

Going for the win-win: including the public in underwater cultural heritage management through citizen science in Australia and New Zealand

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UCH managers are increasingly aware of the limitations of excluding public participation in heritage management both in terms of their own limited resources and need for wide public political support. This article assesses a pilot project in South Australia to train citizen scientists to record and monitor underwater cultural heritage sites. The results reinforced the need to ensure the data collected is robust and meaningful, and that citizen scientists know their contribution is valid; the need to help citizen scientists interpret data and foster peer-to-peer learning, and highlighted the importance of open source data for site conditions.

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In most countries in the world, cultural heritage has been protected through legislation with the intent of it being for the public's benefit. In Australia, underwater cultural heritage (UCH) management agencies have existed since the late 1970s and initially deliberately focussed on creating opportunity for the public to interact with UCH. This approach has become an increasing trend in heritage in world practice (Henderson, 1994: 6; Little, 2002: 3; Smith and Ehrenhard, 2002: 125; Smith, 2014: 750; North, 2006: 52; Viduka, 2008: 20). However, even with the ongoing public engagement efforts in Australia, and increasingly in New Zealand, today bureaucrats and maritime archaeologists are sometimes considered by members of the public as elites who control access and divorce the public from an active role or control of UCH in the name of statutory compliance or scientific rigour. This perception by the public is despite an awareness by UCH managers of the limitation of top-down administrative and legislative approaches in isolation to the community (Carman 2005; Boyd *et al.*, 2005; Smith, 2006).

Certainly, effective and appropriate public engagement in maritime heritage remains a current issue in both Australia and New Zealand. This issue can be viewed as a historic product of the balance shift from amateur-led to professional-led maritime archaeology and UCH management. It could also be seen as an issue created, or at least exacerbated, by increasingly limited human and financial resources for heritage management agencies to engage the public (Australian Government, 1996; Carter, 2006;

Carter and Dodd, 2015; Henderson, 1994; Green, 1995; McKinlay and Henderson, 1985; Viduka, 2008; 2011; 2012; 2014; 2015). However, for Australia and New Zealand, and other countries, to develop a truly contemporary UCH management regime, the role of the public must be elevated above administering a regulatory paradigm that focuses on controlling the actions of a small percentage of the population. This public-good focus needs to be appreciated, supported, and funded by governments, incorporated into all levels of programme planning and activity.

One possible way to engage the public and gain greater funding support for the public's participation in UCH is through citizen science, which has become increasingly popular in the past few decades. Citizen science offers the potential for the public to be appropriately engaged, fostering positive relationships, and for management agencies to collect data beyond their resources that informs science-based decision making. The value of data collected by citizen scientists has been gaining respectability in the mainstream scientific community (Bear, 2016: 56); however, this view remains far from universal and there have been questions about whether the data collected by citizen scientists is as scientifically valid as data collected by traditional methods (Cohn, 2008: 192–197). Concerns have also been raised about whether researchers are asking volunteers to perform unrealistic, overly complex tasks (Lukyanenko *et al.*, 2016: 447–448).

This article outlines the background, methods, learning outcomes, and preliminary observations from

a pilot project conducted in South Australia from July–December 2018 for a maritime archaeological-conservation focused citizen science project. Prior to the pilot project, the author hypothesized that elevating public participation through a conservation-focused programme could invert the current UCH management focus in Australia and potentially establish a paradigm in New Zealand that prioritizes the delivery of ‘public good’ conservation outcomes over statutory compliance. UCH managers in Australia and New Zealand are conscious that the core of good compliance is a regulated, educated and aware community; however, few resources are generally available to achieve this outcome, hence a focus on enforcement occurs, which is generally more easily funded. It is argued that through the proposed public good paradigm of site management there exists a plethora of positive outcomes including: greater potential for increased knowledge; increased positive engagement with the public; social value; public good and public benefit; enhanced engagement and support for statutory compliance; improved reporting of site discoveries; and ongoing management outcomes.

