the site.

References: Gainsford, 2003a.

Risdam

The VOC ship *Risdam* was built for the Chamber of Hoorn in 1713 and made two voyages to the Indies. The vessel is described as a *fluit*, 130 *voet* (36.8 m) long and 100 *last* (approximately 200 tonnes), in the *Uitgezeilde schepen* (8 November 1673–23 February 1796). According to the records, the vessel operating in Thailand loaded tin at Ligor, and then went to Ayutthaya on 29–30 November 1726 where it loaded sapan-wood, barrels of ginger, 40



pots of *achar*, 30 pots of *klak* and 150 empty glazed pots. The vessel left Ayutthaya in a leaking condition on 8 December. When the leak became substantial *Risdam* was intentionally run aground on 1 January 1727, 500 m north of Pulau Batu Gajah, near Mersing, Malaysia, to save the lives of the crew.

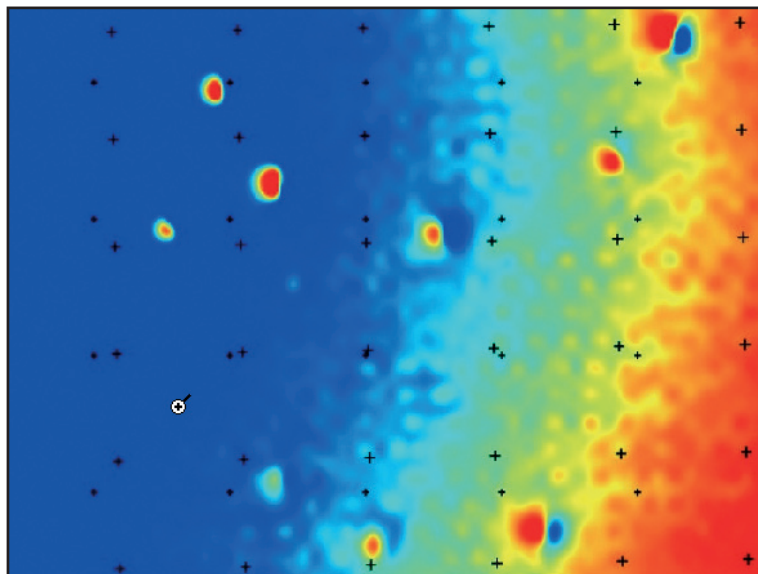
On 6 May 1984, a vessel was intercepted by the Royal Malaysian Customs while engaged in looting a wreck site near Mersing, State of Johore, Peninsular Malaysia. This was the first public announcement relating to the wreck site which is now thought to be the *Risdam*. There followed a brief expedition to the site by the Muzium Negara and a Royal Malay Navy diving team, which recovered over 110 tin ingots, 40 elephant tusks and other material. Later, material recovered by the looters and impounded in Singapore, was returned to Malaysia by the Singapore authorities (five tin ingots and 61 elephants tusks).

A team from the Department of Maritime Archaeology was invited by the Museum Negara, Kuala Lumpur to conduct a survey of the site. During the initial field-work, because the survey yacht (with an airlift) was available for only two days, it was decided to airlift a shallow trench across the site. The objective was not to carry out any major excavation work but to expose the archaeological layer and investigate the extent and nature of the site; detailed survey work would then follow.

The survey clearly showed that the vessel was leaning at an angle of 15° to the starboard and suggested that the starboard side would be better preserved to a depth of about 3.5 m. During the excavation, a tin ingot was found close to the keelson.

The survey indicated that there was more than 500 m³ of internal hull that might contain archaeological material. Also here could well be collapsed material on either side of the vessel. It was determined that the ship had been strongly constructed with regular sets of heavy cross-timbers on the inside of hull for additional strength. This is consistent with the 17th-century shipbuilding manual by Witsen (1690) who states that *fluits* that went to the Indies were strongly built.

References: Green, 1986c; Witsen, 1690.



Rottneest Deep Water Graveyard

Redundant vessels have been scuttled in deep water south-west of Rottneest Island, Western Australia since 1910. The ships' graveyard is encompassed within an area of latitude 32°05' south to 32°00' south and longitude 115°10' east to 115°23' east with a depth range of 50 to 200 m. The sea bed is a mixture of sand and shell with scattered rocky outcrops. The graveyard is host to a wide spectrum of material, from utilitarian barges and dredges to the remains of graceful clipper ships that ended their days as coal hulks in Fremantle harbour before being scuttled.

Remains of historical significance include vessels ultimately linked to the social and economic development of Western Australia, as well as the wreckage from two World Wars. Apart from ship remains, the graveyard was also used in the 1940s as a dumping ground for aircraft and military machinery that had to be disposed of as a requirement of the wartime 'Lend Lease' agreement. There are a total of 47 identified wrecks in the Rottneest Graveyard. In 2001, as part of the Shipwreck Detectives programme (see below), UTS Geophysics, a local company, flew an aerial magnetometer survey over a section of the graveyard and produced some astounding results. Eight clear magnetic anomalies were located and an additional survey over the HMAS *Derwent* site showed that this vessel could be detected easily in 200 m of water. Subsequent sonar and various investigations are providing further information on these wrecks.

There can be little doubt that the application of an aerial magnetometer is the most effective application for shallow water surveys for large to medium vessels containing iron, the system having increased sensitivity over any in-water magnetometer, and, more particularly, because it can cover areas faster and more reliably than the marine magnetometer. The *Derwent* experiment clearly shows that a vessel of 2100 tonnes can be detected at 250 m (50 m flying height) giving a 15 nT anomaly.

The results of the UTS survey of the *Derwent* and Deep Water Graveyard sites shows a noticeable gradient across both search areas due to the natural variation in the Earth's magnetic field. In addition, a series of regular magnetic field intensity fluctuations can be observed and these are attributed to the effect of the swell. 'Swell noise' is caused by the movement of a conductor body (the ocean salt water) through the Earth's magnetic field which produces eddy currents (Faraday's law). The magnetic component of the eddy currents thus increases or decreases the magnetic field intensity. It is not clear if this effect can be compensated for; if it could, then there would be a considerable gain in detection range.

References: Garratt, 1999; Green, 2002b; Kenderdine, 1994.

Rottnest Island Shipwrecks

Rottnest Island is situated about 18 km west of the town of Fremantle, Western Australia, in latitude 32°00' south, and longitude 115°30' east. The island is 11 km long by 5 km at its widest point. The island can be reached by boat from Fremantle or by light plane from Perth. The historic shipwrecks and other sunken vessels are located in waters within the zone controlled by the Rottnest Island Authority.

There are two types of wrecks in the island's vicinity: the historic wrecks—*Denton Holme*, *SS Macedon*, *Janet*, *Gem*, *City of York*, *Mira Flores*, *Uribes*, *Lady Elizabeth*, *Transit* and *Raven*; and, more recent wrecks—*Shark*, *Antira II* and *Kiryō Maru*. Most of the wrecks are in shallow water, apart from the *Mira Flores* where half of the wreck lies at a depth of 12 m. The high number of wrecks at Rottnest may be due in part to the island acting as a type of 'ship trap'. Nineteenth-century mariners often mistook the island for the mainland or believed themselves further up the coast and, as a result of this miscalculation, ended up on the treacherous reefs surrounding the island.

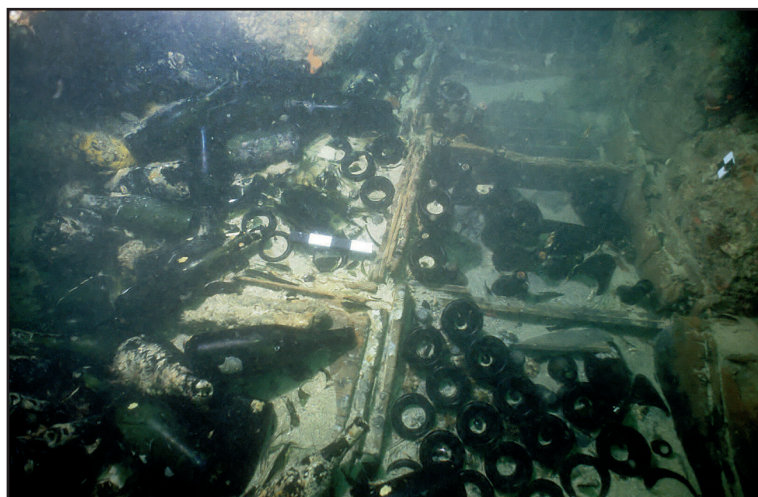
The problem was acknowledged in the sailing regulations of the period which stated that 'if uncertain of the position, Rottnest Island should not be approached on the west or north-west side to a depth less than 30 fathoms or the north side of the island to a depth less than 20 fathoms'.

The Maritime Museum established a wreck trail in 1980–1981. The wrecks around the island were provided with plinths both on land and underwater alerting the public to their presence and to provide some background information (see Outreach and 'Wreck Access' Programmes). The shipwrecks make Rottnest one of the more popular metropolitan dive sites and the Department has an established relationship with tour operators ensuring that long term management strategies for the sites are realised. A pamphlet was published that also provided directions and information regarding the wrecks. Various site and pre-disturbance surveys have been conducted on the wrecks by Department staff, MAAWA and students during the 2002 practicum.

All of the vessels in the Rottnest wreck trail have been inspected and many have had detailed work carried out to determine their level of deterioration. Students from the 2002 practicum were involved in the inspection and assessment of the island's historic underwater shipwreck trail and the interpretive materials and associated artefacts located in the terrestrial environment around the island, that relate to maritime heritage. A management plan for the island's maritime heritage was produced as a result, including recommendations to the Rottnest Island Authority on the future protection, conservation and interpretation of this cultural resource.

References: Kenderdine, 1995a.





Sepia

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 between £1 200 and £1 400.

Travelling at ten knots on the evening of 28 December, the *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. Although no danger was anticipated, as the order was given to haul up, the barque struck a submerged rock without warning at the edge of Five Fathom Bank. The vessel sank in less than ten minutes. The speed at which the *Sepia* sank made the task of rescuing the crew difficult. Heavy seas were breaking over the vessel and the cargo had begun to burst through the hatches. The loss of the vessel was said to have caused ‘a considerable amount of inconvenience to the firms mentioned, they are depending in great measure upon her for their regular supplies’.

This site is considered the most complete iron-hulled vessel in the area containing a well-preserved cargo. The *Sepia* is representative of the vessels visiting Fremantle, and the types of cargo imported, in the late 19th century. The *Sepia*, built in 1864, is a relatively small vessel compared with contemporary sailers shipping to other interstate and overseas ports. Yet, as a regular visitor to Fremantle, it is typical of a late 19th century cargo ship, and analysis of its cargo is expected to provide new insight into the nature of colonial trade to Western Australia.

Both MAAWA and the Department have conducted work on the wreck. A survey of a section of the cargo stowage area of the *Sepia* has been undertaken to identify and determine the context of a fuller range of late 19th century commodities. It is anticipated that the position of objects found *in situ* may be related to those already in the Department’s collection. In order to interpret the attributes of the wreck site in a manner consistent with modern archaeological practice, the processes that led to the deposition of material also need to be understood. In response to this, site formation analyses have been undertaken to monitor the physical effects of seasonal change and human impact on the wreck site. There is also a work-related programme of wreck inspections of similar sites in the metropolitan area. Comparison of the cultural assemblages from other contemporary sailing barques with that of the *Sepia* will be made to provide a broader view of importations into the Colony. Site inspections are being made of these wrecks to compare artefact types and their distribution on site. Literature on this subject includes site plans, photographs and historical data.

References: Cairns & Henderson, 1995; Kenderdine, 1995a.

Shipwreck Detectives

In 2001, Prospero Productions, a local Western Australian documentary production company, entered into a Memorandum of Understanding (MOU) with the Department of Maritime Archaeology, whereby the film company would fund the Department of Maritime Archaeology in an initial series of three projects that would be made into 45-minute documentaries. The series was entitled 'The Shipwreck Detectives' and the three projects selected were the excavation of the *Batavia* grave site on Beacon Island; the Broome aircraft wrecks; and, the Rottneest Deep Water Graveyard off Rottneest. As it turned out, the Deep Water Graveyard sequence became too difficult to complete. Having flown the initial aerial magnetometer survey, this project was abandoned (see Deep Water Graveyard above) and Prospero decided to do an alternative programme on the shipwrecks of Chuuk (Truk) Lagoon in the Federated States of Micronesia in conjunction with Bill Jeffery (see Truk Lagoon below).

