une
University of
New England

GIRT

Gathering Information via Recreational and Technical

Scientific Divers

'Our land is girt by sea', so dive into an ocean full of history!

Monitoring a Site

- *What is a wreck and why monitor-*
- *GIRT versus a full conservation survey*
- *- Subjective and objective data*
- *- Data to be collected on the surface or during a dive*
- *- Making a mud map*
- *- Video transect*
- *- Feature photogrammetry*
- *- Equipment required*
- *- Linking GIRT with an established environmental citizen science program (Reef Check, Eye on the Reef, Coral Watch, Redmap…)*
- *- Other options – remote sensing options, other analytical methods*

What is a wreck?

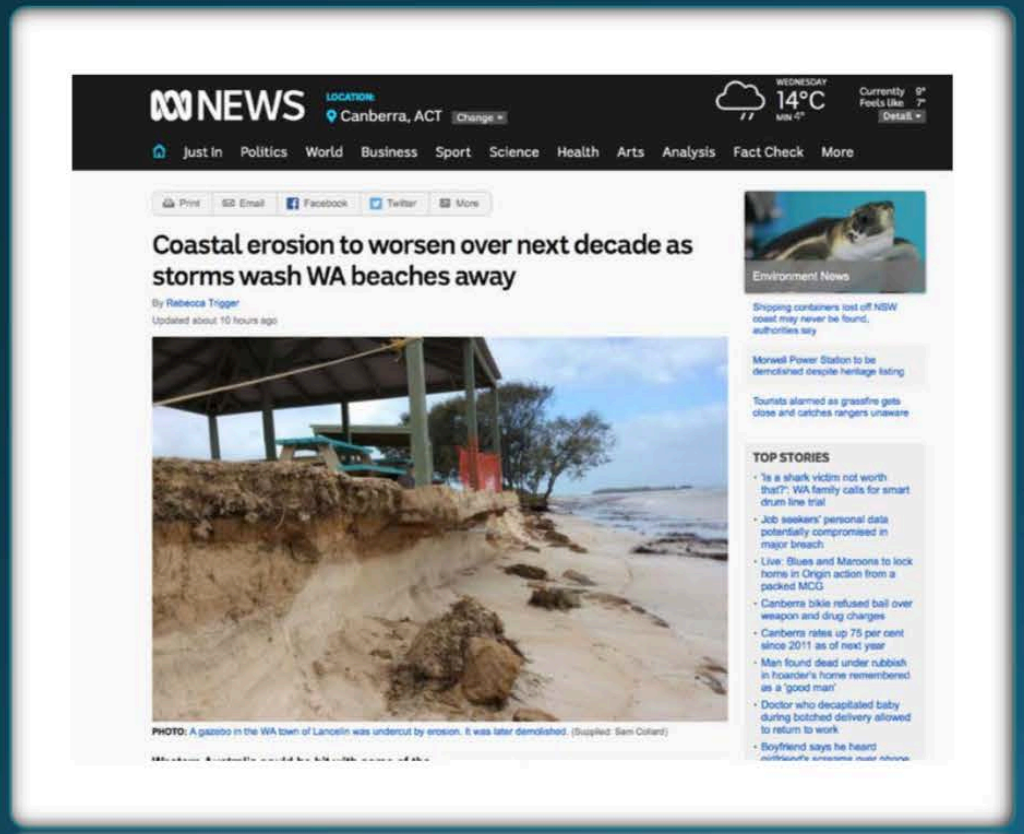
- A shipwreck constitutes those parts and materials that have survived the wrecking process and, following a period of deterioration/stabilisation, reached a dynamic equilibrium with its new environment.

A dynamic equilibrium

- Shipwrecks exist in a dynamic equilibrium with their environment and subsequent environmental or physical changes may occur through storm events or impacts of a cultural nature.
- For the purpose of this study, the environment consists of two broadly different environments 1 - open seawater and 2 -within the seabed

D. Gregory, et al., Conservation and in situ preservation of wooden shipwrecks from marine environments, Journal of Cultural Heritage (2012), doi:10.1016/j.culher.2012.03.005 p8

Monitoring and why



- Regular, systematic monitoring of a site is essential to understand the stability of the site over time.
- By collecting your observations, you, other GIRT members, the public and the responsible underwater cultural heritage managers can be informed about threats to your site and the need, if viable, for active mitigation measures to be employed to ensure its continued stability.

Maritime Archaeological Conservation site survey

Open seawater environment

GIRT Scientific Divers

0%

30%

- observations of macro site and environment that can be extrapolated to indicate micro-changes
- photographic and video documentation

Environment within the seabed

Conservation science

-basic observations of sites and environments
- photographic and video Documentation
- Material identification and analyses
- Corrosion measurements
- Sediment core analyses
- Sediment level monitoring
- Sampling and sacrificial samples
- remote sensing

100%

Subjective/objective

objective observations

GIRT monitoring - detail

- GIRT monitoring is non-impact
- GIRT considers only the environment of open seawater
- GIRT qualitatively and quantitatively assess physical and biological processes of deterioration - sediment transport (scouring/deposition) and the visible activity of wood boring organisms and or corrosion

Other monitoring options

- Technical devices such as **data loggers.**
- These are pieces of equipment that may contain several sensors to collect different data (for example salinity, temperature and dissolved oxygen) over long periods of time.
- A data logger automatically records the data once it is installed and can be retrieved when the data logger itself is collected or through a wireless connection with the device.

A diver with a data logger on the seabed. This apparatus measures the changes in several parameters such as salinity and dissolved oxygen. (BZN 10 wreck, the Netherlands). © R. Obst

Using data loggers

Parameters

- Temperature,
- Salinity,
- Dissolved Oxygen
- Redox Potential (Eh) and
- Acidity / Basicity (pH)

For more information see MOSS Project Final Report

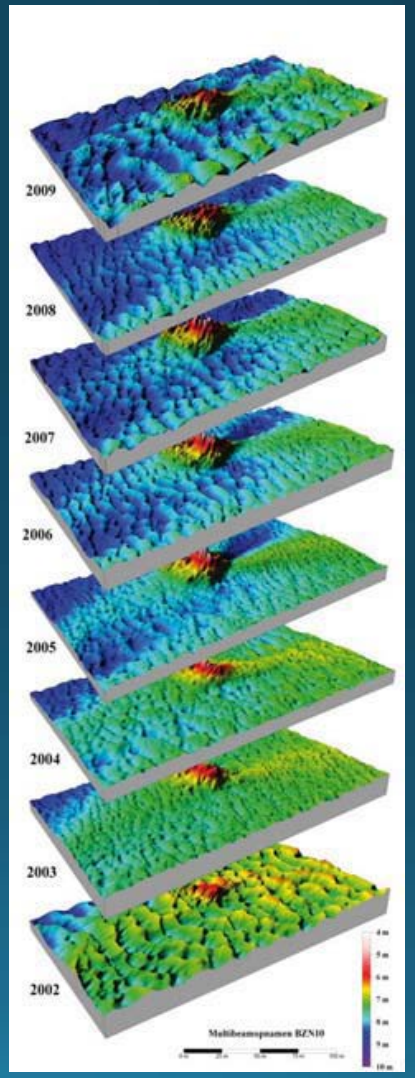
Monitoring the seabed environment

The seabed can be measured in different ways.

- Visually, underwater by divers and **Remotely Operated Vehicles**
- From the water surface with **geophysical methods** like single beam, multibeam, side scan sonar.
- From the **water surface** with traditional sounding (sounding lead).
- **From the air** with laser, aerial photography and satellite

Monitoring sites - Measuring the Extent of Deterioration

Sequence of multibeam images from the BZN 10 wreck 2002-2009. RCE Netherlands



Monitoring within the seabed

- Marine geophysical methods - multi beam sonar - to quantitatively assess change over time.
- Study sedimentary processes - current profilers, sediment sampling, turbidity sensors/loggers can be used to model sediment transport.
- Wood boring organisms - presence and activity over a site - placement of sacrificial blocks of modern wood around a site and recording their presence or absence. If they are present it is likely that any newly exposed timbers will also be colonised.