Climate change and UCH

The destruction of UCH has increased rapidly in the past 200 years, driven increasingly by anthropogenic activities. However, with climate change and increasingly violent storm events occurring more regularly, a site’s equilibrium with its physical environment is under increased threat from natural events. The Earth’s climate is no longer in a familiar equilibrium. As a result of climate change, impacts to archaeological sites is occurring at the level of the microscopic microbial (Hollesen *et al.*, 2017: 94) through to the macroscopic terra-forming (Jensen, 2017: 131; Benlloch *et al.*, 2017: 81; Dawson *et al.*, 2017: 23–25; Lopez-Romero *et al.*, 2017: 73–74; Palsdottir and Feeley, 2017: 102).

The rate of loss of cultural heritage is currently not quantified in most countries, though early coastal monitoring in Scotland since the mid 1990s (Dawson, 2003), and later in England (Wragg *et al.*, 2017), Wales (Gerrard, 2017), Ireland (Bonsall and Moore, 2017), Brittany (Benlloch *et al.*, 2017), Alaska (Jensen, 2017), Iceland (Palsdottir and Feeley, 2017), Greenland (Hollesen *et al.*, 2017), Australia (Carmichael *et al.*, 2017) and Cyprus (Andreou *et al.*, 2016) has demonstrated that our located tangible heritage along the coastline is being lost. By extrapolation that also implies that unknown and unlocated heritage is also being lost. A critical element that is required to understand the rate and magnitude of the destruction of known underwater and intertidal cultural heritage is more real-time data (Viduka, 2019).

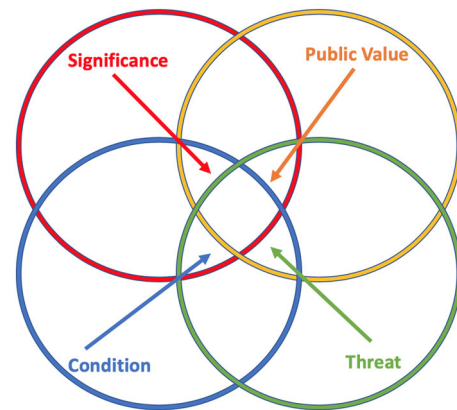


Figure 1. Indication of the intersect of major considerations in a decision model to allocate limited resources for the purpose of protecting a threatened underwater site. Note that two elements, condition and threat are science-based. Public value is identified as separate to historical or archaeological values due to its capacity to shape consideration separately. Direction of arrows indicates increasing state of preservation, significance, threat, or public value.

Managing UCH *in situ*

Under the 2001 *UNESCO Convention on the Protection of the Underwater Cultural Heritage* (the 2001 Convention), *in situ* management of sites is promoted as ‘a first option’ (UNESCO, 2002: 52). It has long been understood that managing heritage *in situ* in the marine environment requires a holistic multidisciplinary approach and regular monitoring (Murphy, 1983; Oxley, 2001). Cultural heritage resource managers primarily manage cultural interactions with a site and attempt to mitigate effects, where possible, of natural events that would cause deterioration. However, UCH managers need basic information as a minimum: where the site is; what condition it is in; what values it may have (public, historical or archaeological); and what cultural and natural processes are threatening or impacting the site (Fig. 1).

To inform this knowledge an UCH manager needs to effectively and systematically monitor sites consistently as part of a planned longitudinal programme.

The shipwreck resource

Australia protects shipwrecks located from the lowest astronomical tide along the coastline out to the end of the Exclusive Economic Zone (EEZ). Approximately 7500 historic shipwrecks are protected that were sunk at least 75 years ago, or individually declared, whether located or unlocated (Viduka, 2014: 13). Since 1 July 2019, the Australian Government’s *Underwater Cultural Heritage Act 2018* extends that protection to submerged aircraft that were sunk at least 75 years ago or individually declared, whether located or unlocated,

Table 1. Breakdown of human resources available for protecting and conserving UCH in 2019

Country	Number of maritime archaeologists/UCH managers	Number of conservators with experience in wet archaeological materials	Number of conservators who can dive
Australia	15–20	10–15	<5
New Zealand	2–5	1–3	1

starting from three nautical miles out to the end of the EEZ. Other UCH can also be individually declared protected under the *Underwater Cultural Heritage Act* 2018. Australian States and the Northern Territory have similar legislation which protects shipwrecks in internal waters (bays, rivers, and lakes).