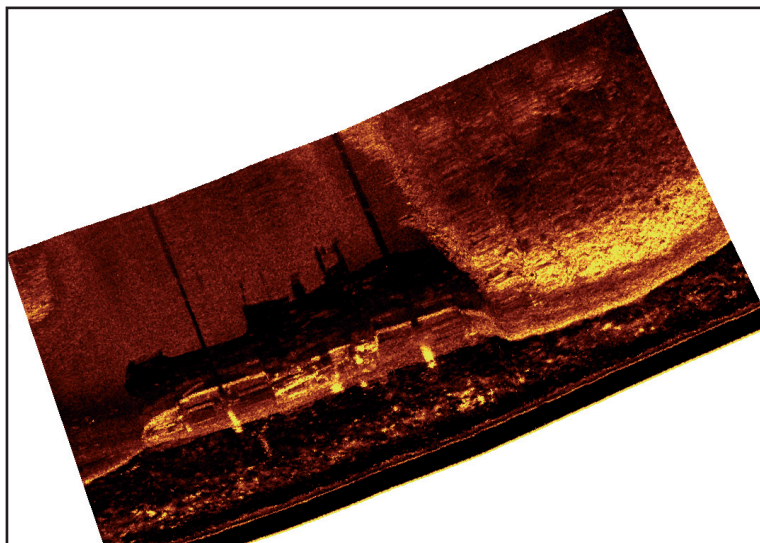


This collaboration with a film production company allowed for other avenues of historical and archaeological enquiry to be explored. The primary purpose was to record the stories on film, but recording of oral histories for all three episodes provided archaeologists with another useful source of data. This was most obvious in the Broome flying boat episode where Prospero funded the return of six ex-servicemen to Broome. Archaeologists were able to make use of their detailed oral histories as well as engage assistance in the identification of the sites and associated material. This collaboration was also perhaps the last opportunity to record first hand oral accounts of WWII incidents both in Australia and overseas. The oral recollections added the human dimension that is often lost in written accounts and a purely academic approach. The written record often fails to convey many of the anecdotal stories as well as personal recollections which further details descriptions and leads to a fuller understanding of events. While the limitations of oral recollections are acknowledged, it can be said that those of survivors of the air raid have assisted in the corroboration and interpretation of the archaeological record.

The programmes have been shown on ABC television, National Geographic Discovery Channel and elsewhere. They have been widely acclaimed as excellent and a 'shop window' for maritime archaeology, having the largest audience for a documentary series recorded for the ABC. While the programmes provide an opportunity for archaeologists to advocate their profession, the collaboration resulted in three projects that the Department would never have been able to fund.

The Department is currently engaged in the production of another three episodes, the first of which is the search and discovery of Australia's first Portuguese shipwreck *Correio da Azia*.

References: Souter, 2003.



Side-scan Sonar

In 1998, the Department of Maritime Archaeology acquired a Marine Sonic two-channel side-scan sonar through the Centre of Excellence initiative (see Centre of Excellence above). This system is a computer-based unit, with a high resolution (600 KHz) and a low resolution (150 KHz), that allows real time navigation through a GPS interface and can be linked to magnetometer input and fathometer (digital echo-sounder) data. The system has been used on numerous projects and has proved to be a very effective search

tool, as well as being able to produce good quality site plans.

Its most significant operation has been in the Murray River, South Australia, where a number of sunken river craft were located at Murray Bridge and Mypalonga. The side-scan sonar was particularly useful in this area because the visibility in the river is very poor, but with the side-scan it was possible to identify vessel types and sizes. In Broome the side-scan was used to locate flying boats that were sunk during a Japanese raid on the town in 1942, a number of sites were identified and it was possible to identify the types of aircraft (Catalina, Dornier X and Short Empire); in the Perth Metropolitan area the side-scan has been used to precisely locate sites and provide simple site plans; the system has also been used on the Rottne Deep Water Graveyard (see above); in Chuuk (Truk) Lagoon, Federated States of Micronesia the side-scan was used to develop a Geographical Information System (GIS) of the wrecks in the lagoon and it also located the last missing vessel from the Second World War US attack on the island in 1944 (see Truk below); and, in East New Britain, the side-scan was used to search for the missing Australian submarine *AE1*.

One of the most interesting developments with side-scan sonar is the ability to georeference the sonar images and use them on a Geographical Information System (GIS). Because the side-scan sonar is constantly monitoring position, the location of the source of the sonar image is known for each sonar 'ping'. Because the course is known, the azimuth or direction of each ping is known. As the range is also known, it is possible to approximately track the path of the sonar sweep. For each point on the graphic image of the sea bed that is output from the side-scan sonar, a precise location can be given. With complex software it is then possible to take the graphic image (usually a tiff or jpeg file) and georeference the image creating a GeoTIFF. Thus when the image is displayed it is shown in its correct orientation and when placed on a GIS the image is shown in its correct geographical position. In other words, each pixel of the GeoTIFF has a unique geographical position (latitude and longitude). Using this GIS it is possible to monitor the survey and plot the precise positions of wreck sites and other physical underwater features.

References: Green, 2002b, 2003a; McCarthy, *et al.*, 2002.

HMS *Sirius*

At daybreak on 13 May 1787, a fleet of eleven ships, sailing with convicts, weighed anchor and departed England—bound for Botany Bay on the east coast of Australia. Leading the convoy was HMS *Sirius*, commanded by Captain Arthur Phillip. Although a large number of historical publications have been produced about the founding of Australia in 1788, the archaeological investigation of the *Sirius* wreck site at Norfolk Island as an Australian Bicentennial project revealed new evidence with which to contest existing interpretations of past events and present new alternatives.



Maritime archaeologists from the Department of Maritime Archaeology were invited to lead and co-ordinate a nation-wide team of experts to investigate the loss of the *Sirius*, on 19 March 1790, on an offshore reef some 100 m from Kingston, Norfolk Island. Experience gained from working on similarly high energy, shallow water, reef sites in Western Australia, such as the *Batavia* (1629), meant the team was better equipped to anticipate and deal with extreme underwater conditions and prepare for potential emergencies.

The *Sirius* Project commenced in 1983 with an exploratory feasibility study. Based on further archival research, a carefully formulated set of research questions guided the subsequent seasons of survey, mapping, excavation and conservation in 1985, 1987, 1988, 1990 and 1993. Information gleaned from the site shed new light on the construction of the *Sirius* and raised challenging questions concerning the theoretical debate as to why Botany Bay was chosen as a penal settlement. Contrary to previously held beliefs, the *Sirius* was shown to have been built as a Baltic trader or ‘East Country’ ship named *Berwick*, and not an ‘East Indiaman’. It was built on similar lines to the north-east coast collier barks such as the *Endeavour* and *Resolution*, ships selected by Captain James Cook for his voyages to the South Seas. These vessels had special qualities of strength, stability and ease of handling, factors deemed appropriate for voyages of exploration.

Artefacts recovered from the wreck site supported an alternative view that the *Sirius* was well equipped for the voyage to Botany Bay, rather than being a decrepit old tub—as convict ships are frequently portrayed. These findings, therefore, tended to support the thesis that the settlement of Botany Bay was part of a considered, well-executed strategic plan to establish and maintain a permanent British presence in Eastern and South Pacific waters rather than a ‘temporary expedient’ to relieve England’s overcrowded gaols.

The *Sirius* wreck site is protected under the Commonwealth *Historic Shipwrecks Act 1976*.

References: Henderson, 1984b, 1984c, 1985b, c, 1987a, 1989c; Henderson & Stanbury, 1985, 1987, 1988; Henderson, *et al.*, 1989; Stanbury, 1991b, 1994b, 1998a; Stanbury & Baker, 2002; Stanbury & Evans, 2002.



Star

The 70-ton, two-masted, fore-and-aft schooner *Star* was built in 1876 by veteran Fremantle boat builder Thomas Mews for local merchants J. and W. Bateman. Batemans initially were unsure as to where they would employ the *Star* and decided to send her to Batavia with a cargo of jarrah. However, it seems that the vessel was utilized as a whaling vessel instead, as by late 1877 it was whaling initially at the Rosemary Islands (which had been fished previously by overseas whalers before the

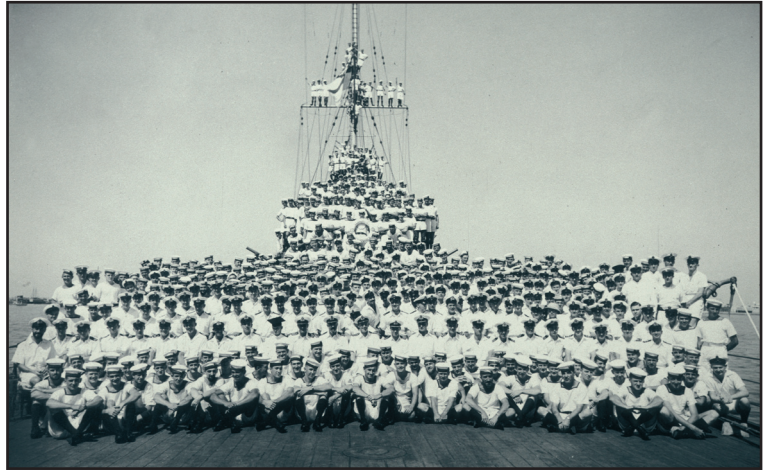
settlement of Western Australia). The *Star*'s initial whaling venture was a success with a return to Fremantle of 147 casks of oil. During mid 1880, the *Star* was fitted out for a short whaling expedition south of Fremantle to Geographe Bay. On 28 February the *Star* left port under the command of Captain John Sheppard with a crew comprised of Malays. The vessel was equipped with two whale boat crews and a spare whaling hand (although these had nothing to do with the sailing of the vessel). After an unsuccessful whaling trip to Geographe Bay, Captain Sheppard sailed north of north-east for the Rottneest Island light, heeding the warning of Bateman not to steer a too easterly course. At 1 a.m. the Captain altered the vessel's course two points to the east assuming this would head the vessel toward the north end of Garden Island. Unfortunately at 3 a.m. breakers were sighted off the starboard bow. The Captain removed the Malay in charge of the wheel, but only succeeded in jamming the wheel down in the confusion. The schooner at once swung toward the reef striking it violently. The wreck lies about 3 km south of the Sisters Rocks on the Murray Reef. It was reported to have sunk with its whaling gear aboard.

The site lies in *c.* 2.7 m of water on the Murray Reef. An excavation of the site was carried out by the Museum in 1983, with assistance from local divers keen to be involved in such a project. Since this was the first locally-built ship to be investigated by the Museum, the main interest was the hull—found to be in good condition and made of local wood. After analysis, these were determined to be jarrah, a sapwood, red mahogany and red gum (the latter two possibly of New South Wales origin). No whaling equipment was found, but large pulleys indicated a need to lift heavy, bulky cargoes. Among the artefacts recovered were a brass ship's log, a penny dated 1876 and various types of ceramic wares. The *Star* is significant because: it was the first locally-built vessel; it was associated with local merchants and ship owners, Batemans; and, it had a direct role in the whaling industry of Western Australia. During the latest site inspection, in 2004, it was noted that very little of the vessel remains at the site, the remains having been broken up or degraded by the high energy environment.

References: Henderson & Henderson, 1988.