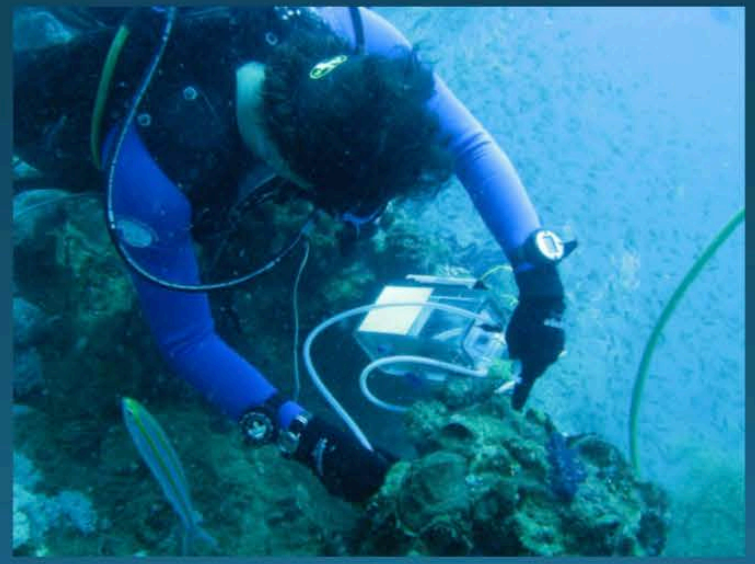
(Marine) Sediments

The effect the burial environment has on the deterioration of materials can be measured by:

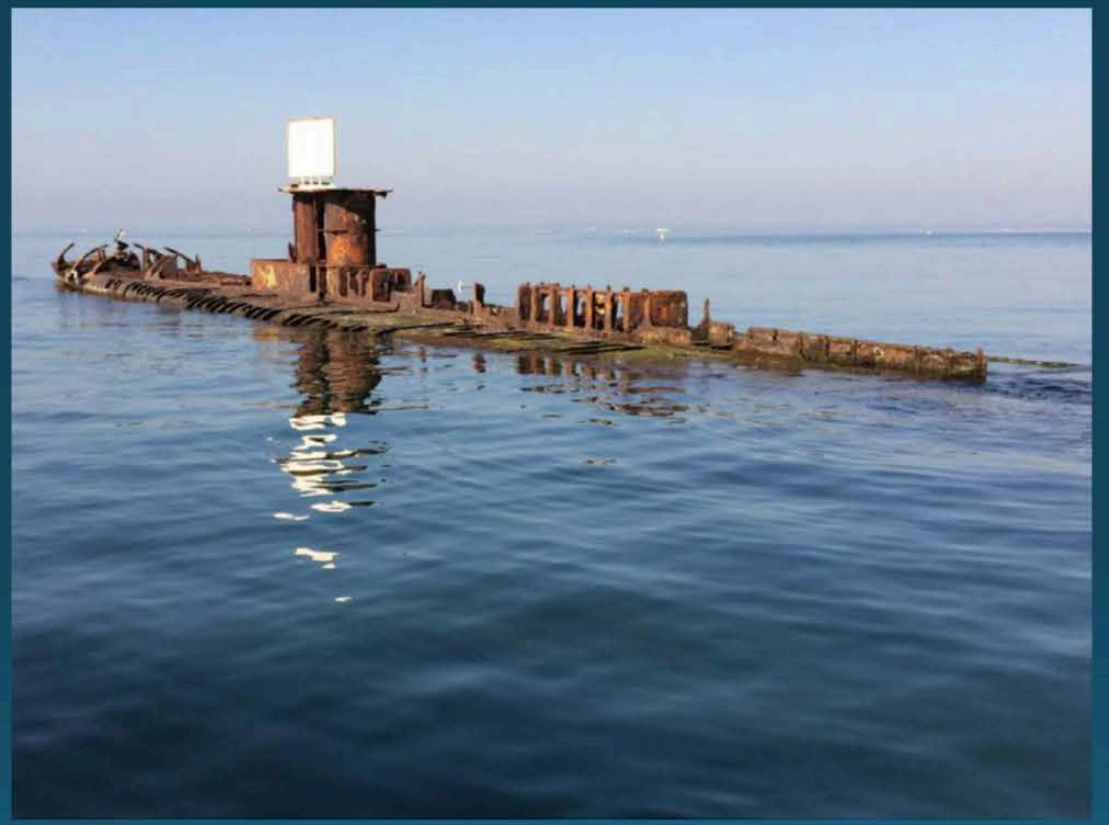
- Placing microelectrodes in the seabed, connected to a data logger
- Using sacrificial objects, which are buried in the seabed and measured for deterioration over time
- Sampling and analysing original elements, objects and sediments recovered from the site

Corrosion surveys

Parameters
-Temperature
- Depth
- Acidity / Basicity (pH)
- Evolution of gas (H)
- Redox Potential (Eh)