New Zealand has 2195 shipwrecks recorded around its coastline, in the Australasian Underwater Cultural Heritage Database (AUCHD), previously known as the Australian National Shipwrecks Database (ANSDB) (Luckman and Viduka, 2013: 76). Only 1519 vessels were sunk before 1900 and are automatically protected unless individually declared under New Zealand's *Historic Places Act* 1993.

For Australia, the management of UCH balances protection of the site with maintaining public access for recreational, scientific, and educational purposes. Thorough documentation is required to assess the physical condition of sites and to determine the chemical, electrochemical, and biological factors driving deterioration (Manders, 2012: 215). In saying that, the author contends that regular systematic observations of the macro environment alone can be used to note trends of stability and condition.

In the face of cultural and environmental challenges, heritage managers must do what they can to protect sites and their associated values. A common challenge that UCH managers face in monitoring the condition of sites is the availability of resources, both human and operational funding. Australia and New Zealand are not exceptions to this case (Viduka 2014). Through Australia's National Historic Shipwrecks Program each jurisdiction reports annually on activities including their monitoring of sites (Australian Government, 2019). Based on those unpublished reports, detailed site monitoring (rather than a simple rapid visual inspection) by maritime archaeologists or archaeological objects conservators throughout Australia is typically less than 40 shipwrecks per year. This model of data collection by a small body of professional archaeologists, conservators, and scientists is not sufficient to effectively manage the total resource (Table 1).

To enable science-based decision making in UCH management more data about what is happening to more sites is required to enable effective prioritization of available limited financial and human resources.

Site monitoring surveys

Thorough documentation is required to assess an UCH site's condition and the impact of cultural activity and or changing environmental parameters on a site's formation and preservation. Many authors have published on *in situ* conservation, site stabilization/reburial, site-formation processes and the factors leading to those processes (Dumas 1962; 1965; Frost, 1962; Nesteroff, 1972; Muckelroy, 1977; 1978; Wildesen, 1982; Florian, 1987; Pearson, 1987; Schiffer, 1987; Oxley, 1996; 1998; Guthrie *et al.*, 1994; Ferrari, 1995; Gregory 1996; 1998; 2007; Murphy, 1997; Stewart, 1999; Ward *et al.*, 1999; Martin, 2011; Keith, 2016). The parameters used by authors in conservation literature to assess the condition of a submerged site can be broadly classed as mechanical/physical, chemical, biological, and electrochemical factors. Without specific scientific equipment, measuring these factors is impossible. However, maritime archaeological conservation documentation includes reference to a large number of qualitative and quantitative values that can be observed by non-professionals and measured using standard diving equipment temperature and depth gauges. The acquired values can broadly indicate the stability or change of a site.

Since the mid 1990s the term 'citizen science' has been used to describe research conducted by non-professionals, entering the Oxford dictionary in 2014 (Strasser *et al.*, 2019: 53–54). On a global basis Scotland has been in the forefront of community engagement with two coastal-focused public archaeology programmes: the Scottish Coastal Archaeology and the Problem of Erosion (SCAPE) and Scotland's Coastal Heritage at Risk Project (SCHARP) (Dawson, 2003: 2016; Dawson *et al.*, 2017; Graham *et al.*, 2017; Hambly, 2018). England and the United States' Florida Public Archaeology Network (FPAN), have also led in UCH community engagement. In England there has been a number of projects created or led by groups such as the Nautical Archaeological Society (NAS), which developed the Adopt-a-Wreck scheme in about 2000, which encourages members of the public to document shipwreck sites they visit (NAS Programme). Other projects have been developed and delivered by Wessex Archaeology, the Maritime Archaeology Trust (Arch-Manche project) and the Museum of London Archaeology (Coastal and Intertidal Zone

Archaeology Network project). In more recent years, citizen science projects have blossomed globally with thousands of projects happening around the world (Benlloch *et al.*, 2017; Bonsall and Moore, 2017; Carmichael *et al.*, 2017; Gerrard, 2017; Hollensen *et al.*, 2017; Jensen, 2017; Palsdottir and Feeley, 2017; Wragg *et al.*, 2017; Zooniverse, 2019).