HMAS *Sydney*

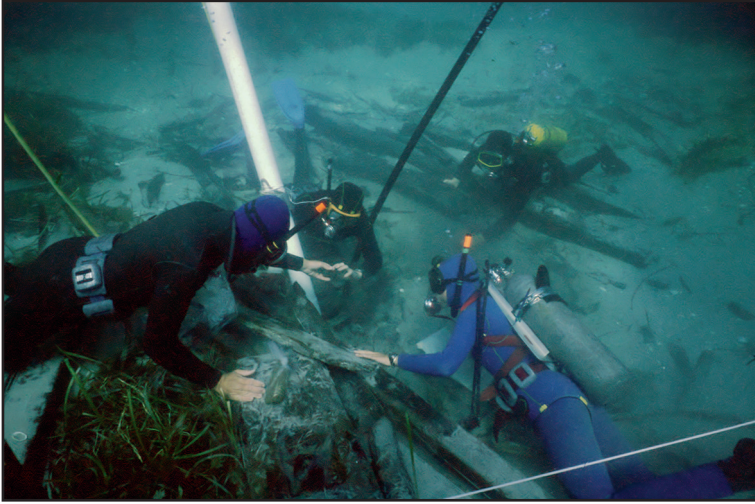
The HMAS *Sydney*/HSK *Kormoran* engagement on 19 November 1941 resulted in the loss of 79 or 80 German seamen and the entire *Sydney* crew of 645 men and boys. Coming from virtually every major town and city in Australia, it was a major blow to the country as a whole during World War II and was an unexplained loss that many families were unable to come to terms with, some expressing concerns decades after the event.



In 1976, under the terms of the new Commonwealth *Historic Shipwrecks Act*, the Department of Maritime Archaeology of the WA Maritime Museum became responsible on behalf of the Federal Government for all the historic wrecks off the coast of Western Australia. At the time, it was believed that HMAS *Sydney* and its adversary HSK *Kormoran* were covered under that Act. Staff of the Department of Maritime Archaeology established links with all major parties concerned—with vision to keeping abreast of the debate; to provide informed and objective opinions; and, to be in a position to properly manage the wrecks should they be found. The waters in which the engagement was believed to have taken place were considered too deep for actual search and analysis however.

The possibility that HMAS *Sydney* was attempting to make the coast before it disappeared was considered a reasonable assumption, and oil exploration records of the Shark Bay area were searched leading to the discovery of a very promising magnetic anomaly. A combined Department of Maritime Archaeology and RAN team operating from HMAS *Moresby* analysed the anomaly in October 1981, resulting in the location of a geological formation lying *c.* 200 m below the sea bed off Kalbarri. Though a large-scale search for *Sydney* did not occur, partly as a result of the findings of the 1991 Forum, held at the Department of Maritime Archaeology, the Department continued work in the water both independently and with the assistance of the RAN. In February 1996, at the request of the Museum and other interested parties, World Geosciences completed an analysis of two promising magnetic anomalies off Port Gregory that had appeared in its oil search data. These also proved to be geological. This work is ongoing as part of the Museum's perceived brief under the terms of the Commonwealth *Historic Shipwrecks Act 1976*. Since that time, many other groups have become involved, most operating independently of the Museum, the RAN and each other. A number of inquiries and seminars on the loss of HMAS *Sydney* have been held since, all assisted by the Museum. Advice and assistance is also provided to the many prospective searchers where it is sought, though the Museum steadfastly retains its independence such that it can be best placed to serve its obligations under the Act.

References: Green, 1991f; Green, *et al.*, 1984; McCarthy, 1984d.



Sydney Cove

A merchant ship carrying a speculative cargo from Calcutta to Port Jackson, New South Wales, the *Sydney Cove*, was wrecked at Preservation Island, off the south-eastern coast of Australia, on 9 February 1797. The route was a considerable risk to the Calcutta based company Campbell and Clark; and, so were the uncertain returns from a fledgling colony. Subsequent events connected with the loss of the vessel include the discovery and exploration of Bass Strait, separating the island of

Tasmania from mainland Australia; the first circumnavigation of Tasmania; the establishment of a sealing industry in the region; and, an understanding of Australia's climate, fauna and geography. The *Sydney Cove* is also Australia's eighth oldest shipwreck site.

There is sparse documentary evidence regarding the history of the vessel but the excavation has been able to confirm that *Sydney Cove* was constructed for use in the 'country' trade, carried out between Asian ports and the European colonies in the East. Trade between Asia and New South Wales was increasing during this period. The *Sydney Cove* was trading in primarily alcohol, foodstuffs, textiles, luxury goods and livestock. Built upon European lines, the 250-ton vessel was lightly constructed with a shallow draft of a fast sailor designed for the short coastal voyages common to vessels of the country fleet. While the ship was constructed of locally obtained materials, the larger metal fittings such as anchors, cannon and rudder braces, were imported from Europe via the English East India Company (EEIC). The rapid transfer of European technologies has also been demonstrated by the use of copper sheathing, in combination with more traditional Indian methods, to protect the vessel's hull. The artefact collection has provided material evidence for the extensive trade networks that existed even during the earliest years of European settlement in Australia.

The wreck was discovered on 1 January 1977. *Sydney Cove* has been the responsibility of the Tasmanian Parks and Wildlife Service since the discovery and the site was declared historic on 29 March 1977. In 1978 and 1980 archaeologist Graeme Henderson was invited to study the wreck, as Tasmania had no trained maritime archaeologists. The excavation, assisted by staff of the Department of Maritime Archaeology, was undertaken between 1991 and 1993. While the majority of the artefact material located during the excavation was raised and is undergoing conservation treatment to stabilize the artefacts, the surviving hull structure and substantial quantities of dunnage (packing timbers) were recorded *in situ* before reburial. The remaining timbers made up an area of 95 m² and consisted of most of the lower 'floor' frames; a proportion of the hull planking below the waterline and the keel. The conservation and subsequent management of the artefact collection has been carried out by the Queen Victoria Museum, based in the northern Tasmanian city of Launceston. Other excavations by the Tasmanian Heritage Office followed this.

References: Henderson, 1978a, 1986b.

Trial

In 1621 the English East India Company dispatched the ship *Trial* to the Indies; during the outward voyage in May the following year the vessel was wrecked on a then unknown reef off the coast of Western Australia. The wreck was found in 1969 and is the earliest known wreck of an East Indiaman on these shores, and Australia's earliest known shipwreck.

Trial was lost as a result of a navigational error on the part of the master, who was following a new course (Brouwer's Route) to the Indies that had been learned from the United Dutch East India Company (VOC) a few years earlier. Following this course, some VOC ships had sailed too far to the east and, as a result, in 1616 the coast of Western Australia was discovered. Navigators of the time were faced with several problems, both because of uncertainty of the position of the land and the related difficulty in determining the ship's longitude.

In the debacle that followed the wreck, more than 100 men were lost, as well as most of the Company's goods. Subsequently, there were serious allegations against the Master: that he was negligent; that he had stolen some of the Company's goods; and, that he was an incompetent navigator. Examination of the records seem to indicate that the Master falsified the location of the rocks to make it appear that he had been following orders. Because of this falsification, Trial Rocks remained undiscovered for over 300 years, simply because they were not where they were said to be.

The Master's subsequent career is interesting as it reflect on his honesty. He was acquitted by the Company of any blame, and was then given the command of the East Indiaman *Moone*, that returned home in 1624. In 1625, the *Moone* was wrecked off Dover. The Master was immediately imprisoned in Dover Castle for purposely wrecking the ship. The court case dragged on for two years.

By the 18th century, there was complete confusion in the charts as to the position of Trial Rocks. At least four groups of non-existent islands were charted in the area, and it was not until the advent of accurate longitude determination and the Admiralty Hydrographic Surveys in the late 18th and early 19th century that these anachronisms were sorted out. Initially, the Admiralty officially declared Trial Rocks non-existent. Later, their position was rather arbitrarily assigned to a group of islands in the general area. In 1934, Lee published the Master's letters which showed that a reef known as Ritchie's Reef was in fact the reef on which the *Trial* was lost. The Australia Pilot was amended and so finally Trial Rocks were officially and correctly located 314 years after their first tragic discovery.

In 1969 an expedition was mounted to locate the wreck site of *Trial*. On the first day of the search around the rocks, a wreck site was located and tentatively identified as that of *Trial*. Although four museum expeditions have visited the site since, no evidence has been found to identify the site conclusively, although circumstantial evidence indicates that the wreck site is that of the *Trial*.

Reference: Green, 1977a, 1986e; Stanbury, 1979.





Truk Lagoon, Chuuk, Federated States of Micronesia

In February 2002 staff from the Department visited Truk Lagoon, Chuuk, Federated States of Micronesia (FSM) to assist Bill Jeffery who was working with the Historic Preservation Office of Chuuk to produce a management plan for the wrecks in the lagoon. Bill Jeffery, contracted as a maritime archaeologist with the FSM government, considered world heritage

listing of the Truk Lagoon underwater cultural heritage sites an issue worthy of investigation. The Museum's involvement in the project was sponsored by Prospero Productions as part of their Shipwreck Detectives series (see Shipwreck Detectives above). During the Second World War, in February 1944, an attack was made by US forces on the Japanese base in Truk. The action was named Operation Hailstone and consisted of co-ordinated fighter operations and subsequent torpedo and bomber operations from an aircraft carrier fleet against military installations, fighter defence aircraft and a fleet of ships in the lagoon (the major Japanese fleet units had managed to escape prior to the attack). Over 60 vessels were still in the lagoon, and the Americans sunk over 45 vessels totalling over 220 000 tons. In addition to the loss of the vessels over 4000 Japanese, 120 Chuukese and other Pacific Islanders, and a number of Americans died. The destruction of the Japanese Naval Base at Truk was an important event in the American strategy to end the war in the Pacific. Once Truk was neutralized, the USA launched further west into the Pacific and on to the road to Tokyo.

These sites are now a major tourist destination and the Government of Micronesia is concerned to ensure that they are properly managed and preserved. The World War II underwater sites in Truk Lagoon provide Chuuk with its single biggest tourist attraction. Scuba divers from all over the world visit Truk Lagoon to dive the sunken Japanese ships and aircraft, a World War II enthusiast's dream and one of the great undersea wonders of the world. The wrecks of Truk Lagoon are war graves. Strict policies exist that prevent the removal of any artefacts or marine life from the wrecks. The Trukese hope to preserve their lagoon as an underwater museum.

The objective of the survey was to locate as many as possible of the known wrecks and produce detailed sonar images that could be placed on a Geographical Information System (GIS) of Chuuk. Most of the sites are known to dive tour operators, but their precise location is not known, nor is their orientation, size and condition. It was hoped that a side-scan sonar survey would provide much of this information. In addition, a search was conducted for the *Sapporo Maru*, a vessel that has never been found. Survey work was carried out from 4 to 21 February and covered an area of 7.5 km². During this survey, a total of 66 wrecks were located and investigated. In addition, the wreck of the *Sapporo Maru* was also located.

References: Green, 2002b; Jeffery, 2004.

L'Uranie

In 1817 Captain Louis de Freycinet was appointed by the French Government to lead a comprehensive scientific expedition around the world in the corvette *L'Uranie*. This resulted in a visit to Shark Bay where the de Vlamingh plate was removed, a stay in Sydney where ten convicts successfully stowed away and a shipwreck in the Falkland Island where *Uranie* was deliberately run ashore after striking the rock that now bears its name. After six weeks ashore, when a great deal was salvaged, including the plate, another ship was purchased and the expedition safely returned home.

As a young sub-lieutenant, de Freycinet had been a part of the earlier Baudin voyages, and as a result of his cartographic and leadership skills was promoted above many others to be in charge of *Le Casuarina* another of Baudin's exploration vessels. Some of his works are considered to be charting masterpieces.

Making this story doubly of interest, de Freycinet had secretly conspired to take his young wife Rose on board for the voyage. She recorded the subsequent three-year voyage, including being robbed at Sydney, a vivid description of the places, peoples and customs encountered en route. *Shipwrecked and Marooned in the Falklands* appeared in a series of letters home and these provide one of the very rare accounts of the life of a woman on board an exploration vessel. Rose de Freycinet was the second woman to circumnavigate the globe, after Jean Baré and was the first to provide an account of her travels. Her letters became the substance of two acclaimed books. This element has served to make the *Uranie* voyage unique and from a social perspective, most important.