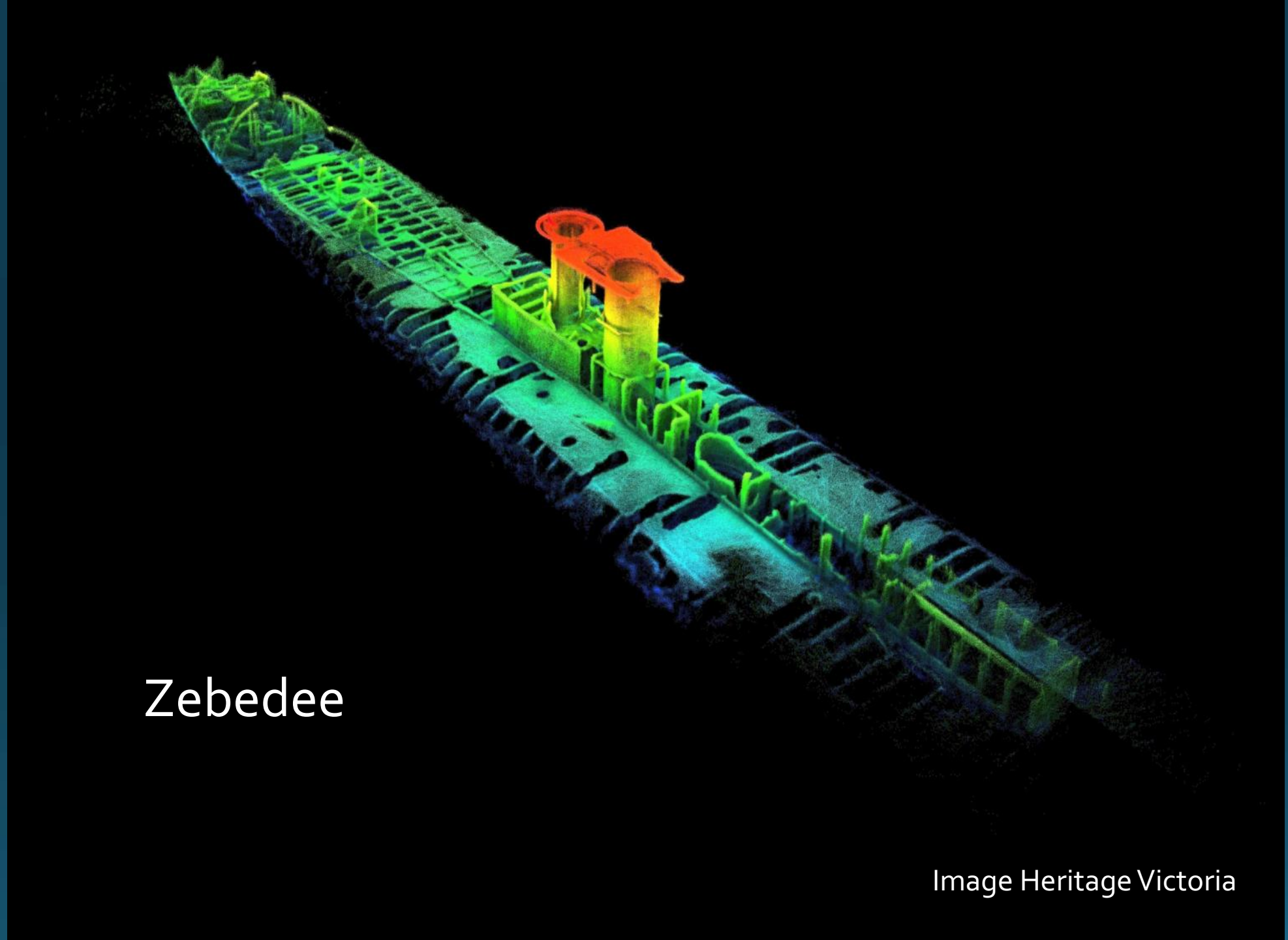


Dense point cloud - Shipwreck Documentation and Monitoring



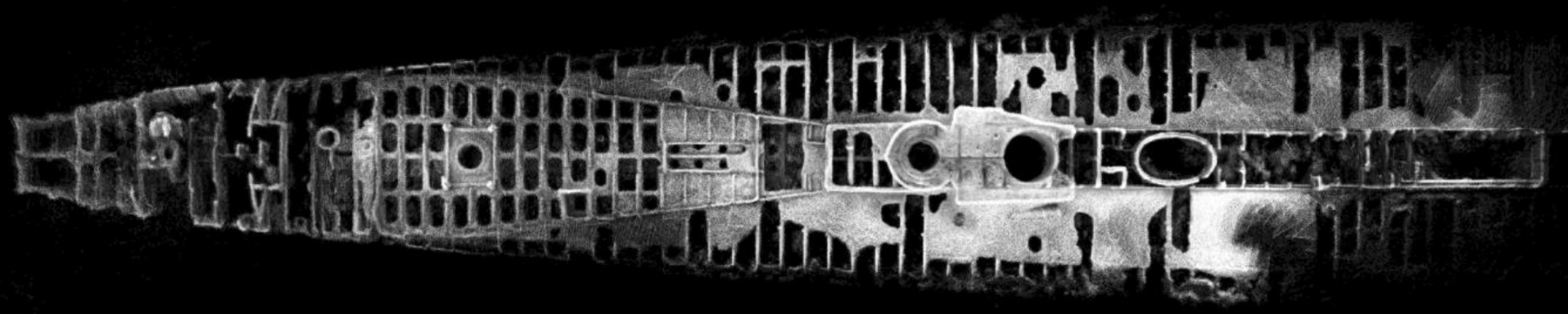
Handheld unit Zebedee

Image Heritage Victoria



Zebedee

Image Heritage Victoria



Six minutes

Image Heritage Victoria

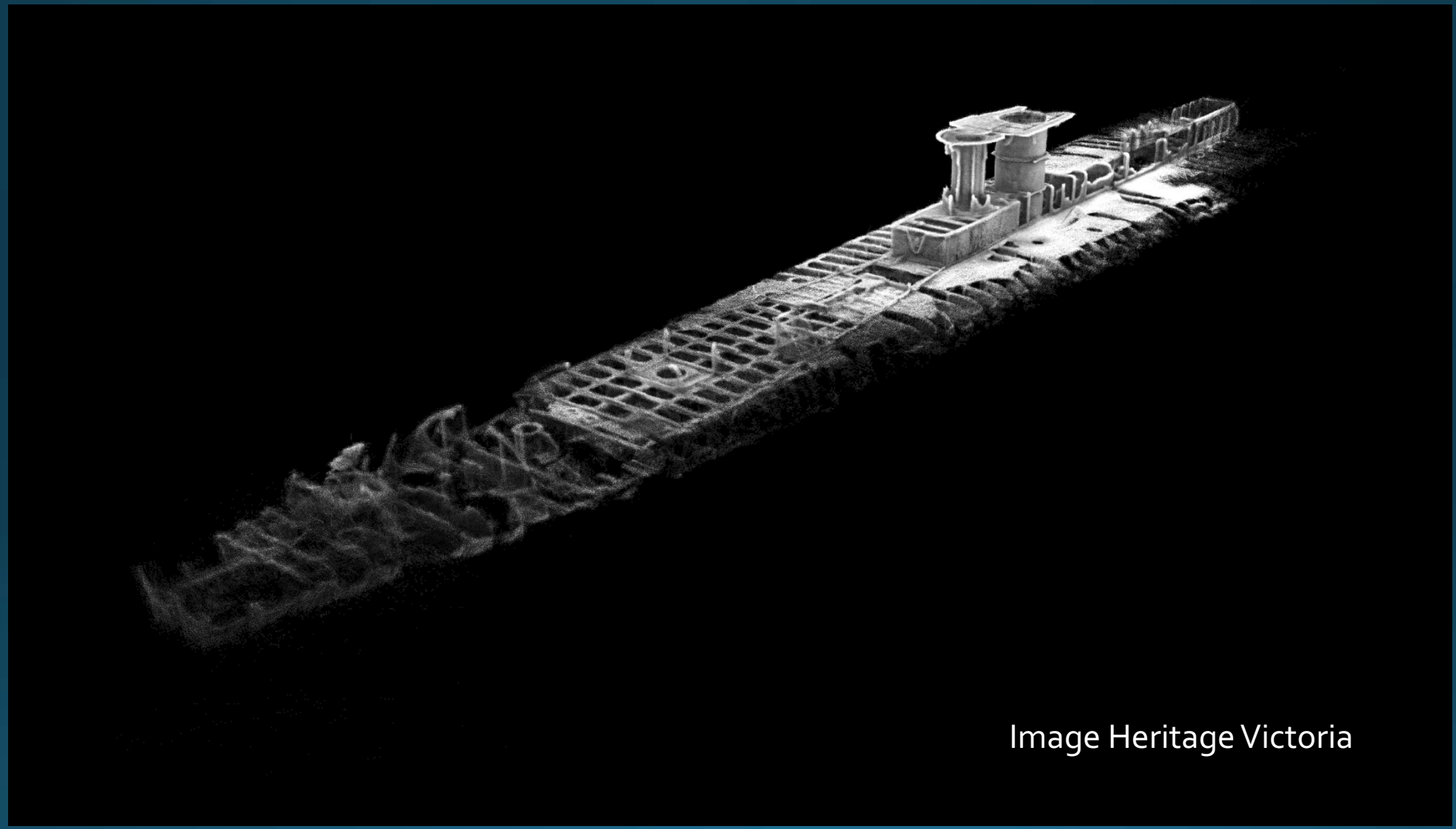
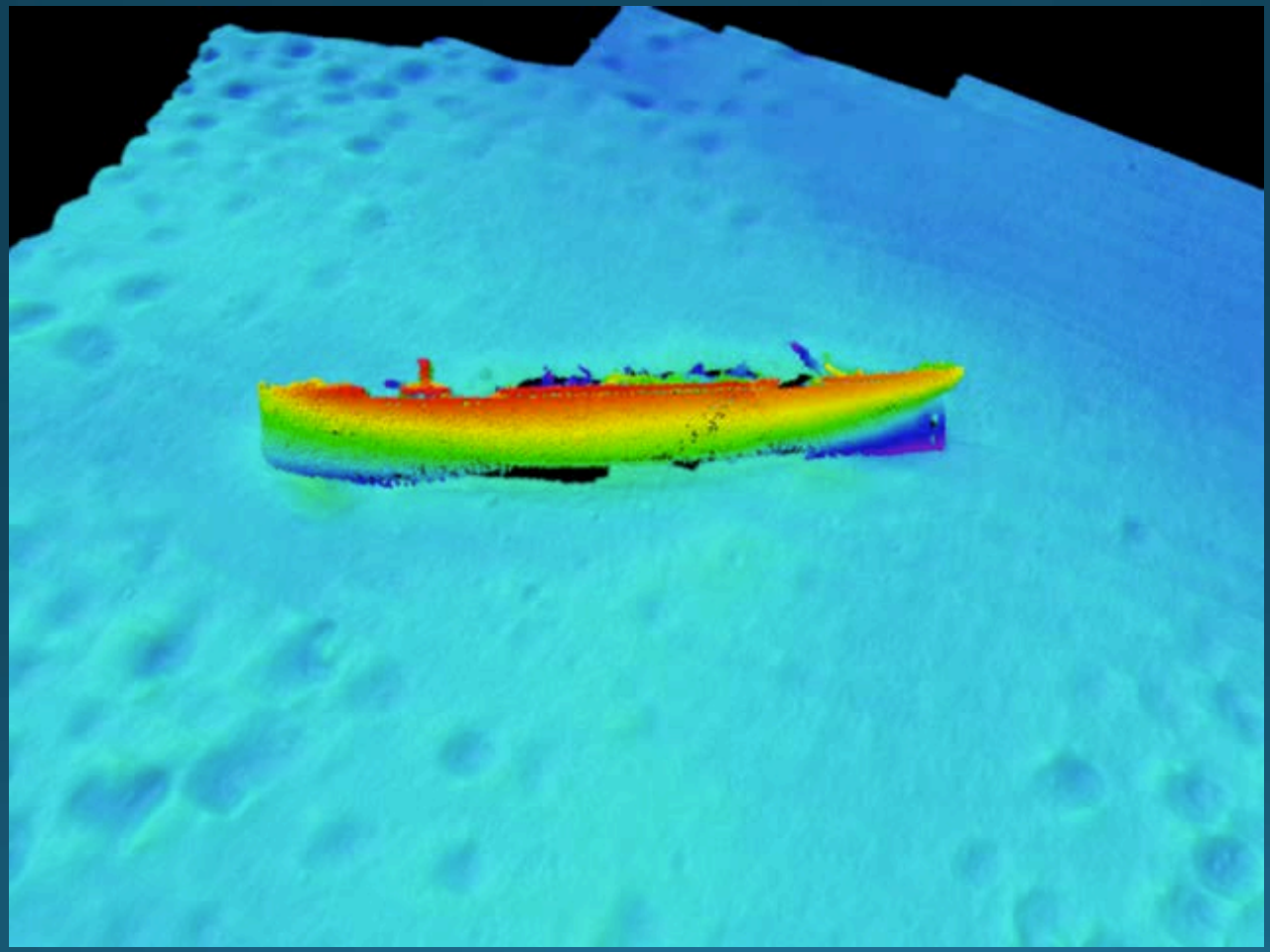


Image Heritage Victoria

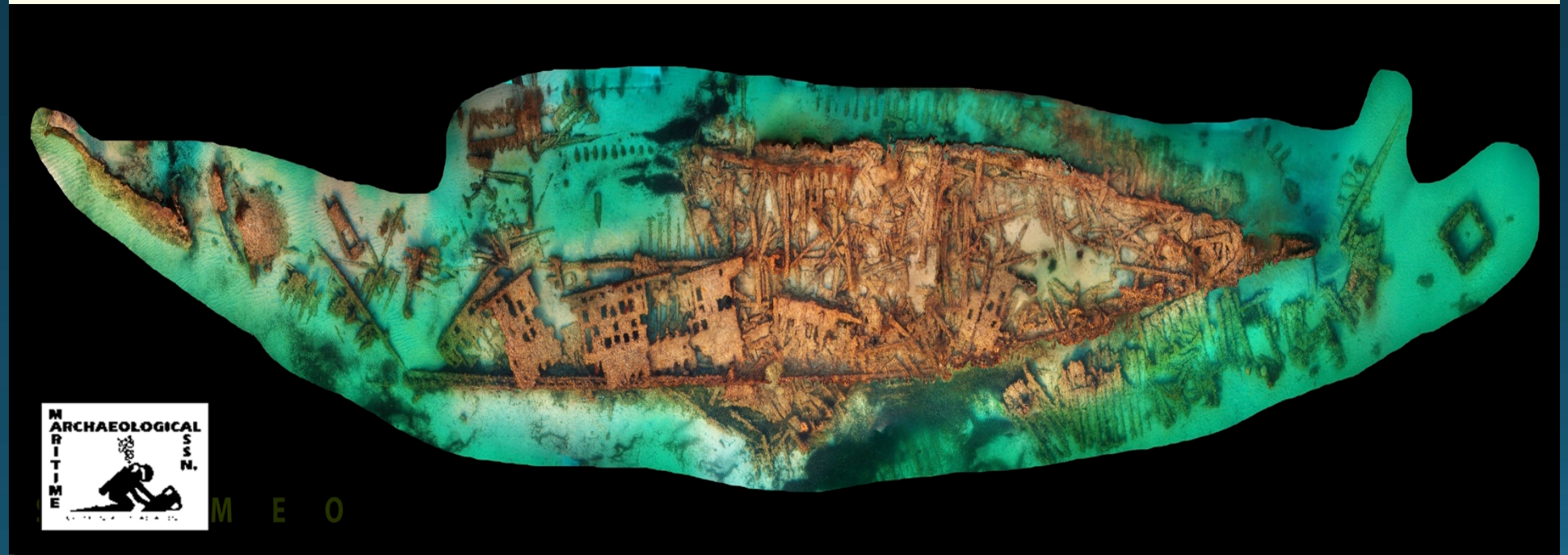
Multibeam bathymetry SS Yongala (1911)