Within the context of archaeology, citizen science has been incorporated into 'public' archaeology. The FPAN undertake a range of community engagement programmes (Scott-Ireton, 2014; Scott-Ireton and Moates, 2019) and defines public archaeology as:

...a branch of modern archaeology that focuses on increasing public awareness and education about archaeology. A goal of Public Archaeology is the preservation of the fragile sites of our prehistoric and historic past that are being destroyed at an alarming rate through natural process and development... (FPAN, 2019).

Scientists striving to obtain data beyond their physical means have embraced a citizen science approach to develop a more geographically comprehensive, if not always statistically robust dataset (Smith, 2014: 749–750). By aligning the role of an archaeological heritage manager to enable public engagement with the need to create value for the community from the archaeological record, the project discussed here proposed to demonstrate the potential of making a useable past for the public (Little, 2002; Smith, 2006) for the benefit of heritage preservation, the divers, and the public good (Jewell, 2004; Edney, 2011; 2012; 2018; Underwood, 2015).

Conservation site assessments

Pre-disturbance, post-disturbance, and monitoring surveys are all employed by maritime archaeologists and management agencies to understand the condition of submerged sites at specific times. Through establishing a complete conservation baseline condition assessment, it is possible to plan the conservation of recovered artefacts and the stabilization of a site post excavation (Guthrie, *et al.* 1994; 1996; Gregory, 1998; Björðal and Nilsson, 2008; MacLeod and Viduka, 2011: 135; Manders *et al.*, 2008; Richards, 2001; 2007; 2011; Veth, *et al.* 2016).

Since its inception in 1971, the Conservation Section of the West Australian Museum (WAM) has led maritime archaeological conservation science in Australia and have undertaken the vast majority, if not all, of full conservation site assessment activity in Australia. Jon Carpenter of the WAM conservation team has reported that approximately 20 sites in Australia have been assessed for physical, chemical, biological and electrochemical effects since the 1970s (Carpenter pers. comm. 2017). That amounts to ~ 0.26% of Australia's protected shipwreck

assemblage having been documented through a 'complete conservation' assessment.

However, monitoring a site's condition for many UCH management purposes does not need that level of analytical study. Monitoring surveys fulfil a different management function to complete conservation surveys and are the principal methodology by which we regularly note change to a site facilitating decisions to be made.

Vested-interest management of UCH

While there is clear value for businesses engaged in cultural tourism to assist in the protection of archaeological sites from which they directly benefit (Viduka, 2008), the public in Australia and New Zealand today largely remains only obliquely or on an *ad hoc* basis engaged in site preservation, documentation, and management outcomes. This is despite the origins of Australian maritime archaeology and the wreck registers in each jurisdiction originally being predominantly an outcome of avocational research. This is also despite the deliberate broadening of the objectives of the 1983 Historic Shipwrecks Program to include engagement with the public, the 1994 Guidelines for the Management of Australia's shipwrecks encouraging appropriate public engagement (Henderson, 1994: 6), and the existence of the Australasian Institute for Maritime Archaeology (AIMA) advocating for the public. From the author's experience and observations over decades, professionalization, increasing workplace health and safety issues, staffing reductions and reduced operational funding have all contributed to increasing dislocation for avocational researchers.

In New Zealand, government-led community engagement or research in maritime archaeology does occur but is not well resourced (Carter and Dodd, 2015: 522). Maritime-archaeology-focused activity has predominantly been done by non-professionals (Carter and Dodd, 2015: 515). This situation led to the establishment of the New Zealand Underwater Heritage Group and, in 1989, the Maritime Archaeological Association of New Zealand to control and direct such activities (Churchill, 1991: 7). Part of the reason for the lack of New Zealand Government-led community engagement activities since the 1950s is legislative, which dictates the allocation of funding and human resources, and the requirements of occupational diving, which restrict volunteer and professional collaboration on projects (Carter and Dodd, 2015: 511).