In 2001, staff from the Department of Maritime Archaeology undertook a journey to the Falkland Islands to find the remains of the *Uranie*. Extensive planning, preparation and receiving all the necessary letters of permission were required. The latter included the approval needed to camp at Long Island Farm, adjacent the wreck, and approval from the Falklands Island Museum and National Trust, and the Receiver of Wreck in the Falklands 'to conduct a strictly non-disturbance search and inspection' of the site. Sponsors were sought and the Department of Maritime Archaeology's team arrived at Port Stanley to conduct its field-work, which began with a surface search of beached shipwreck material in Uranie Bay at Berkeley Sound. A large survivors' camp was identified and examined, and after a week of searching the wreck of *L'Uranie* was found adjacent a large kelp bed.

References: McCarthy, 2002a.





Vergulde Draeck

On 4 October 1655, *Vergulde Draeck* of the Amsterdam Chamber of the Dutch United East India Company (VOC) set sail from Texel, on what was to be its second and final voyage to Batavia (modern Jakarta) in the East Indies. The *jacht Vergulde Draeck* carried a cargo of trade goods worth 106 400 florins, together with eight chests of silver coin worth 78 600 florins. The Amsterdam Chamber purchased the vessel in 1653 for trade, its first voyage being between Holland and the East Indies. The crew and consignment consisted of 193 men, a cargo of trade goods and eight chests of silver coin.

Following Brouwer's route, the vessel made use of trade winds before making a northward turn to the East Indies. The vessel was lost on 28 April 1656 on a reef off the coast of Western Australia, north of Yanchep, near Ledge Point. The vessel began to break up immediately and two of the ship's boats were launched. Subsequently, a boat was dispatched to Batavia to get help. Arriving on 7 June they reported that 75 people of the 193 people on board had reached the shore and that the ship's boat had been driven

ashore and damaged. Several vessels were dispatched to try and find the survivors but no one was ever found.

The site was discovered in 1963; it was looted and damaged. A group of the original finders approached the Western Australian Government suggesting that they transfer their rights as finders of the site to the Government on the condition that the site was protected under legislation. This was completed in late 1963 and the Department of Maritime Archaeology was called in to assess and excavate the site in 1971. The Department's first major excavation took place in 1972. Over several months a very large collection of artefacts was systematically excavated from the site. Finds included beardman jugs, clay tobacco pipes (including a box of complete pipes), bronze and brass utensils, tools, accessories, glass bottles, various armaments, over 8000 bricks from the Netherlands (presumably used as paying ballast on the ship) and over 8500 silver coins, mostly Spanish reales. The 1972 field-work was the first major underwater archaeological excavation undertaken in Australia and was the commencement of a series of major archaeological excavations by the Department in the 1970s and 1980s. Subsequent visits to the site were made in 1981 and 1983. The objectives in 1981 were to excavate the main wreck site areas that had been left at the end of 1971–72. This proved to be extremely difficult because of the bad weather and limited time. The 1983 season was a great success due to long periods of unusually calm weather. During the excavation period, on the 19 days when diving took place, a total of 332 hours diving were recorded. Finds included a Southeast Asian smoking pipe (a very unusual find for the mid-17th century), several beardman jugs and an astrolabe.

References: Green, 1977b, 1981h, 1983c; Huystee, 1993; Stanbury, 1979.

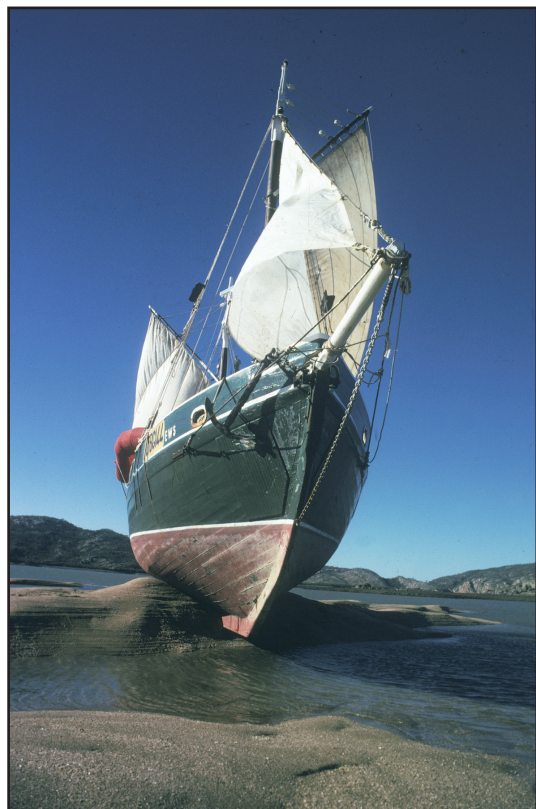
World Wide Web

The Department of Maritime Archaeology pioneered the presentation of the activity of the Museum on the web. The Department's web site, opened in November 1994, was the first Australian museum web site and the first international maritime museum site. The site initially documented the work of the Department, but quickly became involved in the Maritime Museum in general. Sarah Kenderdine was then contracted to develop the web site with a new style and layout. At the same time, on-line databases were developed, firstly an historic shipwreck database using a FileMaker Pro program and an additional program WebFM to make the database accessible over the internet using a web browser. This system was then developed for the National Shipwreck Database that was an Australasian Institute for Maritime Archaeology initiative. The Department continued to manage the running of this facility until 2001 when it was transferred to the Historic Heritage Management Section of the Commonwealth Department of Environment and Heritage in Canberra. Since then, the Department maintains an up-to-date state database. In 2003, Stuart Sevastos re-developed the on-line databases section of the web site. This now has a new and much faster database engine and the pages that allowed web surfers to search the databases in the same way as before, but now with noticeably improved reliability and performance. The new on-line databases were launched on 28 October 2003 and now include artefacts, bibliography and WA Shipwrecks.

In addition, a wide range of web pages and portals have been created. Initially this was done under Bob Richards and then later Stuart Sevastos. Projects include a web site that links in all the wrecks that have been found in Western Australia—initially a TAFE student project, and later called 'Wreckfinder'. This web site was launched late 2001 and has been very popular with museum staff and the public.

The Maritime Museum section of the Western Australian Museum web site is in three tiers: our sites, collections and research, and 'join in'. The maritime part of the collections and research section contains information on the departments of Maritime Archaeology and Maritime History, as well as the Submarine Heritage. The maritime part of the 'our sites' section contains general information about the three sites of the Maritime Museum, the exhibitions at the Shipwreck Galleries (Cliff Street) and the New Maritime Museum (Victoria Quay), venue hire information, and contact details. The maritime part of the 'join in' section contains information on admission fees, how to join MAAWA (Maritime Archaeological Association of Western Australia), and other details.





Wreck Inspection North Coast (WINC) Expedition

In 1978, the Department of Maritime Archaeology embarked on the final stage of a three-year wreck inspection project funded by the Australian Research Grants Committee (ARGC). This was the most adventurous, and remote, tour of wreck inspection ever undertaken by the Museum. Using the Broome-built, ex-pearling lugger *EWS* as an operational base, maritime archaeologists investigated more than 50 shipwreck and historic sites, and recorded 28 wrecks, along the north and north-west coasts of Western Australia.

During the eleven-week trip from Fremantle to Wyndham and return, the team visited locations along the Kimberley coast that were still relatively uncharted, navigation through dangerous passages and shoals frequently being accomplished only with the use of 19th century Hydrographic Remark Books, Journals and sketch maps. Extreme tides, up to 14 m, and strong currents on this part of the coast made boating and diving precarious, not to mention the dangerous marine life that inhabits these

tropical waters. Strategic planning and precautionary measures were paramount in ensuring the safety of participating personnel.

Of particular significance was the wreck of the 882-ton ship *Calliance*, lost in 1865 at Camden Harbour. The vessel was one of four chartered to convey pioneer settlers, their families and belongings from Melbourne via Fremantle to the North-West in November–December 1864. They had been persuaded that Camden Harbour was an ideal place for settlement, had mortgaged all they had and set off with high hopes to carve out a new future for their families. Alas, the sketchy reports from early explorers proved inaccurate, and the attempt to establish a European foothold in this hostile Kimberley environment failed. Archaeological remains of the settlers' temporary encampments, and the crew of the *Calliance*, were located and mapped. On nearby Sheep Island, the gravestone of Mary Jane Pascoe, aged 30, was a stark reminder of pioneering fortitude and heartbreak.

Following the expedition a letter sent from the Camden settlement was donated to the Museum. This letter was written by Richard Daly on 15 March 1865 and is illustrated with two water-coloured sketch maps. These clearly show the layout of the settlement and should be of great help in future site mapping and interpretation. Even more remarkable was the 1996 discovery in the Battye Library collections of a photograph of the settlement, taken on 31 May 1865 by a Mr Hamilton, passenger aboard *Forlorn Hope*.

References: Sledge, 1977a, 1979a; Sledge & Stanbury, 1982.

Looking forward towards the boiler, after the raising of the engine
(Photo: Patrick Baker)

Xantho

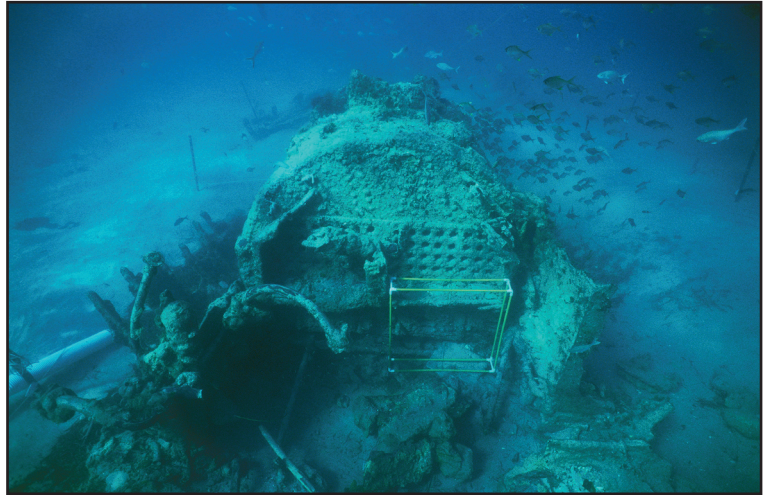
SS *Xantho* was built for use in Scottish waters as a paddle steamer in 1848. At the end of a refit that saw it converted to screw propulsion, in 1871, the iron-hulled *Xantho* was purchased by colonial entrepreneur Charles Broadhurst for use as a transport in the north-west Australian pearling industry. He also intended to use it as a 'tramp steamer' picking up 'Malay' labourers for the pearling industry, passengers and cargoes on its voyages from Fremantle to Batavia via intervening ports and pearling havens. Overloaded with lead ore and worn out, in November 1872 *Xantho* sank at Port Gregory, on the mid Western Australian coast.

In 1979, an iron wreck at Port Gregory was located, and detailed record showed that it was the SS *Xantho*. In 1983, in treating the remains of this iron steamer as a new 'class' of underwater site, conservators and biologists from the Western Australian Museum were invited to join the archaeologists in its investigation *ab initio*. This was the first full pre-disturbance study of any wreck's biological and electrochemical state, providing concrete insights into the wreck, its status and predicted life if left undisturbed on the sea bed. The underwater corrosion study showed that the engine, which was found to be intact, had a limited life on the sea bed. The inspection also revealed that it was engineered not as expected, with a new condensing, two-cylinder compound engine, but with a ten-year-old, 60 hp, non-condensing, double-acting, double-trunk engine, exhausting to the atmosphere. Subsequent research showed that the ageing SS *Xantho* was sold to a Glasgow scrap metal merchant Robert Stewart who, in 1871, had replaced the paddle machinery with a second-hand, ex-RN screw engine, new boilers and pumps, and offered the revamped hybrid lot for sale. Was Stewart dishonest? The marine equivalent of the shady horse dealer or today's crooked used-car dealer? These were early impressions.