Shipwreck Documentation and Monitoring

3DMAPPR

Two years and hundreds of hours of manual recording

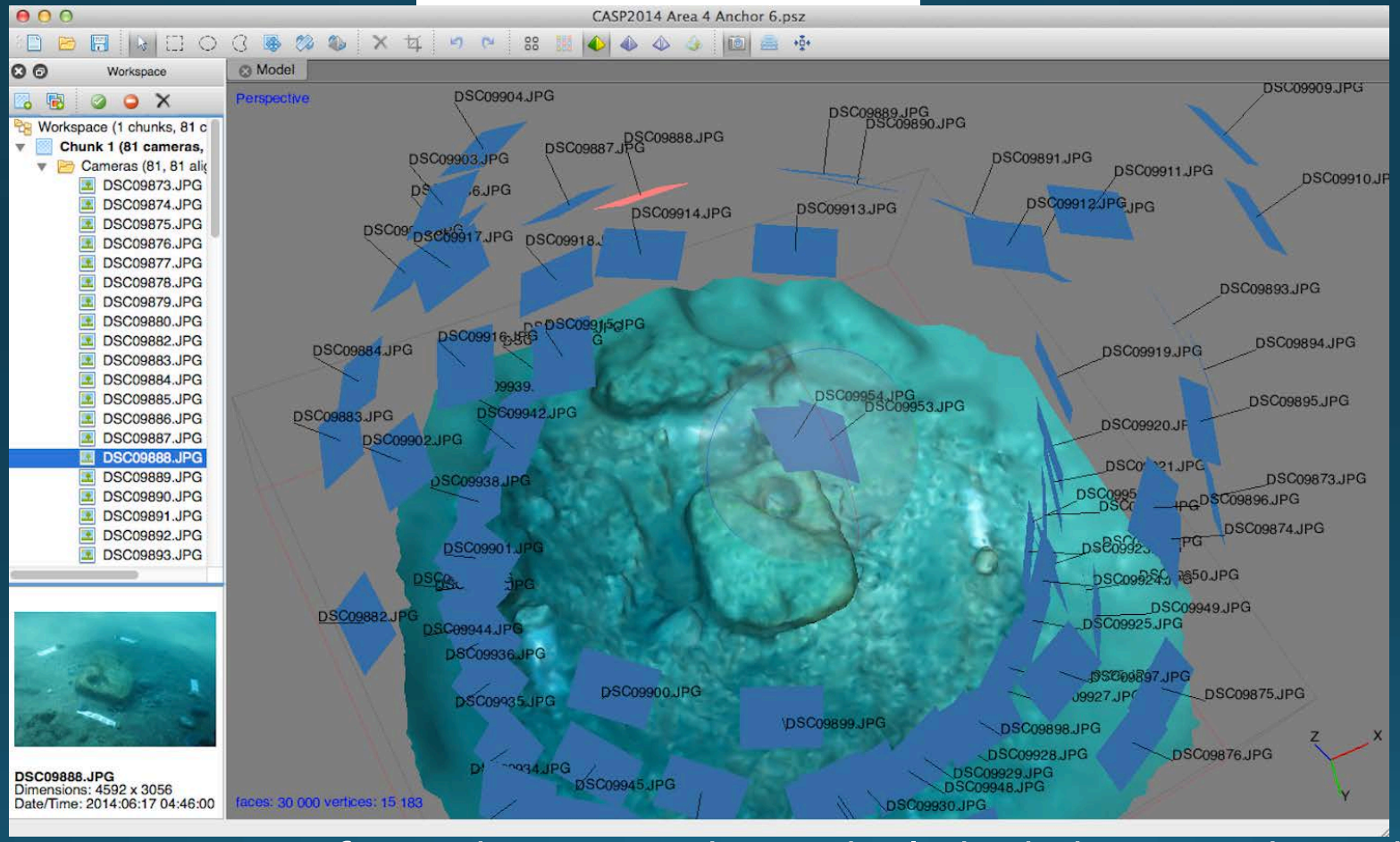


Feature Photogrammetry- Shipwreck Documentation and Monitoring

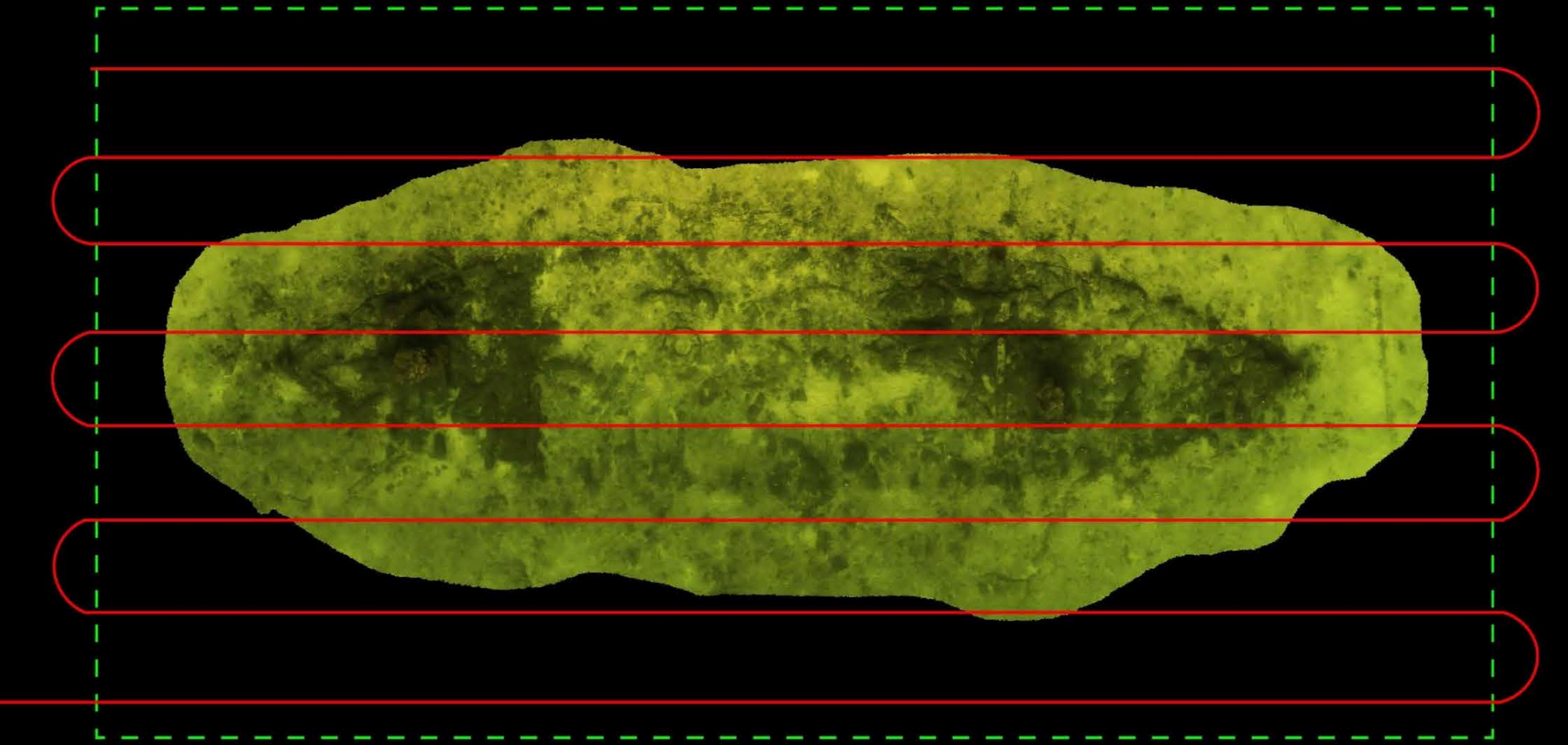
Cyprus (Viduka and Fulton) 2014 trialed photogrammetry for survey, analytical and CRM value

Underwater documentation of anchor in situ. Laminated computer generated coded targets were distributed around the anchor