For both Australia and New Zealand, a failure to focus on engaging the public to participate actively and appropriately in maritime archaeology, to create a sense of public custodianship of UCH has come at a cost. Without public support for heritage there is little political will and few resources to protect and preserve such sites. There is also a focus on enforcement

rather than collaboration. For heritage located under water, largely unseen and out of public consciousness, the need for community understanding, appreciation, and support is vital to protect maritime archaeological heritage. The need to link the public with UCH to create a vested interest in its preservation is vital for more effective protection and management of the assemblage (Viduka, 2008; 2015).

Citizen science and GIRT

Citizen science is not new, having started in the Victorian period but under different names (Cooper, 2012a). Often these early forms did not reach out to the broad public but more often involved lay scientists with as much knowledge as the scientists (Cooper, 2012b). While people of most ages can be involved in citizen science, increased life expectancy has introduced more people, often with higher levels of education, financial resources, and recreational time, who, when empowered with new technologies, can participate effectively as citizen scientists. Gathering Information via Recreational and Technical (GIRT) Scientific Divers is a citizen science programme developed to capitalize on these demographic factors and technological advances. It has been used to test the potential of broadening the number of individuals who systematically collect conservation-focused maritime archaeological data.

As with other citizen science projects, the public's involvement in GIRT potentially brings a spatial scale and longevity to UCH monitoring programmes beyond the capacity of management agencies or grant programmes to resource. GIRT outlines an underwater conservation-focused methodology that enables systematic robust data collection by members of the public. Participation in GIRT by members of the public could potentially address the lack of quantity of *in situ* site data and provide information on a scale and in the resolution necessary to understand environmental change. The collected data may also potentially better inform management agencies who can then target limited financial and human resources more appropriately.

GIRT was designed and developed by the author as a bespoke citizen science project attached to PhD research, testing the hypothesis, 'Citizen science data collection can productively inform underwater cultural heritage management'. The research uses a mixed-methods pragmatic research approach.

To ensure that the proposed GIRT citizen science programme was both interesting to prospective members and that the requirements of the data collection project were within their capacity, an approximately six-month pilot project was planned and run. Pilot-project participants and other selected colleagues also tested a proposed motivation survey's questions prior to their finalization. In July 2018, the GIRT pilot project became one of 604 projects listed

on the Atlas of Living Australia website (Atlas of Living Australia, 2019) and incorporated within the Australian Citizen Science Association.

Post the pilot-project phase reported here, data collected by GIRT members over two years will be considered from the perspective of its value to UCH managers and compared against existing other public underwater archaeology programmes with greater longitudinal data and known effectiveness. The data collected from GIRT members in the motivation survey will be similarly studied against other comparable recreational diver surveys and then synthesized with the other acquired data.

Aims

GIRT aims to enable better understanding of the condition of shipwrecks or other UCH adopted by members and the factors driving the preservation or deterioration of these adopted sites (for the purpose of readability I will now refer only to shipwrecks as these were the primary focus of the pilot project). The GIRT citizen science programme can easily sit alongside and enhance any existing maritime/nautical archaeology-focused public archaeology programme without significant duplication.

GIRT objectives

The intent of GIRT is aligned with the Annex Rules of the 2001 Convention (Rule 4) 'Activities directed at underwater cultural heritage must use non-destructive techniques and survey methods in preference to recovery of object...' (UNESCO, 2002: 58). GIRT is also aligned with Australia's Historic Shipwrecks Program Objectives to 'promote public awareness, understanding, appreciation and appropriate use of Australia's underwater cultural heritage' (Australian Government, 2019) and section 3(c) of the *Underwater Cultural Heritage Act 2018* to 'promote public awareness, understanding, appreciation and appropriate use of Australia's underwater cultural heritage' (Underwater Cultural Heritage Act, 2018: 2). As a programme that will continue under the auspices of the not-for-profit research group Wreck Check Inc., GIRT aligns with the objectives of Wreck Check Inc. to 'promote and encourage community interest in the maritime cultural heritage' (Wreck Check Inc., 2019).