The excavation of the stern section of the wreck, which was completed in 1984, partly to answer these questions, also included the recovery of the ship's engine in the context of that work. It was a unit since acknowledged as the first mass-produced, first high pressure and first high revolution marine engine. The treatment and 'excavation' of the engine, begun in a conservation laboratory soon after it was raised in 1985, was completed a decade later with the opening up of the last of the internal spaces and the freeing of all working parts. Even in the disassembly of the engine in the conservation laboratory, where over 2 000 kg of concretions were removed, evidence was found of both a technical nature, and of the way Charles Broadhurst, the owner, operated the ship. Of additional importance, all the threads on the engine were of the British Standard Whitworth type.

Work has since begun on rebuilding the engine in the exhibition galleries, where the entire *Xantho*/Broadhurst programme is presented to the public as a 'work-in-progress'.

References: McCarthy, 2000a.





Zeewijk

On 7 November 1726, the VOC ship *Zeewijk* left the Netherlands bound for Batavia (modern Jakarta), with a complement of 208 seamen and soldiers. *Zeewijk* was a Zeeland ship, 40.6 m (145 ft) long with a draught of 5.53 m (19.75 ft) in the stern and 4.9 m (17.5 ft) forward. The vessel was registered at 140 *lasten* (278 tonnes) and armed with 36 cannon and six small, breech-loading, swivel guns. On the maiden voyage, *Zeewijk* carried heavy

ironwork, bricks and cash money in ten chests amounting to 315 837 guilders.

During the voyage Captain Steyns made an unfortunate decision: despite the protests of the steersman (helmsman), the ship's log of 21 May 1727 reads: 'It was decided unanimously to steer ENE, if there [was] an opportunity, in order to, if feasible, call at the land of *Eendracht* (Western Australia)'. This decision contravened the strict sailing orders of the Directorate of the Dutch East India Company. As a result, at 7.30 p.m. on 9 June 1727, with the small sail and foresail set, and both topsails double-reefed, *Zeewijk* ran aground on the northern edge of Half Moon Reef, opposite Gun Island, in the Houtman Abrolhos on Western Australia's mid-west coast.

In 1840, officers and crew of the British survey ship HMS *Beagle* landed on the island where the marooned sailors from the *Zeewijk* had camped and found numerous relics, which they believed to be from the *Batavia*, so confusing later searches for this wreck. Subsequent colonial visitors and guano miners further located artefacts left by the survivors. In the 1950s and 1960s, visitors continued to discover material on the island and in the shallows.

In 1968, the outside of the reef was searched for the main wreck site. During March of that year, the major wreckage was discovered consisting of anchors, cannons and a large mound of conglomerate (items concreted together). A combined underwater and land survey was conducted by the Underwater Explorers Club (UEC) in 1972, under museum supervision. Following a feasibility study of the archaeological sites by the Department of Maritime Archaeology in 1974, plans were made to undertake more intensive investigations. In 1976, the Department commenced the *Zeewijk* Project—a combined land and underwater survey of the *Zeewijk* site. Several expeditions ensued over the following years.

References: Bevacqua, 1974e; Henderson, 1980f; Ingelman-Sundberg, 1976a, 1977d, 1978a, b, n.d.; Stanbury, 1998b.

Zuytdorp

The Dutch East India (VOC) ship *Zuytdorp* was lost without trace in the winter of 1712 en route from the Netherlands to Batavia (now Jakarta) carrying a rich cargo and silver bullion. Of the seven VOC, English East India Company, Portuguese and American East India ships known to be lost off the coast of Western Australia, *Zuytdorp* is the only wreck from which survivors did not reach the nearest European settlement at Batavia to tell the tale.



The site has proved one of the most difficult and dangerous wrecks on the Australian coast. Following a series of land excavations by amateur enthusiasts and station people, and then a number of dives by recreational and salvage-oriented divers, the Western Australian Museum became legislatively responsible for the site in 1963. It then began a series of salvage attempts aimed at removing the remaining silver bullion in order to deter looters. Rarely is a good day experienced on the site, precluding the application of accepted archaeological techniques. In order to facilitate the work and better protect the site, in the late 1970s, a full-time watch keeper was installed in quarters adjacent the wreck. As a result of the difficulties working on the site, lack of funding and other pressures, work at the *Zuytdorp* was put in abeyance in the early 1980s. A local abalone fisherman was employed to act as part-time watch keeper and monitor the site.

In 1986, work recommenced on the site. Research and field-work concentrated on collating previous work in order to determine the best approach to working the site. As a result, it was decided to work from the sea out of a 7 m work-boat, rather than work from land. Given the dangers and difficulty of working the site, innovative recording and recovery strategies were also devised and applied. Plans of the wreck were produced using aerial photography and other airborne photogrammetric techniques. Rapid diver deployment and material recovery strategies also proved successful in the removal of a well-preserved cannon, coins, lead ingots, exquisite glass-ware and a large anchor.

Since 1986, work has involved questions relating to the survivors and what happened to them. The possibility that they may have intermarried with Aborigines was also examined. Historical archaeologists and other specialists were invited to join the project in order to broaden its scope. Prehistorians, for example, examined shell middens found near the site, and identified them as Aboriginal, dating to around 4 000 BP.

Diving operations were again halted in 2000. Currently a study is underway to assess the amount of coins still on the site and the potential for recovery.

References: McCarthy, 1997c; 1998c, f; 2000c; Morse, 1988.

Chronological list of projects undertaken
by the Department of Maritime
Archaeology 1971–2003

Date	OIC	Project	Reference
1971	JNG	First <i>Vergulde Draeck</i> expedition. Limited excavation.	Bloom, 2000c; Green, 1973b, c; 1974c; 1975b; 1977b; 1981h; 1983c; 1997a; Halls, 1969c; 1970i; Huystee, 1993; Stanbury, 1973; 1979; 1983c.
	JNG	Discovery of the <i>Eglinton</i> (1852). Site inspection, survey and recovery of objects for identification.	Green & Henderson, 1970; Halls, 1978a; McCarthy, & Stanbury, 2003; Stanbury, 2003.
1972	JNG/GJH	First <i>Eglinton</i> excavation. Limited excavation.	Green & Henderson, 1970; Halls, 1978a; McCarthy, & Stanbury, 2003; Stanbury, 2003.
	JNG	Second <i>Vergulde Draeck</i> expedition. More extensive survey and excavation.	See <i>Vergulde Draeck</i> 1971 for references.
	JNG	First <i>Batavia</i> expedition.	Baker & Green, 1976; Bevacqua, 1974a, b, c; Bird, 2003; Franke, 2000a; Gibbs, 1992; 1994b; 2002b; Green, 1974b; 1975c, d; 1976; 1977c; 1980i; 1981c; 1983h; 1986f; 1988b, e; 1989a; 1991b, c; 1997a; 1998b; 2000; n.d.; Green & Pearson, 1975; Green & Parthesius, 1989; Halls, 1962j, k; 1964e; Hundley, 1983a; Huystee, 1993; 1994a; 1996; 1998b; 2000; Huystee & Pasveer, 1998; Ingleman-Sundberg, 1975b, c; Kimpton, 1990; Kimpton & Stanbury, 2002; Marwick, 1999; O'Neill, 1999; Pasveer, 1997; 1998; 2001; Pasveer, <i>et al.</i> , 1998; Rixon, 2001; 2002; Schneider, 2001; Shepherd, 1992; 1994a, b; Stanbury, 1974; 1979; 1980b; Stanbury & Shepherd, 1996; Wilson, 1985a; 1989.
1973	GJH	<i>James Matthews</i> , discovery and inspection.	Baker & Henderson, 1979; Burgh de & Henderson, 1979; Henderson, 1975a, b; 1976a, b; 1978d; 1979; Henderson & Stanbury, 1983; Metcalf, 1996; Pollard, 1978.
	GJH	Second <i>Eglinton</i> excavation.	See <i>Eglinton</i> 1972 for references.
	JNG	Second <i>Batavia</i> expedition. Survey of land sites associated with the <i>Batavia</i> : Beacon Island, West Wallabi.	See <i>Batavia</i> 1972 for references.
	SS	Wreck inspection. Northern coast.	McCarthy, 1980i; 1982c; 1983h; Sledge, 1977a; 1979a.
	JNG	First ANCODS meeting.	Green, 1998a; McCarthy, 2002g; Stanbury, 1982a; 1983c; 1985a; 2002b; Stanbury & Sawday, 1991.
	GJH	Wreck inspection. Norwegian barque <i>Solglyt</i> and its destruction.	
1974	JNG	Third <i>Batavia</i> expedition. Recording and raising of timbers.	See <i>Batavia</i> 1972 for references.
	GJH	<i>James Matthews</i> site work.	See <i>James Matthews</i> 1973 for references.
1975	GJH	First <i>James Matthews</i> expedition. Exposure of part of hull structure for recording and raising of cargo items and ship's equipment exposed during the process.	See <i>James Matthews</i> 1973 for references.
	PEB	Akko, Israel, photographic survey of submerged building site.	

Date	OIC	Project	Reference
	SS	Wreck inspection. South-West.	McCarthy, 1980i; 1982c; 1983h.
1976	GJH	Second <i>James Matthews</i> expedition. Recording of entire hull.	See <i>James Matthews</i> 1973 for references.
	CIS	First <i>Zeewijk</i> expedition. Plotting of main site; mapping the distribution of artefacts in the lagoon; land survey of Gun Island; land excavation on Gun Island.	Brown, 1978; Huystee, 1993; Ingleman-Sundberg, 1976a, c; 1977a, b, c, d; 1978a, b; n.d.; Moncrieff, 1978; Souter, 2001; Stanbury, 1979.
	SS	Wreck inspection. Admiralty Gulf .	McCarthy, 1980i; 1982c; 1983h.
	JNG	Fourth <i>Batavia</i> expedition. Survey of inside reef area.	See <i>Batavia</i> 1972 for references.
	JNG	Second ANCODS meeting.	See ANCODS meeting 1973 for references.
1977	GJH	Third <i>James Matthews</i> expedition. Recording material in trench on starboard side of wreck.	See <i>James Matthews</i> 1973 for references.
	CIS	Second <i>Zeewijk</i> expedition. Swim-line searches on Half Moon Reef; mapping main site; soundings to locate <i>Sloepie</i> launching place; geological survey; biological survey.	See <i>Zeewijk</i> 1976 for references.
	SS	Wreck inspection. South Coast—Eyre wreck.	McCarthy, 1980i; 1982c; 1983h.
	JNG	First <i>Santo António de Tanna</i> (1697) expedition, Mombasa, Kenya.	Green, 1980d; 1991a.
	GJH	Wreck inspection. Albany.	Boocock, <i>et al.</i> , 1990; Dahl, 1990; Garratt, 1994f, g, h; Garratt, <i>et al.</i> , 1995; Henderson, 1979b; Holmes, <i>et al.</i> , 1993; Jorgensen, <i>et al.</i> , 1993; Marshall, 1991; Sledge, 1975c; Vosmer & Wright, 1991.
	JNG	First Southern Hemisphere Conference on Maritime Archaeology, Perth.	Green & Pearson, 1977a; Green, 1978a; Henderson, 1978e.
	SS	<i>Day Dawn</i> excavation. Recording, recovery of material.	Kimpton & Henderson, 1991; McCarthy, 1979a; 1980g; Sledge, 1976b; 1979c.
1978	GJH	Albany wreck sites, including <i>Lady Lyttleton</i> .	See Albany Wrecks 1977 for references.
	CIS	Third <i>Zeewijk</i> expedition. Test excavations and recording.	See <i>Zeewijk</i> 1976 for references.
	SS	Wreck Inspection N Coast (WINC) expedition. Kimberley and NW.	McCarthy, 1980a, i; 1982c; 1983h; Sledge, 1977a; 1979a; Sledge & Stanbury, 1982.
	GJH	Wreck inspection. <i>Rapid</i> site at Point Cloates.	Bird, 2001; Garratt, 1993f; Halls, 1971p; Henderson, 1979c, d; 1980d, e; 1981a, c; 1983e, g; Sledge, 1978d.
	GJH	First <i>Rapid</i> expedition. Site survey and excavation of stern area.	See above.
	SS	Wreck inspection. Midlands wreck.	McCarthy, 1980i; 1982c; 1983h.
	JNG	Second <i>Santo António de Tanna</i> (1697) expedition, Mombasa, Kenya.	See First <i>Santo António de Tanna</i> 1977 for references.
1979	JNG/MS	Pelsaert Island expedition. Guano survey; wreck survey; magnetometer survey of Gun Island.	Stanbury, 1982b.