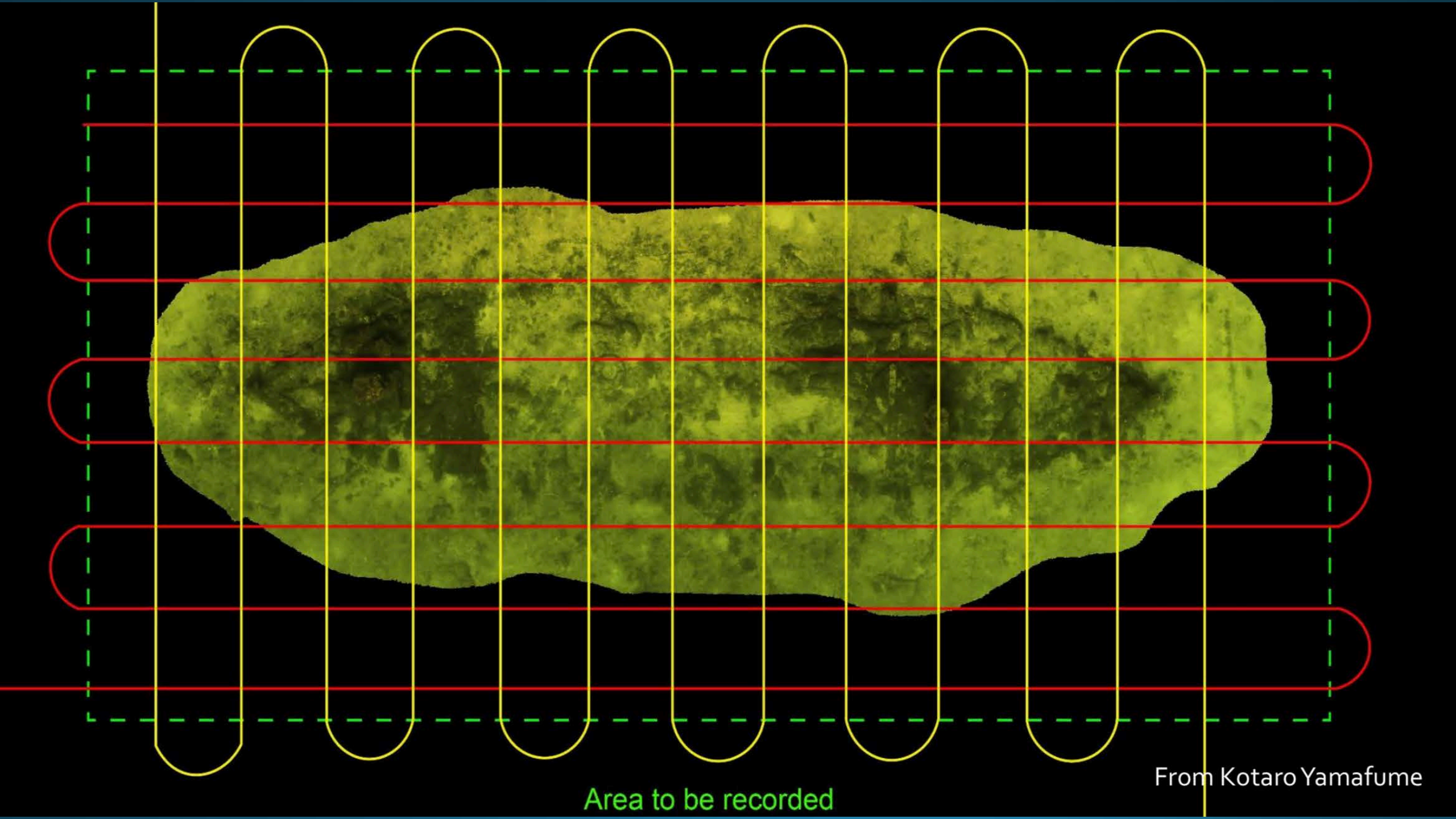
Agisoft



A screen capture from PhotoScan shows the linked photographs and surface for an anchor photographed underwater



From Kotaro Yamafume


Area to be recorded
From Kotaro Yamafume

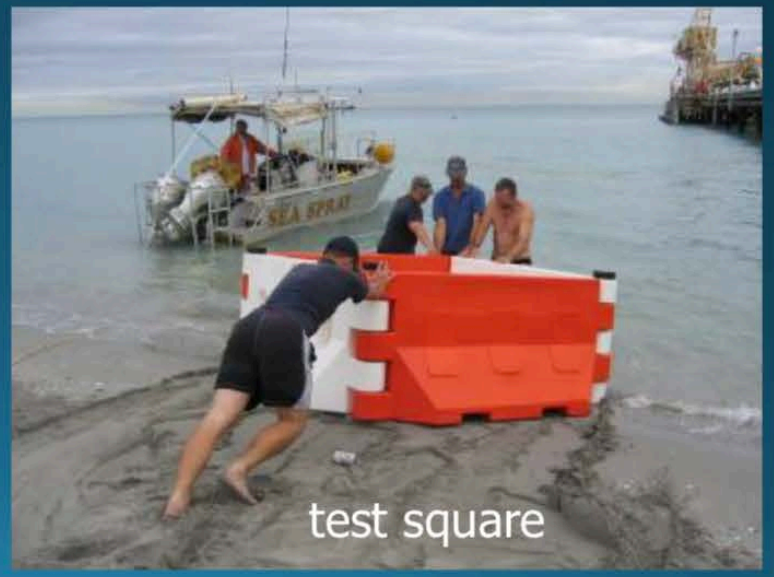
What are mitigation measures?

Reburial experiment conducted on *James Matthews* shipwreck in 2005 by Vicki Richards Western Australian Museum


polymeric sand bags


artificial seagrass mat


shade cloth mat


test square

James Matthews
Fieldwork November 2013

AUSTRALIAN
HISTORIC SHIPWRECK
PRESERVATION PROJECT

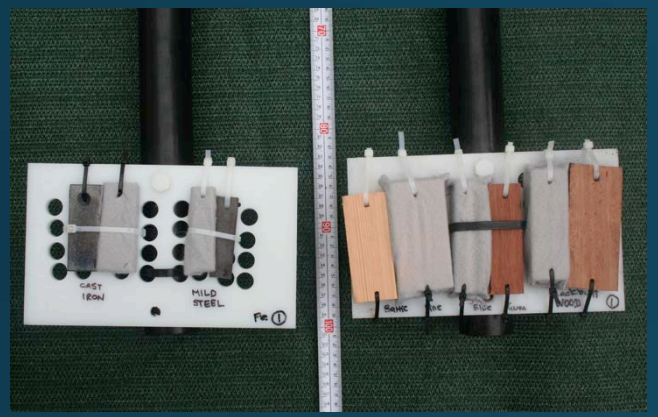
THE IN-SITU PRESERVATION & REBURIAL
OF THE COLONIAL TRADER CLARENCE (1850)

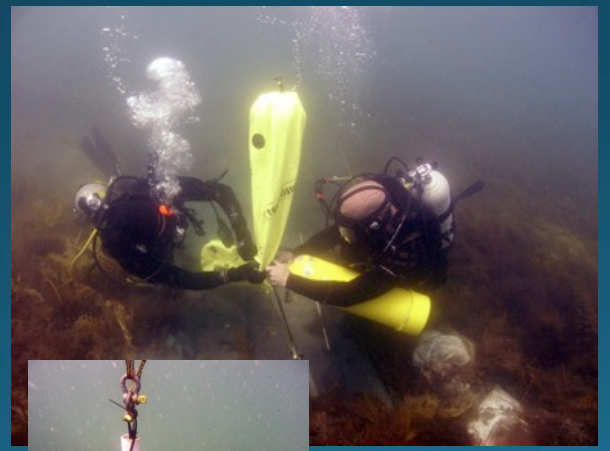
Reburial and Site Stabilisation Project aims:

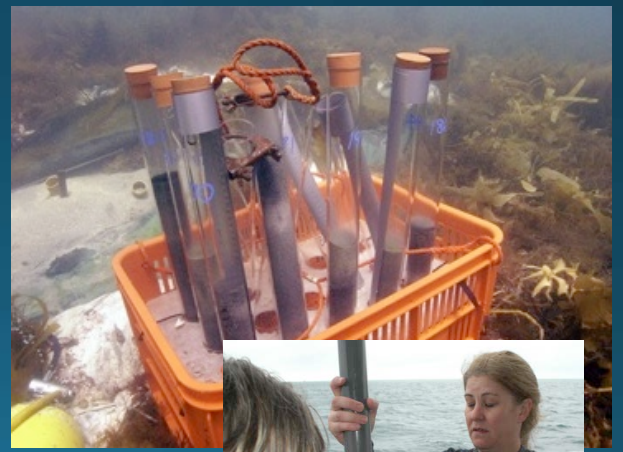
- Investigate options for research and rescue excavations without long-term conservation and storage issues
- Research and develop reburial methodologies
- Test *in-situ* preservation methodologies through case studies:
  - *Clarence* (1850) – a 'rapid recording and reburial' strategy
  - *James Matthews* (1841) - development and investigation of an innovative reburial strategy

AUSTRALIAN HISTORIC SHIPWRECK PRESERVATION PROJECT

THE IN-SITU PRESERVATION & REBURIAL OF THE COLONIAL TRADER CLARENCE (1850)