Once trained through participation in a day-long session, GIRT members (individuals, groups, or businesses), adopt-a-wreck that is of interest to them, mirroring the NAS scheme of the same name (NAS, 2019). Members agree to monitor the site at least once a year using the GIRT documentation methodology (detailed below). 'Adopted', for the purposes of GIRT, does not confer title or ownership or any other legal right to a selected wreck; however, it does give a member a sense of custodianship for the site. Through the training day, members also have an opportunity

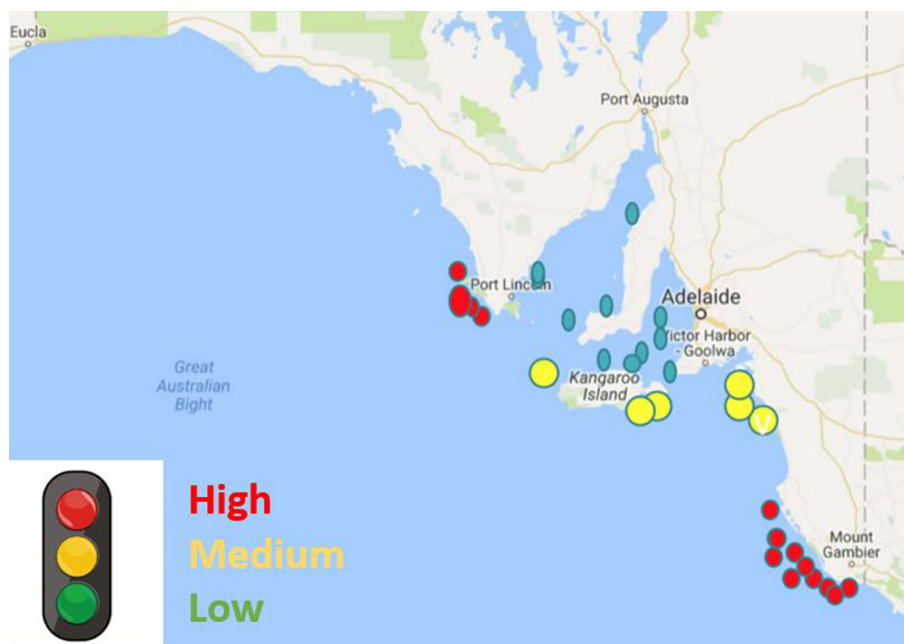


Figure 2. Indicative image for pilot-project participants to demonstrate potential for showing spatial patterns across a region. The first proposed GIRT threat assessment matrix in July 2018 only had a three-tier traffic-light model. This was revised at the end of the pilot-project to the current four-tier model to give greater granularity of assessment.

to talk with an individual who represents the local UCH management regulatory agency. Through these discussions GIRT members make personal contact with the local regulator, can test their ideas about a site to adopt, or, if looking for an option, be guided to sites of specific interest to the maritime regulatory agency.

Using qualitative observations in conjunction with quantifiable data and photographic condition reporting documented in five survey sheets, GIRT members are able to assess and indicate the threat level to their site from natural or cultural activities using a ‘traffic-light’ system: low (green), medium (yellow), high (orange) or severe (red). The threat level is allocated by the member utilising a standard risk assessment approach including identifying threats, assessment of likelihood, and consequence.