Date	OIC	Project	Reference
	SS	Recovery of <i>Atlantis</i> sea-plane float.	Sledge, 1982a.
	MMcC	Jervoise Bay survey and site excavations.	Gainsford, 2003a; Garrat & Souter, 1997; McCarthy, 1979b, c; 1980f; 1981b; 1983d.
	JNG/MS	Third ANCODS meeting.	See ANCODS meeting 1973 for references.
	GJH	First <i>Pandora</i> expedition. Site inspection.	Baker, 1983; Coleman & Henderson, 1984; Garratt & Kimpton, 1996; 1998; Green & Souter, 1999; 2002; Henderson, 1979a, e; 1980a, c; 1984d; 1985c; 1986a; 1990a; Henderson, <i>et al.</i> 1983; May, 1984; 1985c, d, e; McCarthy, 1985a; Richards, 1984a, b.
	JNG	First Thailand project. Ko Kradat expedition and SPAFA training programme.	Green, 1980h; 1981e, f; 1982a; 1983i; 1984e; Green, <i>et al.</i> , 1980; 1981; Green & Harper, 1983a, b.
	JNG	Third <i>Santo António de Tanna</i> (1697) expedition, Mombasa, Kenya.	See First <i>Santo António de Tanna</i> 1977 for references.
1980	JNG	First <i>Zuytdorp</i> project. Excavation.	Green, 1997a; Halls, 1968h; Huystee, 1993; Kimpton & McCarthy, 1988b; McCarthy, 1990b, f; 1993b; 1997c; 1998d, g; 2000c, d; Morse, 1988; Silvester, 1998; Stanbury, 1979; Weaver, 1994.
	GJH	Second <i>Rapid</i> expedition. Excavation of midships area to bow.	See <i>Rapid</i> 1978 for references.
	MMcC	Wreck inspection. South-West.	McCarthy, 1980i; 1982c; 1983h.
	JNG	Second Thailand project. Ko Kradat expedition Thailand.	See Ko Kradat 1979 for references.
	MMcC	Wreck inspection. North-West.	McCarthy, 1980i; 1982c; 1983h; Sledge, 1977a; 1979a.
	GJH	First <i>Sydney Cove</i> (1797) excavation, Tasmania.	Henderson, 1978a; 1980c; 1988a.
	MMcC	Rottnest Island wreck trail established.	Barblett, <i>et al.</i> , 1982; McCarthy, 1981g; 1982e.
	Dept	First post graduate diploma course in maritime archaeology.	
	MS	Abrolhos Islands, West Wallabi Island survey, Beacon Island land site excavation.	Bevacqua, 1974c; Franke, 2000a; Gibbs, 1992; Green & Stanbury, 1988a; 2001a; Green, <i>et al.</i> , 1992; Huystee, 2000; O'Neill, 1999; Pasveer, 1998; 2000; 2001; Souter, 2000a; Stanbury, 1991a; 1993a; 1998b.
	PEB/SS	<i>Mary Rose</i> , England. Photographic recording & tutoring.	
	GJH	Pearling luggers, Northern Australia & Thursday Island.	Gainsford & Kimpton, 2003; Henderson, 1981b; 1983c, d; May & Leonard, 1991.
1981	JNG	Third <i>Vergulde Draeck</i> expedition. Short excavation.	See <i>Vergulde Draeck</i> 1971 for references.
	GJH	Boston research identifies <i>Rapid</i> .	See <i>Rapid</i> 1978 for references.
	MMcC	Rowley Shoals inspection trip, location of the <i>Lively</i> .	Atkinson, 1987c; Henderson, 1986d; Henderson & McCarthy, 1981; 1982; McCarthy, 1981l.

Date	OIC	Project	Reference
	Dept.	Second post graduate diploma course in maritime archaeology.	
	MMcC	First HMAS <i>Sydney</i> search (with RAN).	Australia Parliament, 1997–99; Franke, 1998a; Gibbs, 1997; 2000a; Green, 1991f; Green, <i>et al.</i> 1984; Kirsner & Hughes, 1993; McCarthy, 1984d; 1991d; 2000d; 2002j; McCarthy, <i>et al.</i> , 1990; McCarthy & Kirsner, 1991; Olson, 1995; 1996; Olson, <i>et al.</i> , 2001.
	PEB	<i>Mary Rose</i> , England. Photographic recording & tutoring.	
	GJH	Pearling luggers, Aru Island.	Gainsford & Kimpton, 2003; Henderson, 1981b; 1983c, d; May & Leonard, 1991.
1982	GJH	Third <i>Rapid</i> expedition. Bow area.	See <i>Rapid</i> 1978 for references.
	MS	Norwegian Bay whaling station survey.	Garratt, 1994c, e; Stanbury, 1983a; 1984a; 1985d.
	PEB	Cootamundra Shoals survey.	
	PEB	<i>Mary Rose</i> , England. Raising of ship.	
	JNG	Fourth <i>Vergulde Draeck</i> excavation.	See <i>Vergulde Draeck</i> 1971 for references.
	GJH	First <i>Lively</i> expedition, Rowley Shoals.	See Rowley Shoals 1981 for references.
	Dept	Second Southern Hemisphere Conference on Maritime Archaeology. AIMA formed.	Jeffery & Amess, 1983.
	MMcC	Removal of <i>Cheyne's III</i> engine (with John Bell).	
	MMcC	Bunbury Wrecks survey and excavation.	Cushnahan & Staniforth, 1982; McCarthy 1982c.
	JNG	Third Thailand project. Pattaya wreck site excavation.	Green & Harper, 1982b; 1983a, b; Green & Intakosai, 1983.
	JNG/MS	ANCODS meeting.	
	JNG	Korea visit to the Shinans shipwreck at Mokpo, Korea.	Green, 1983f; 1988c; Green & Kim, 1989.
	JNG	Takashima Kubila Kahan expedition, Japan.	Green, 1983e; 1987a, c.
1983	GJH	Survey and excavation of the <i>Star</i> (1880), recovery of material.	Henderson & Henderson, 1988.
	JNG	Fifth <i>Vergulde Draeck</i> excavation.	See <i>Vergulde Draeck</i> 1971 for references.
	JNG	First China project. Quanzhou ship survey.	Green, 1983g; 1984b; 1986b; 1989b; Green, <i>et al.</i> , 1998.
	MMcC	First <i>Xantho</i> (1872) project. Feasibility and pre-disturbance survey.	Burgess & McCarthy, 1994; Gilman, 2001b; Kimpton & McCarthy, 1988a; McCarthy, 1983i; 1985b, d, e; 1986a, b, d; 1988a, c, d; 1989a, b; 1991c; 1996e, g; 2000a; McCarthy & Garcia, 1996; Sledge, 1979i; Veth & McCarthy, 1999.
	JNG	Fourth Thailand project. First Ko Si Chang I excavation.	Green, 1983d; 1985c; 1986a, b; Green & Harper, 1983a, b; Green, <i>et al.</i> , 1987; Richards, 1984c, 1985; 1986.

Date	OIC	Project	Reference
	GJH	Second <i>Lively</i> expedition, Rowley Shoals. Excavation.	See Rowley Shoals 1981 for references.
	MMcC	<i>Pandora</i> fastenings study.	McCarthy, 1983e.
	MMcC	Wreck inspection. South-West.	McCarthy, 1980i; 1982c; 1983h.
	GJH	Second <i>Pandora</i> expedition. Excavation.	See <i>Pandora</i> 1979 for references.
	GJH	First <i>Sirius</i> expedition, Norfolk Island. Feasibility study.	Edmiston & Jeffery, 1989; Henderson, 1984b, c; 1985b; 1987a; 1989a, c; Henderson & Stanbury, 1987; 1988; Henderson, <i>et al.</i> , 1989; Kimpton, 1987; 1992; Nayton, 1988; Stanbury, 1987c, d, e; 1990a, b; 1991b; 1994b; 1998a; Stanbury & Baker, 2002; Stanbury & Evans, 2002; Western Australian Museum, 1989.
	JNG/MS	ANCODS meeting.	Green, 1998b; McCarthy, 2002d; Stanbury, 1982a; 1983c; 1985a; 2002b; Stanbury & Sawday, 1991.
	JNG	Churchill Fellowship study Indonesia Spice island castles.	
	SS	First historic shipwreck map.	
	MMcC	Scuttling of <i>Cheyne</i> III with Southcoast Divers.	
1984	SS	<i>Cumberland</i> (1830). Survey and limited excavation.	Sledge, 1983a, b.
	SS	Wreck inspection. Scott Reef /Osborne Is/ North-West Cape.	
	JNG	Fifth Thailand project. Second Ko Si Chang I excavation.	See Ko Si Chang I 1983 for references.
	MS/J.Mc	Bathers Bay whaling excavation.	Garratt, 1994c, e; Gibbs, 1990; 1994; 1995; 2000a; Halls, 1961k; Henderson & Stanbury, 1982; Stanbury, 1985d; 1999b.
	GJH	Third <i>Pandora</i> expedition.	See <i>Pandora</i> 1979 for references.
	GJH	Historic boats programme (CEP Grant).	
	MMcC/DG	Long Jetty excavation, site survey and recovery of a large collection.	Anderson, <i>et al.</i> , 1996; Garratt, 1987; 1990; Garratt, <i>et al.</i> , 1994; McCarthy, 2002c; Souter, 1996a.
1985	JNG	Sixth Thailand project. Third Ko Si Chang I excavation, ARGS Program Grant; Southeast Asia.	See Ko Si Chang I 1983 for references.
	MS/J.Mc	Bathers Bay excavation [whaling].	See Bathers Bay excavation 1984 for references.
	MMcC/GK	Second <i>Xantho</i> (1872) project. Excavation of stern section. Recovery of engine.	See <i>Xantho</i> 1983 for references.
	MMcC	First AIMA on-site practical and theoretical seminar (iron and steamship archaeology).	McCarthy, 1988b.
	GJH/MS	Second <i>Sirius</i> expedition, Norfolk Island.	See <i>Sirius</i> 1983 for references.
	JNG	<i>Trial</i> excavation.	Green, 1977a; 1986e; 1997a; Stanbury, 1979.