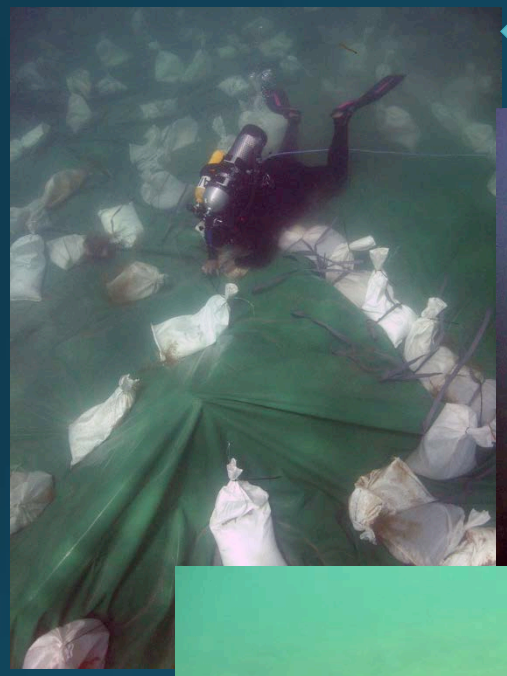




Images by AHSPP/Jon Carpenter

AUSTRALIAN HISTORIC SHIPWRECK PRESERVATION PROJECT

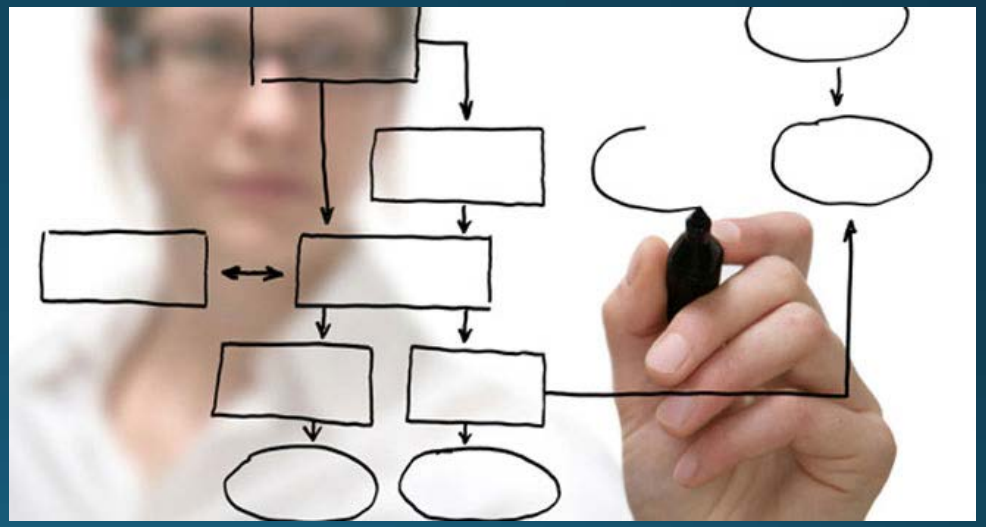
THE IN-SITU PRESERVATION & REBURIAL OF THE COLONIAL TRADER CLARENCE (1850)



November 2012

Images by Jon Carpenter

GIRT methodology



Utilising established methods and variables used in site condition, marine science and documentation survey

GIRT

Scientific Divers

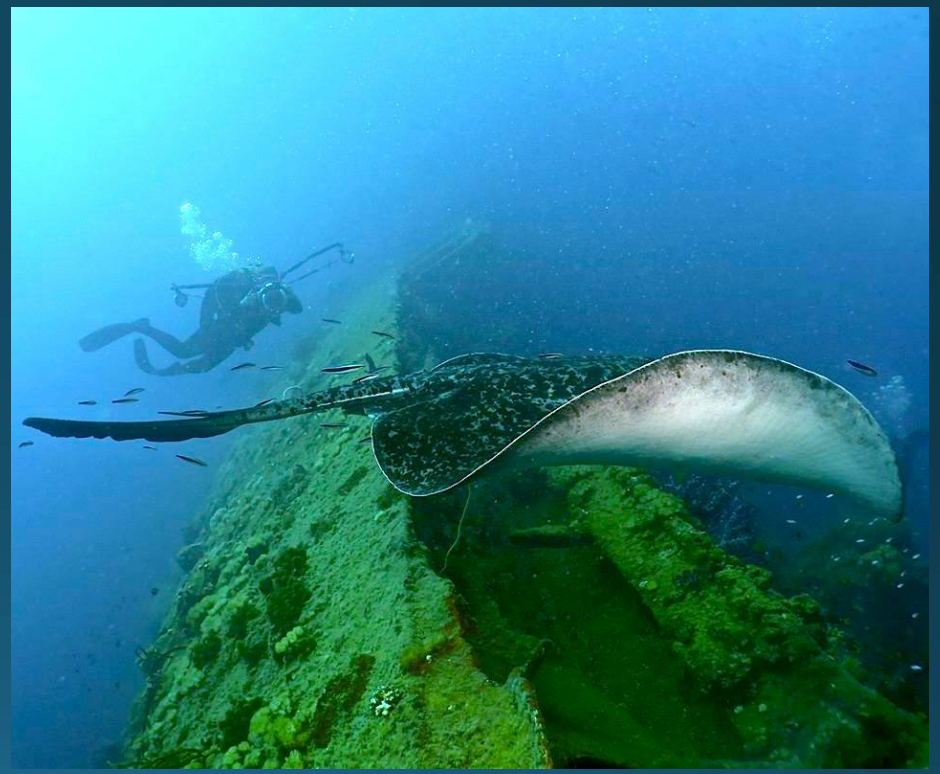
Adopt a wreck
Answer initial questionnaire survey
Develop a site mudmap
Populate template survey data sheet
Photo condition survey
30 m transect video survey
Feature photogrammetry
TBA – Your preferred Marine environment citizen science model
Upload survey data and labelled images and video into ANSDB
Repeat two more times (or once a year for three years)
Do exit survey questionnaire

GIRT – 39 Site Survey data fields

1 - Date of Survey
2 - Time of Survey
3 - Observer/s name
4 - Survey experience (approximate number of surveys completed)

5 - Site (name of wreck, year of sinking)
6 - Location (stern, midships, bow) in decimal degrees –
7 - Site Orientation (compass bearing stern to bow)
8 - Site Classification (using Muckelroy)
9 - Site Dimensions including debris field (length, width, area)
10 - Composition of dominant wreck material (iron, aluminium, wood)
11 - Distance from Land/Reef (nautical miles)
12 - Degree of site exposure (height above seabed)
13 - Percentage of concretion coverage on site

14 - Location of lowest point on wreck
15 - Depth at lowest point on wreck
16 - Location of highest point on wreck
17 - Depth at highest point of wreck



GIRT – Site Survey data (continued)

18 - Water Temperature (surface, at depth)
19 - Visibility (<5m, 5-10m, >10 m)
20 - Weather Condition
21 -Sea Condition
22 - Swell
23 - Current at surface (rate, direction, speed)
24 - Current on site (rate, direction, speed)
25 - Tide at survey (Low, Mid, High)
26 - Freshwater/Saltwater Influence (rivers, springs, sea water)
27 - Flood plume (Yes, No)

28 - Seabed Topography (flat, crest, slope)
29 - General Sediment Composition
30 - Mobility of sediment surface (rippling, direction and frequency)
31 - Sediment build up on site (Yes, No) (indicate on mud map)
32 - Sediment Slope (gradient)
33 - Sediment Gradation (changes in colour) (Yes, No)

GIRT – Site Survey data (continued)

34 - Evidence of timber infestation by marine borers (Yes, No)
35 - Exposed artefacts (indicate on mud map)
Photograph with scale
36 - Evidence of seasonal or storm/cyclone exposure
37 - Evidence of human disturbance
38 - Is rubbish present around the site (Yes No)
Number of pieces in survey area (fishing line, plastic, netting, rope, other)
39 - Your observation about change of the site's condition from one observation period to another (subjective) Change quantified as a number between (1 -10)

Last step - qualitatively assessing the THREATS and RISK to your site

A site is **threatened** if there is evidence of cultural or natural activity that has negatively impacted the potential preservation of the site.

While some actions are indications of threat ,the risk those activities pose to the site's preservation vary considerably.