During the pilot-project phase, GIRT members are informed that their survey observations, images, video transect, 3D photogrammetry, and their threat assessment, once entered by them into the website’s relational database, will be linked to their adopted site’s record on an interactive map. This map will eventually be embedded in the GIRT website (www.girtsd.org). Finally, the data from the GIRT member’s site survey will be sent to the member in a compressed file format. During GIRT training members are encouraged to choose to attach this information to their site’s formal record in whatever statutory database is relevant. This process both ensures recognition for the member’s activities beyond the scope of GIRT and guarantees a permanent record of their survey is kept in association with the site’s permanent statutory record. For people

in Australia, and in New Zealand since 2014, the register of UCH is the AUCHD (Luckman and Viduka, 2013: 76). The AUCHD has been built to include a public researcher functionality so that members of the public can submit information, images, or videos that can be attached to records.

Theoretically, by being able to add GIRT monitoring records to the AUCHD, not only will these annual observations of a site’s condition not be lost, importantly the records will also be available for everyone to view. Through the combination of hosting information on the GIRT website and sharing collected data with a relevant statutory database, this process encourages the democratization of information about the condition of our UCH. GIRT members are therefore directly facilitating a greater understanding of what is happening to our UCH in our marine coastal environment from cultural or natural events, including climate change. Potentially, with enough GIRT members adding their individual observations, the GIRT citizen science project may be able to go beyond understanding a specific site’s quasi-equilibrium in the environment over time and inform a new or more quantified site-formation theory.

Proposed colour attributions by GIRT members indicating the level of threat to their adopted site will enable anybody to see if there are spatial patterns to climate events impacting UCH (Fig. 2). Through the proposed GIRT methodology, members can potentially contribute directly to science-based decision making by presenting robust and repeatable data that may inform relevant regulatory authorities

planning and prioritization of activities. These are potential outcomes beyond the immediate benefits of a more informed and engaged public who work closely with local management agencies and become active ambassadors for the protection of UCH with peers (horizontally) and statutory agencies (vertically).

GIRT is not designed with the expectation of a large numbers of members. In the terms of citizen science, GIRT is a project based on 'super-volunteers'. The term 'super-volunteers' is used to describe the amount of time allocated by a volunteer to an activity, but also can be used to describe individuals who are highly capable, trained divers, with expertise, a high level of interest in shipwrecks, capacity, and motivation (Lukyanenko *et al.*, 2016: 448; Einolf and Yung, 2018: 3–5). This type of volunteer aligns with the recreational and technical diver demographic. GIRT does have a cost barrier to participation. Besides standard dive gear, members need: access to a digital camera with an underwater housing or GoPro; 30 m reel tape; photography scales; slate/s and pencil; and GIRT monitoring templates printed on waterproof paper. The methodology for data collection by members has been carefully selected to stay within the competency of a qualified open water diver, who must be over 18 years of age.

Motivation survey

To better understand the individual motivation of participants, members were asked to complete a survey that builds on research conducted by Joanne Edney researching diver characteristics, motivation and attitude in Chuuk Lagoon (Edney, 2012: 10–11; 2018: 100–103), which was itself derived and adapted from other surveys of scuba divers (Holecek and Lothrop, 1980; Davis, 1997; Todd *et al.* 2001; Ditton *et al.*, 2002; Cottrell and Meisel, 2004; Jewell, 2004; Meisel and Cottrell, 2004; Stolk *et al.*, 2005; Thapa *et al.*, 2005;). The GIRT motivation survey utilises some of Edney's questions about characteristics, motivation, and attitude to bring about a consistency of method and allow the aggregation of some data. The survey includes other questions to better understand individual participant's background in volunteering, interest in heritage, support for the protection of heritage, and background in science and conservation.

The motivation survey utilises a non-random sampling approach with pilot-project participants asked to answer an anonymous 15-minute online quantitative social survey that had been prepared, peer tested, and had received ethics approval [HE18-102]. This data will form a baseline understanding of participants motivation to join GIRT and lends itself for an identical survey in the future to understand if their motivation has significantly changed throughout the course of their participation and why.