Date	OIC	Project	Reference
	MS	Monte Bellos pearling survey.	Stanbury, 1986b; 1994d.
	JNG/MS	ANCODS meeting.	Green, 1998b; McCarthy, 2002d; Stanbury, 1982a; 1983c; 1985a; 2002b; Stanbury & Sawday, 1991.
1986	MMcC/ GK	Second <i>Zuytdorp</i> project. Feasibility survey.	See <i>Zuytdorp</i> 1980 for references.
	McCarthy	Wreck inspection. Mid-west coast.	
	JNG/RH	Seventh Thailand project. Ko Si Chang III.	Green, 1983b; 1985c; 1986a, b; Green & Harper, 1983a; Green, <i>et al.</i> , 1987; Richards, 1984c, 1985; 1986.
	JNG	<i>Rijdsdam</i> excavation, Malaysia.	Green, 1986c; Green & Gangadharam, 1985.
	Dept.	Third post graduate diploma course in maritime archaeology.	
	GJH/MS	Historic boats programme (CEP Grant).	Stanbury, 1986c.
	MS/GJH	Technical drawing programme (CEP Grant).	
	GJH/PH	First survey of <i>Edwin Fox</i> , New Zealand.	Hundley, 1987; 1988a, b; McKinlay & Henderson, 1985.
1987	MMcC/ GK	Third <i>Zuytdorp</i> project. .	See <i>Zuytdorp</i> 1980 for references.
	GJH/MS	Third <i>Sirius</i> expedition, Norfolk Island.	See <i>Sirius</i> 1983 for references.
	GJH	Wreck inspection. Search for <i>Correio da Azia</i> Ningaloo Reef.	
	JNG	Eighth Thailand project. Survey expedition.	
	JNG	First Oman survey.	Kenderdine & Vosmer, 1994; Souter, 1997b; 1988; Vincent & Green, 1990; Vosmer, 1993b; 1994; 1997a, b; Vosmer, <i>et al.</i> , 1996; 1998.
	JNG	Second China project. Quanzhou ship survey, China–Australian Academy of Humanities.	See Quanzhou Ship 1983 for references.
	MS	ICMM Conference, Amsterdam & Rotterdam.	Stanbury, 1987a.
1988	MMcC/ GK	Fourth <i>Zuytdorp</i> project. Excavation.	See <i>Zuytdorp</i> 1980 for references.
	JNG/PC	First Butuan boat project, Philippines.	Clark, <i>et al.</i> , 1993; Green, <i>et al.</i> , 1993.
	GJH	North-West Whaling expeditions.	Garratt, 1994c, e; Gibbs, 1990; 1994; 1995; 2000a; Halls, 1961k; Hendsen & Stanbury, 1982; Stanbury, 1985d; 1999b.
	MMcC	Third <i>Xantho</i> (1872) project. Excavation and recovery of machinery from stern section.	See <i>Xantho</i> 1983 for references.
	MMcC	Wreck inspection. Dirk Hartog Island.	Gibbs, 1996a; Halls, 1971c; Souter, 2000d.
	MMcC	Wreck inspection. Mid-west coast.	McCarthy, 1980i; 1982c; 1983h.
	GJH/MS	Fourth <i>Sirius</i> expedition, Norfolk Island.	See <i>Sirius</i> 1983 for references.
	PH	Second <i>Edwin Fox</i> survey, New Zealand.	Hundley, 1987; 1988a, b; McKinlay & Henderson, 1985.

Date	OIC	Project	Reference
	JNG	Fifth International Symposium on boat and ship archaeology, Amsterdam.	Green, 1991g.
	JNG	<i>Lelystad</i> project, Netherlands. <i>Batavia</i> replica.	Green, 1988e; Kimpton, 1990, Kimpton & Stanbury, 2002.
	JNG	Oxford University research project.	
	JNG	Third China project. Establish programme.	Atkinson-Millar, 1990; Burns & Green, 1989; Green, 1997b; Green, <i>et al.</i> , 1993.
	JNG	Ninth Thailand project. Survey.	
1989	GJH	South Coast whaling expeditions, <i>Belinda</i> discovery.	Henderson, 1989e.
	MMcC	Wreck inspection. With <i>Flamingo Bay: I 124</i> , Indonesian trochus divers.	McCarthy, 1990a; 1991b
	MMcC	Albany Jetty excavation. Investigation of scour pit.	Garratt, 1994h; Garrat, <i>et al.</i> , 1995; McCarthy, 2002c.
	GJH/MS	Fifth <i>Sirius</i> expedition, Norfolk Island.	See <i>Sirius</i> 1983 for references.
	GH/GK	Wreck inspection. Kimberley.	McCarthy, 1980i; 1982c; 1983h.
	JNG/MS	Abrolhos Island survey.	Stanbury, 1991a.
	JNG	Maldives survey and cultural heritage management meeting.	Millar, 1993; 1994.
	MMcC	Hamelin Bay wreck trail pamphlet.	McCarthy, 1989d.
	Dept	AIMA conference.	Stanbury, 1989a.
1990	MMcC	Fifth <i>Zuytdorp</i> project. Excavation land sites, start of greening.	See <i>Zuytdorp</i> 1980 for references.
	PC/KM	Fourth China project. Start of China maritime archaeological training programme.	Atkinson-Millar, 1990; Burns & Green, 1989; Clark & Wei, 1990; Green, 1997b; Green, <i>et al.</i> , 1993; Kenderdine, 1995b.
	PC	Fifth China project. First Bai Jaio excavation, Dinghai, China.	See above.
	MMcC	HMAS <i>Sydney</i> research, Melbourne & Canberra.	See HMAS <i>Sydney</i> 1981 for references.
	MMcC	Bunbury wreck trail established.	
	JNG	Release of BBC Chronicle 'Voyage to Disaster'.	
	GK	<i>Lelystad</i> project, Netherlands. <i>Batavia</i> replica.	Green, 1988e; Kimpton, 1990; Kimpton, & Stanbury, 2002.
	GJH/MS	Sixth <i>Sirius</i> expedition, Norfolk Island.	See <i>Sirius</i> 1983 for references.
1991	GJH	<i>Belinda</i> site survey and excavation.	Henderson, 1989e.
	MMcC	Wreck inspection. Broome aircraft wrecks.	Edwards, 1983; 1994; McCarthy, 1993a; McCarthy, <i>et al.</i> , 2002; Souter, 2003; Green, 2002b.
	MMcC	Sixth <i>Zuytdorp</i> project. Excavation of land sites.	See <i>Zuytdorp</i> 1980 for references.
	MMcC	Wreck inspection. SS <i>Pericles</i> video.	

Date	OIC	Project	Reference
	MMcC	Wreck inspection. South-West.	McCarthy, 1980i; 1982c; 1983h.
	JNG	Tenth Thailand project. Training programme, Rayong site.	
	MMcC	Mandurah wreck trail.	
	MMcC	HMAS <i>Sydney</i> forum.	See HMAS <i>Sydney</i> 1981 for references.
1992	JNG	First Galle, Sri Lanka, project. Wreck site survey.	Carpenter, 1994; Green, 1998a; Green, <i>et al.</i> , 1992; 1998; Green & Devendra, 1993a; Green & Parthesius, 1998; Souter, 1998; 1999.
	JNG	Australia Academy of Humanities Netherlands research grant.	
	MMcC	Wreck inspection. Shark Bay.	
	MMcC/ GK	Seventh <i>Zuytdorp</i> project. Excavation of land and sea, regreening.	See <i>Zuytdorp</i> 1980 for references.
	MMcC	Fourth <i>Xantho</i> (1872) project. Excavation and final recovery of machinery from stern section.	See <i>Xantho</i> 1983 for references.
	JNG	Wreck inspection. Exmouth.	McCarthy, 1980i; 1982c; 1983h.
	MMcC	Hamelin Bay wreck trail established.	McCarthy, 1989d.
	MMcC	Coral Coast (Exmouth).	Green, 1992.
	MS	Abrolhos Islands field expedition 4–17 May.	Green, <i>et al.</i> , 1992.
	JNG	Maldives ethnographic boat study.	Millar, 1993; 1994.
	JNG/ PC?TV	Second Butuan boat project, Philippines.	See Butuan boat project 1988 for references.
	NB	Vietnam boat ethnography and bamboo boat replica.	
	MS/GJH	Australian ICOMOS 1992 National conference workshop	
	MS	International Maritime Heritage Year conference, <i>The Archaeology of Ships of War</i> , National Maritime Museum, London.	Stanbury, 1998a.
1993	JNG	Second Galle, Sri Lanka, project. Wreck site survey.	See Galle, Sri Lanka 1992 for references.
	JNG	Sixth China project. Quanzhou and South China inspection, Chinese Academy of Social Sciences.	See Quanzhou ship survey 1983 for references.
	MMcC	HMAS <i>Sydney</i> research, Eastern States.	See HMAS <i>Sydney</i> 1981 for references.
	MMcC/ GK	Eighth <i>Zuytdorp</i> project. Excavation land and sea.	See <i>Zuytdorp</i> 1980 for references.
	MMcC	Sinking of J. Clarke's barge <i>Gemini</i> .	
	GJH	Fourth <i>Pandora</i> expedition.	See <i>Pandora</i> 1979 for references.
	MMcC	Port-related structures study commenced (With Dennis Cumming and Dena Garratt).	Cumming, <i>et al.</i> , 1995a, b; Garratt, 1987; 1990; 1993a, b, c, d; 1994, a, b, c, d, e, f, g, h; Garratt, <i>et al.</i> , 1994, 1995.

Date	OIC	Project	Reference
	MS/RAJ/ JP(1)	Heritage Council of WA/AICC project. Survey of sites at Rat Island, Easter Group.	Stanbury, 1993b.
	MS	Historic shipwrecks amnesty. Field inspections, registration, etc.	Stanbury, 1993c.
	TV	Second Oman survey (water-craft).	See Oman Survey 1987 for references.
	MMcC	South coast map and pamphlet.	
	MMcC	Geraldton and Abrolhos map and pamphlet.	
1994	MMcC/ DG	Albany Jetty excavation. Major excavation of area under threat.	Garratt, 1994h; Garratt, <i>et al.</i> , 1995; McCarthy, 2002c.
	MMcC	Albany Wreck trail established (With Adam Wolfe and ASHS).	
	PC/NB	Seventh China project. Quanzhou ship survey Western Australia–China Economic and Technical Research Fund.	See Quanzhou Ship 1983 for references.
	DG/RAJ	SE port-related structures tour (with Denis Cumming).	See port-related structures 1993 for references.
	MMcC	Ninth <i>Zuytdorp</i> project. Land excavation.	See <i>Zuytdorp</i> 1980 for references.
	SK	Wreck inspection. Mandurah to Moore River for <i>Shipwrecks 1656–1942</i> .	Brooks, <i>et al.</i> , 1991; Punchard, 1990.
	MMcC	Wreck inspection. Shark Bay.	
	MMcC	Lighthouses structures study commenced (With Dennis Cumming).	See port-related structures 1993 for references.
	MS	Amnesty visits.	Stanbury, 1993c.
	MS/MG/ BH/JP(1)	Excavation of skeleton SK5: Beacon Island Houtman Abrolhos (with Martin Gibbs/Jenni Potts, Bernie Hunneybun).	Gibbs, 1992; 1994b; Hunneybun, 1995; Huystee & Pasveer, 1998; 2000; O'Neill, 1999; Pasveer, 1997; 1998; 2000; 2001; Pasveer, <i>et al.</i> , 1998.
	TV	Third Omani survey. Watercraft.	See Oman Survey 1987 for references.
	GK	<i>Gudrun</i> anchor recovery and installation at Denham.	
	GK	Prospero Productions— <i>Batavia</i> film.	
	NB	Research on traditional shipbuilding in Indonesia.	Green, 1984e, f; 1986a; Halls, 1961i; May, 1988e.
	MMcC/ DG	Shark Bay pamphlet.	
	MMcC	Access to maritime sites for people with disabilities pamphlet.	
	JNG/MS	AIMA Conference, Brisbane.	
1995	MMcC	Wreck inspection. Pilbara.	
	DG/GK	Fifth <i>Pandora</i> expedition.	See <i>Pandora</i> 1979 for references.
	SK/JNG	Eighth China project. Second Bai Jaio excavation, Dinghai, China.	See Bai Jaio Excavation 1990 for references.