Threat + Likelihood + Consequence = Assessed Level of Risk

Threat to UCH

Likelihood of threat

Numerical	Historical	
>80%	Is expected to occur in most circumstances Has occurred in the past year	Likelihood
60-79%	Will probably occur Has occurred in the past two years	
29-59%	Might occur at some time Has occurred in the past five years	
10-29%	Could occur but considered unlikely or doubtful Has occurred in the past ten years	
<10%	May occur in exceptional circumstances Has not occurred in the past ten years	

	Consequence				
	Minor	Moderate	High	Major	Critical
Highly Likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

Threat and Risk Level Assessment

Examples of threats, their likelihood and consequence

1 - The site has been totally or partially exposed by a major weather event

Highly likely – Moderate to high Consequence – HIGH threat

2 - Timber appears newly exposed on the site

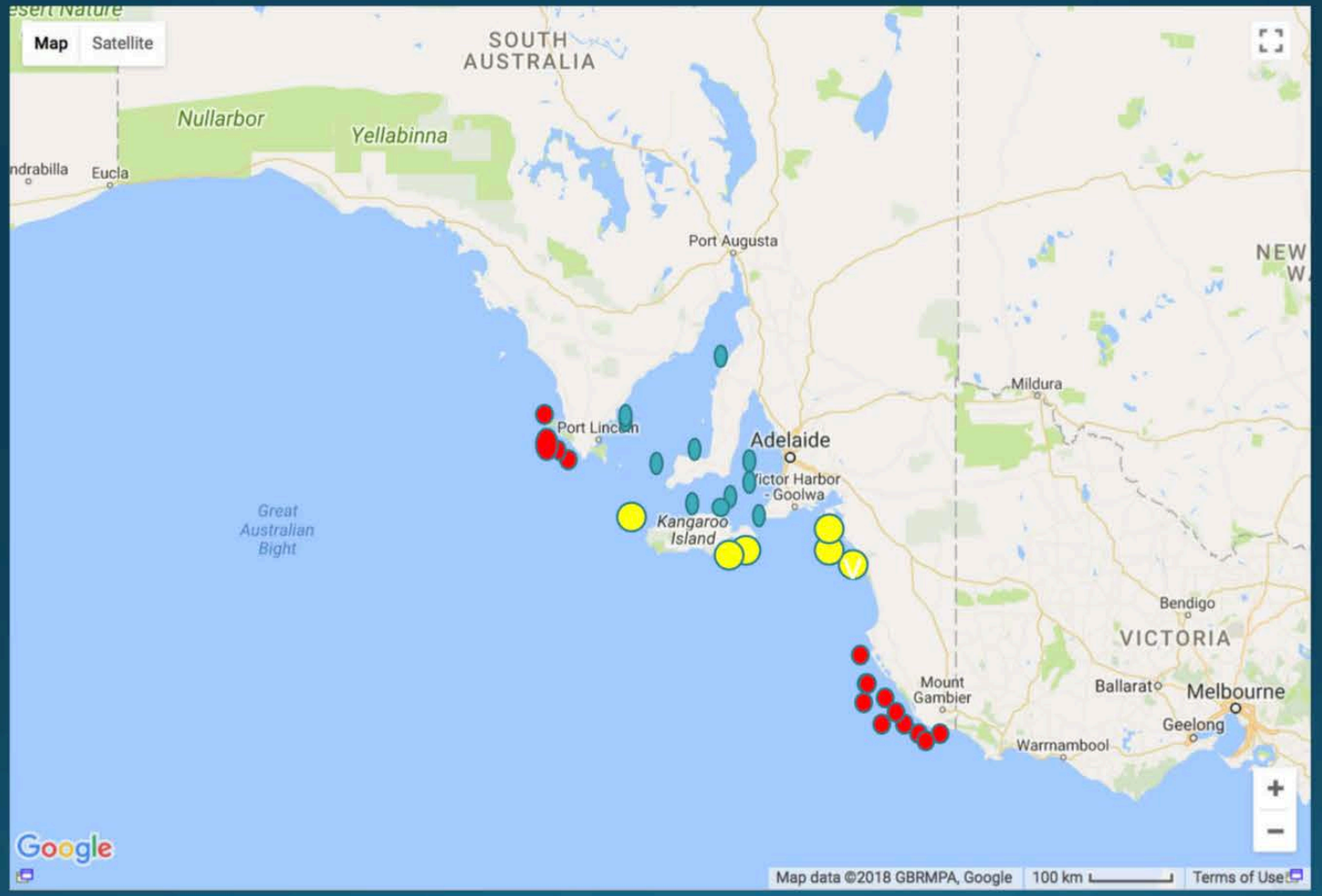
Likelihood ? Consequence? - Threat level?

3 - Evidence of visible anchor damage

Likelihood ? Consequence? - Threat level?

GIRT

This could allow us to.....

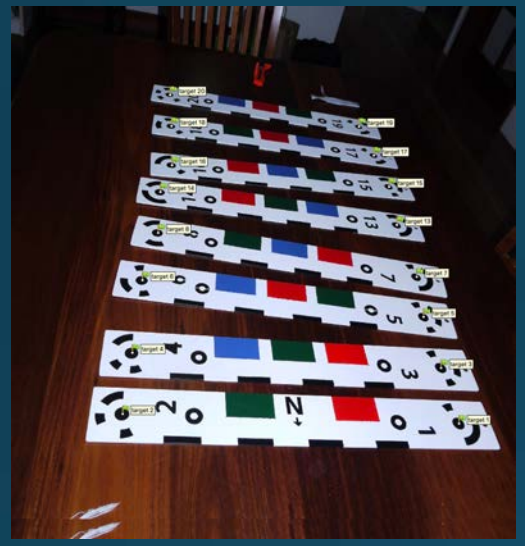


Spatially see sites that are threatened and potentially even see the impact of broad scale events

Simple equipment and specific task focus

Compass

Depth and temperature



Wreck Check Photogrammetry Scale with north arrow

GIRT

ANSDB

Australian National Shipwrecks Database

UW camera stills and video

Tape

Dive slates with pro forma templates

Equipment needed

- Personal dive gear (compass, and depth gauge (with temp))
- Camera and UW housing
- One meter colour scale
- Dive slate, pencil and water proof paper
- 30 meter tape

- For Photogrammetry
- RADS (+ L shaped config for site imaging)

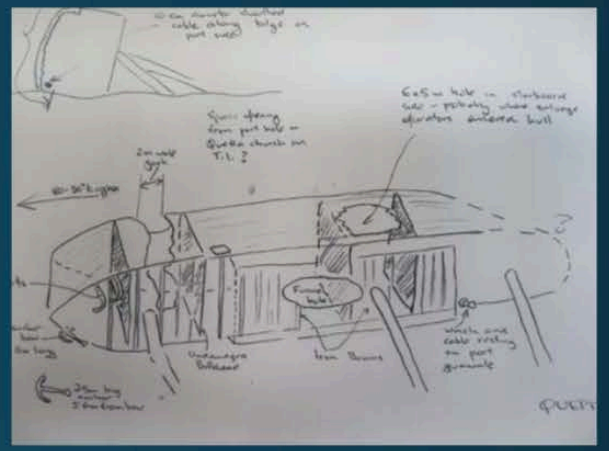
- At home – computer
- Optional – Agisoft Photoscan Standard or Pro Version

What is a Mud map and how to make one

The sketch should show:

- Important features on the site in relation to each other
- Approximate dimensions of the site, length and width
- The orientation of the site, which way is north
- Note if the site is submerged, intertidal or above water
- Water depth at points across the site, or heights if on the foreshore
- Note if the site is intact, broken up or scattered, upright, on it side or upside-down
- Notes on any features or objects on the site
- Notes on potential for buried objects
- Notes on seabed types
- Potential hazards such as trawl nets
- The 'metadata' that tells us about the sketch; who drew it, the name of the site, when it was drawn, the depth, visibility and current on the site at the time

http://www.3hconsulting.com/techniques/TechSketching.html



Selecting sampling locations and identifying features

- For the purposes of GIRT – select a number of prominent features on the site that enable you to see sediment movement and/or the effects of scouring on individual objects
- Remember that the site can be impacted from any direction and your sample selection needs to account for this fact
- Ideally you should be able to swim around all your chosen sites in one or two dives and do all photo documentation and metadata requirements

Filling in the GIRT templates- above water below water

- Of the 39 survey questions, slightly less than half are to be populated on the surface before diving

- The focus of template questions underwater is to understand the site layout, depth, condition and the environment the site is in. This focusses on the slope and geology of the seafloor and the uniformity of the covering of marine materials

Photo condition reporting

- Refer **GIRT – Photo condition reporting guide**

Images taken with scale – Oblique (45 degree), elevation, plan and detail views

Witnessing damage to a site

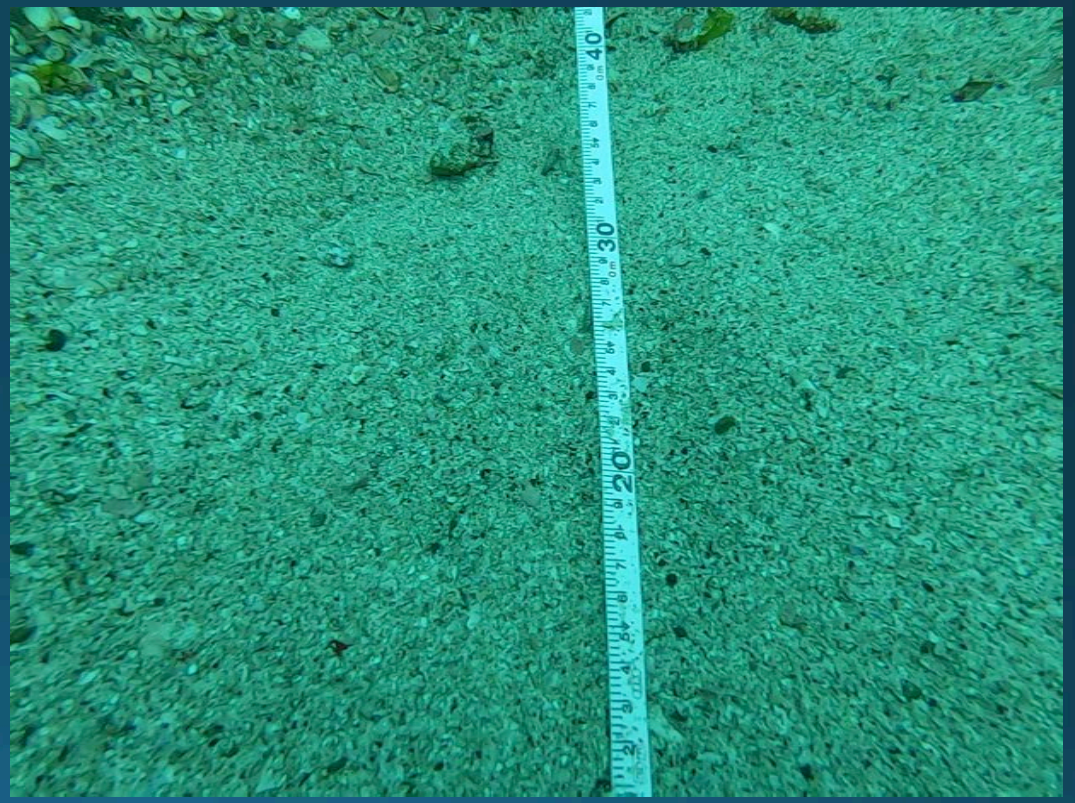
During GIRT activities, members may see damage caused by divers or anchors to a protected[1] site or even to a site that is not known to be protected under any legislation

Proposed action, in line with the principle of condition reporting the site…

- photo document the damage
- make notes of your observations
- add these to your site survey
- on return to shore, advise the relevant authorities

[1] In every country there is different legislation protecting heritage. In Australia all shipwrecks 75 years old or more are protected. In New Zealand shipwrecks that occurred before 1900 are protected.

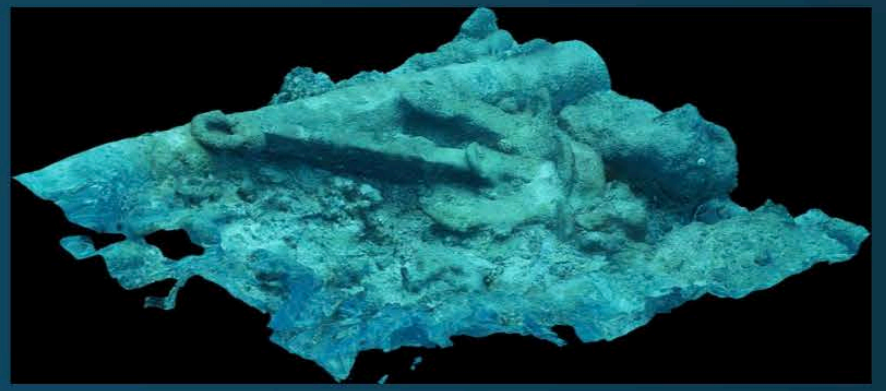
Video transect survey



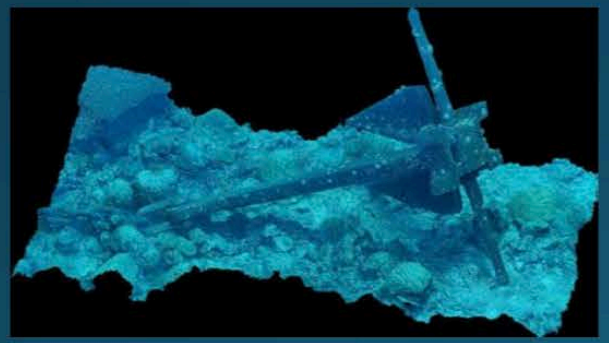
Lay down a measuring tape 30 m between two easily identifiable features that have ‘typical marine coverage’. Record the direction of the tape from one feature to another and depth. Slowly swim in one direction ~ 3 meters above the tape keeping the tape in the centre of the viewer.

Feature photogrammetry

Photogrammetry of props from Catalina JX 435 wreck Cocos (Keeling) Islands



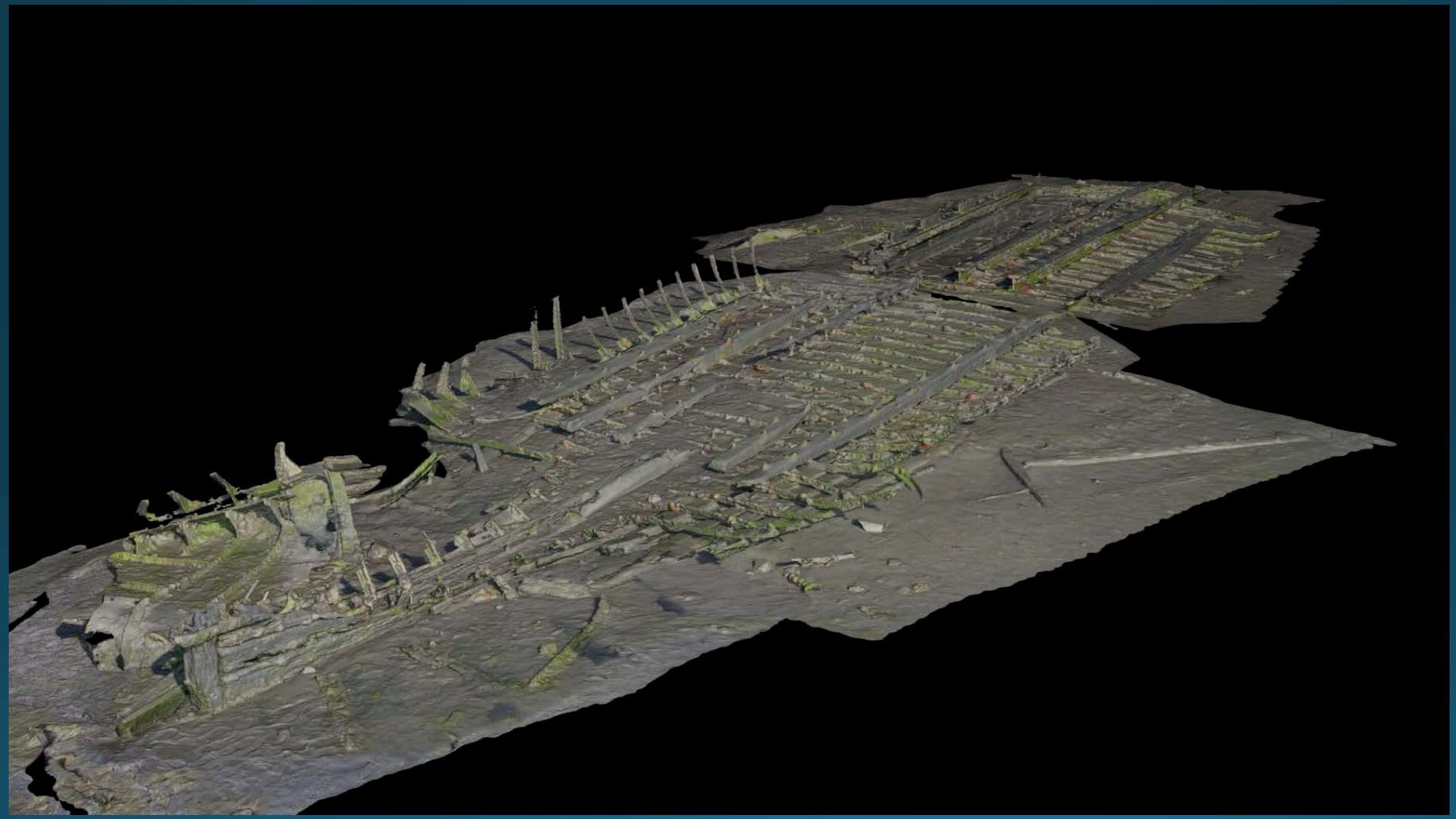
Chunks from a site model of SMS *Emden*, North Keeling Island



Rendered models of two anchors, one located outside the Golden Bosun Tavern and one from underwater in Flying Fish Cove, Christmas Island

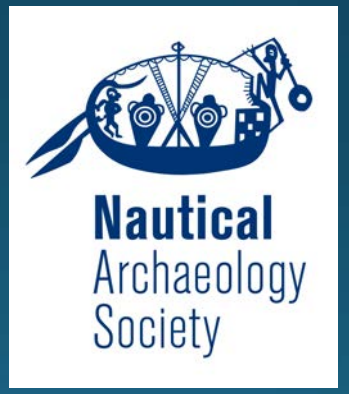
Rendered model of a Prahu Cadik at from Flying Fish Cove, Christmas Island

PS *Trafalgar*, South Australia



Keen to learn more? - AIMA/NAS

AIMA, in conjunction with the Nautical Archaeology Society (NAS - United Kingdom), teaches a 4-part course on maritime archaeology. This internationally recognised course is currently run in the UK, South Africa, New Zealand, Canada, Micronesia and the USA - among other places.



http://www.aima-underwater.org.au/parts-i-iv/

Great resources to further your knowledge

- **Training Manual** for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific
- **Manual for Activities directed at Underwater Cultural Heritage**
- **Australasian Institute for Maritime Archaeology (AIMA)/Nautical Archaeological Society** training course
- Nautical Archaeology Society (NAS) **Underwater Archaeology: The NAS Guide to Principles and Practice**
- **3H Consulting -** Peter Holt Southampton University MOOC
- **AIMA** annual conference (this year in Sydney)
- Publications supplied

GIRT

Scientific Divers

DIVE INTO AN OCEAN FULL OF HISTORY

Supported by:

Wreck Check Inc.

Australasian Institute for Maritime Archaeology

Nautical Archaeology Society

une University of New England

This project has been approved by the Human Research Ethics Committee of the University of New England