Date	OIC	Project	Reference
	MMcC	Tenth <i>Zuytdorp</i> project. Regreening.	See <i>Zuytdorp</i> 1980 for references.
	MMcC	Wreck inspection. Kimberley.	
	MMcC	Wreck inspection. Shark Bay.	
	MS/PEB	Amnesty visits in South-West.	Stanbury, 1993c.
	Dept	Fourth post graduate diploma course in maritime archaeology.	
	Dept	Excavation of <i>Dato</i> and <i>Day Dawn</i> .	Anderson, <i>et al.</i> , 1995; Kimpton & Henderson, 1991; McCarthy, 1979a; 1980g; Sledge, 1976b; 1979c.
	MS/GJH	AIMA/ASHA conference, Hobart.	
1996	JNG	Third Galle, Sri Lanka, project. Wreck site survey.	See Galle, Sri Lanka 1992 for references.
	DG	Gingin wreck trail established.	
	JNG	Centre of Excellence established.	
	MMcC	Eleventh <i>Zuytdorp</i> project. Excavation and site regreening.	See <i>Zuytdorp</i> 1980 for references.
	MMcC	Wreck inspection. Shark Bay.	
	GK/DG	Sixth <i>Pandora</i> expedition.	See <i>Pandora</i> 1979 for references.
	TV	Fourth Omani survey (water-craft).	See Oman Survey 1987 for references.
	DG	Wanneroo wreck access programme established.	
	MMcC	HMAS <i>Sydney</i> research and briefing.	See HMAS <i>Sydney</i> 1981 for references.
	MMcC	Wreck inspection. North-West and Pilbara.	
	NB	<i>Duyfken</i> project.	Huystee, 1995; 1997.
	Dept	AIMA mini-conference.	
1997	Dept	ANCODS Colloquium.	Green, 1998b; Green, <i>et al.</i> , 1998; McCarthy, 2002d; Stanbury, 1982a; 1983c; 1985a; 2002b; Stanbury & Sawday, 1991.
	Dept	Indian Ocean Week, Fremantle—AIMA international conference.	
	MMcC	Wreck inspection. South-West, including scuttling of HMAS <i>Swan</i> .	Souter, 1996f.
	JNG	Fourth Galle, Sri Lanka, project. Harbour survey.	See Galle, Sri Lanka 1992 for references.
	JNG	<i>Correio da Azia</i> search and location of <i>Stefano</i> .	Green, 2003d; Green & McCarthy, 1997; Warne, 1994.
	CS/DG	Jervoise Bay study.	Gainsford, 2003a; Garratt & Souter, 1997; McCarthy, 1979b, c; 1980f; 1981b; 1983d.
	MMcC	Shark Bay inspections and de Vlamingh Tri-centennial re-enactment.	Briggs, <i>et al.</i> , 1994; Cooper, 1997a, b; Garratt & McCarthy, 1997; Garratt, <i>et al.</i> , 1997; Gibbs, 1996a; Halls, 1968d.

Date	OIC	Project	Reference
	GK/JNG/ MMcC	East Indiaman shipwrecks cultural tourism programme.	
	MMcC/ DG	Shark Bay heritage study.	
	TV	Fifth Oman survey. Qalhat /Musandam survey.	See Oman Survey 1987 for references.
	MMcC/GK	Twelfth <i>Zuytdorp</i> project. Field-work.	See <i>Zuytdorp</i> 1980 for references.
	DG	Silver Coast wreck access programme.	
	MS	Let's Face It! The 7th Scientific Meeting of the International Association for Craniofacial Identification, Melbourne.	Stanbury, 1997a
1998	MMcC	French coin/ <i>Perseverant</i> inspection.	Halls, 1971c; McCarthy, 1998a; Robinson, 1988; Souter, 2000d.
	JF	Centre of Excellence photogrammetric training programme (NSW/SA).	
	MS	Dirk Hartog Island. Survey and excavation of French bottle site, location of <i>Perseverant</i> .	Halls, 1971c; Harrison, 1998; McCarthy, 1998a; Robinson, 1988; Souter, 2000d.
	JNG	Darwin Catalina side-scan survey.	Green, 2002b.
	SS(2)	<i>City of Launceston</i> HPASS survey, photography and photogrammetry.	Garratt, 1991.
	PG	Seventh <i>Pandora</i> expedition.	See <i>Pandora</i> 1979 for references.
	JNG	<i>Correio da Azia</i> expedition.	See <i>Correio da Azia</i> 1997 for references
	RP/KM/ CS	Fifth Galle, Sri Lanka, project.	See Galle, Sri Lanka 1992 for references.
	CS/MMcC	Arthur Head study.	Bavin & Gibbs, 1988; Souter & McCarthy, 1998.
	TV	Sixth Oman survey. Qalhat stone anchor survey.	See Oman Survey 1987 for references.
	MS	Overseas research (French bottle), France, London.	
1999	MS/JNG/ JP(2)	Coastcare: Abrolhos Islands project.	Stanbury, 1991a; 2000c.
	GK	Wreck inspection. Broome aircraft sites.	Edwards, 1983; 1994; Green, 2002b; McCarthy, 1993a; McCarthy, <i>et al.</i> , 2002; Souter, 2003.
	SS (2)	First training course for Historic Shipwrecks Act Inspectors.	
	MMcC	ICOMOS/ICUCH (Mexico City).	Henderson, 1992b; McCarthy & Cox, 2001.
	McC	<i>Hundley</i> Symposium, Charleston, USA.	
	RP/KM/ CS	Sixth Galle, Sri Lanka, project. <i>Avondster</i> excavation, Galle Maritime Museum display.	See Galle, Sri Lanka 1992 for references.
	PG	Eighth <i>Pandora</i> expedition, Queensland. HPASS survey and stereophotogrammetry.	See <i>Pandora</i> 1979 for references.
	JNG	Wonnerup remote sensing <i>Chaloupe</i> survey.	Gerritson, 1995.

Date	OIC	Project	Reference
	JNG	Luban conference on maritime archaeology, Malaysia.	
	JNG	First INA Tektas excavation of 4 th century BC shipwreck site, Turkey.	Green, <i>et al.</i> , 2002.
	MMcC	HMAS <i>Sydney</i> enquiry.	See HMAS <i>Sydney</i> 1981 for references.
	MMcC/ GK	Fifth <i>Xantho</i> project. Engine rebuilding.	See <i>Xantho</i> 1983 for references.
2000	JNG	Plymouth maritime archaeology conference, UK.	
	JP(2)	<i>Batavia</i> skeletal analysis programme.	See <i>Batavia</i> 1972 for references.
	TV	Seventh Oman survey. Al Balid excavation.	See Oman Survey 1987 for references.
	JNG	Search for the <i>Geographe</i> anchors.	
	RS/JNG/ PEB	Sixth <i>Xantho</i> project. Documentary film.	McCarthy, 2000a; Parrott, 2001.
	JNG	Second INA Tektas excavation of 4 th century BC shipwreck site, Turkey.	Green, <i>et al.</i> , 2002.
	CS	Watching brief and excavation of new Maritime Museum site.	Souter, 2000c.
	Prosp	Signing of agreement to produce <i>Shipwreck Detectives</i> a three-part documentary series.	
	MMcC	<i>James Matthews</i> site investigation.	See <i>James Matthews</i> 1975 for references.
	CS	Use of HPASS on Roman Bridge at Maastricht.	Green & Souter, 2002; Souter, 2000b.
2001	JNG/CS/ PEB	Wreck inspection. Middle Island project inspecting <i>Mary Ann</i> , <i>Penguin</i> , <i>Belinda</i> and whaling and sealing sites on island.	Green, 2002b; Green, <i>et al.</i> , 2001; Henderson, 1989e.
	JNG/CS/ Prosp	Rottnest Deep Water Graveyard project.	Garratt, 1999.
	JP/JNG/ CS/PEB/ JK/Prosp	<i>Batavia</i> film project, part of <i>Shipwreck Detectives</i> .	See <i>Batavia</i> 1972 for references.
	JNG/CS/ MMcC/ Prosp	Broome flying boat site location, part of <i>Shipwreck Detectives</i> .	Edwards, 1983; 1994; McCarthy, 1993a; McCarthy, <i>et al.</i> , 2002; Souter, 2003.
	CS	Gun Island and <i>Zeewijk</i> site inspection.	See <i>Zeewijk</i> 1978 for references.
	JNG	Palermo & Siracusa conference: <i>Means for the Protection and Touristic Promotion of the Marine Cultural Heritage in the Mediterranean</i> .	Green, 2002c.
	JNG	Third INA Tektas excavation of 4 th century BC shipwreck site, Turkey.	Green, <i>et al.</i> , 2002.
	MMcC	<i>James Matthews</i> site investigation.	See <i>James Matthews</i> 1975 for references.
	MMcC/AW	Albany summer school.	
	MMcC/ GK	Dampier/de Freycinet— <i>Roebuck/Uranie</i> . Ascension and Falklands Islands.	McCarthy & Godard, 2001; McCarthy, 2002a, b, g, j.
2002	JNG/MMc	<i>Redemptora</i> project, survey.	Gainsford, 2003a.

Date	OIC	Project	Reference
	MS/PEB	<i>Sirius</i> expedition.	See <i>Sirius</i> 1983 for references.
	CS	Rottneest Island, post graduate diploma course fieldschool, Rottneest Island Management Plan.	
	CS/MMc	<i>Sepia</i> survey (6–19 April).	
	MMc	Wreck inspection. HMAS <i>Swan</i> .	Souter, 1996f.
	MMc	<i>James Matthews</i> site investigation.	See <i>James Matthews</i> 1975 for references.
	MMc	Wreck inspection. Albany.	
	Dept	Fifth post-graduate diploma course in maritime archaeology. July–December.	Gainsford, 2003a; Green & Gainsford 2003.
	CS	<i>Omeo</i> survey with Brown University MA student Brian Gohacki (July–August).	
	VR/CS	HMAS <i>Perth</i> corrosion studies (March).	
	JNG	National Research Council, Oceans Studies Board, Committee for Exploration of the Seas, International Global Ocean Exploration Workshop (9–16 May).	
	CS	INA Pabuc Burnu excavation, Turkey (June).	
	JNG	Lecture at Terrasini's Museum, Palermo, Sicily on underwater cultural heritage (1 June).	
	JNG	INA technical workshop, Bodrum, Turkey (14–21 June).	
	JNG/CS	Truk Lagoon side-scan sonar survey for Historic Property Office, Federated States of Micronesia. Sponsored by Prospero Productions and assisting Bill Jeffery (3–22 Feb.).	Green, 2002b
	JNG	Wilsons Promontory <i>Cheviot</i> survey using photogrammetric techniques to assist Heritage Victoria (21–27 March).	
	JNG/MS/CS	AIMA conference Townsville (18–22 Nov.).	
2003	VR	<i>James Matthews</i> . Conservation survey.	See <i>James Matthews</i> 1975 for references.
	JNG	<i>Redemptora</i> . Replacing removed ballast.	Gainsford, 2003a.
	JNG	Bathers Bay, magnetometer survey.	
	JNG	Seventh Galle, Sri Lanka, project. (22 April–9 March).	See Galle, Sri Lanka 1992 for references.
	JNG/CS	Dirk Hartog Island, <i>Perseverant</i> site (17–24 May).	
	PEB	Oman, Qalhat, sea bed search and video.	
	CS	INA Pabuc, Burnu excavation, Turkey.	
	CS	Archival research, London, UK.	
	CS	<i>Europa</i> site inspection with MAAWA.	

Date	OIC	Project	Reference
	CS	NAS <i>Omeo</i> survey (1–2 Feb.).	
	CS/AP	Dampier Archipelago survey (Sept.).	
	CS	Tertiary sector teaching and learning workshop, University of Sydney (Sept.).	
	CS/MS	AIMA conference Port Arthur.	
	VR/MMc	<i>Omeo</i> , road lego, test squares.	
	VR	<i>Santiago</i> , SA corrosion survey.	
	VR	HMAS <i>Hobart</i> , SA corrosion survey.	
	VR	HMAS <i>Perth</i> , corrosion survey.	
	MPG/GK	Wreck inspection. Broome.	Gainsford & Kimpton, 2003.
	MPG	Wreck inspection. James Rocks anchor.	Gainsford, 2003c.
	JNG	Wreck inspection. South Metro wrecks.	Gainsford, 2003b.
	JNG	Excavation of 4 th century AD wreck site at Scauri, Pantelleria, Sicily.	
	JNG	Research project with INA Bodrum studying recording methods and stereo-photogrammetry on the <i>Santo António de Tanna</i> .	
	JNG	UNESCO Asia–Pacific workshop on the 2001 Convention on the Protection of Underwater Cultural Heritage (18–20 Nov.).	Green, 2003a
	JNG	Search for the RAN submarine <i>AEI</i> , Duke of York Islands, New Britain.	Green, 2003b
	JNG	International Committee on Underwater Cultural Heritage annual general meeting, Galle, Sri Lanka (1–5 Dec.).	Green, 2003c

Note: Throughout this period there was an active on-going programme of *ad hoc* individual wreck inspections, small-scale salvage and survey projects necessitated by development activities, research projects not involving field-work e.g., stereo-photogrammetry. This list does not include maritime history events that were once part of the Department's responsibility.

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