GIRT monitoring methodology

Because wet archaeological materials are better preserved from factors of deterioration in stable anaerobic conditions, which are typically found at buried depths of 500–1000 mm dependent on grain sizes of sediment cover (Gregory, 1996: 97; Nyström Godfrey *et al.*, 2009: 172), GIRT trains members to establish a monitoring programme for their adopted site that records the movement of sediment over the site and observations of the sediment cover. The site pre-disturbance conservation variables used in the GIRT monitoring methodology have been utilised for well over 20 years by staff of WAM (Jeffery *et al.*, 2007: 23–31). Many of these variables were built on earlier work by Dumas (1962; 1965:16) and Muckelroy (1977: 51; 1978: 157–214), to name a few. The advantage of this approach is twofold. Firstly, it produces comparable results with earlier pre-disturbance studies. Secondly, the selected variables can be populated by the public with little background in conservation science or maritime archaeology, yet their results will be valid, repeatable, and consistent subjective or objective observations against each data field.

A key element of the GIRT methodology is that members must do an approximately scaled mud map of their site and then number up to ten features or locations where they will survey. Those points are then placed into a legend with a description of each survey point so that anybody else could replicate their survey in the future. Condition photos of specific locations are taken with a coloured scale and that data is combined with meta-data of depth and compass orientation for each photo. Further, members collect a 30 m video transect of the 'typical' sea-floor environment near the site and can optionally make up to five feature records or a complete site photogrammetry record. This corpus of data is gathered as a complete survey report that can be interpreted by the GIRT member or any other interested researcher. Importantly, the data variables spread across the five survey sheets work together to create a complete survey. Variables on one sheet support the interpretation of data recorded on another survey sheet. The set of current survey sheets and the latest member Guidance document can be downloaded from <http://girtsd.org/register>.

Regardless of the fact that all these observations by necessity are limited to the open water environment, conservatively they form an approximate first 30% of a full conservation pre-disturbance survey for any underwater archaeological site. As such observations by GIRT members should give a valuable baseline record of the macro condition in a site's specific environment (Fig. 3).

GIRT training presentations

With consent, GIRT uses training material on photogrammetry created by members of the Maritime

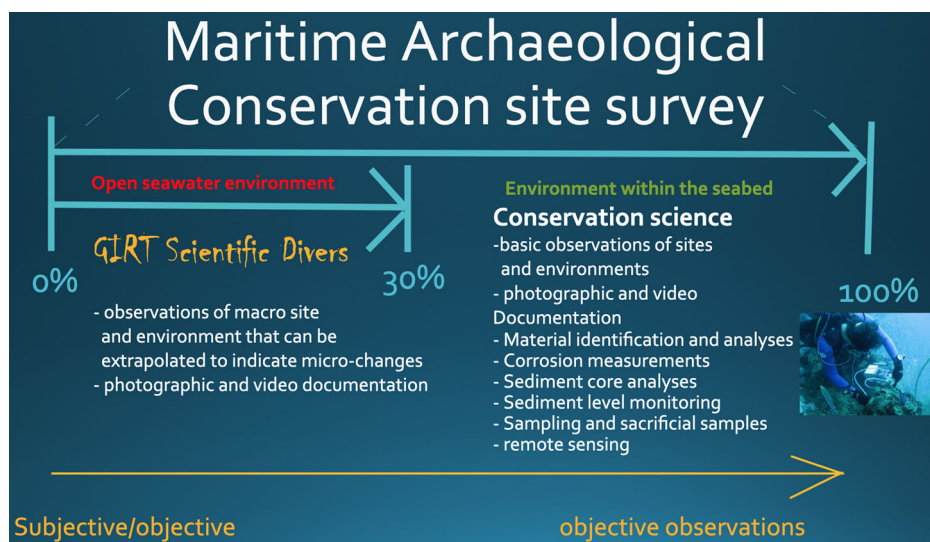


Figure 3. Graphic indicating to GIRT participants how their observations fit within the context of a full conservation site survey that includes sampling and analysis.

Archaeological Association of Western Australia (Ian McCann and Kevin Edwards) as well as photogrammetry techniques developed in Cyprus in conjunction with Andrew Hutchison (Curtin University and Wreck Check member) and Carrie Fulton (University of Toronto) (Fulton *et al.*, 2016: 19–21).

GIRT training presentations incorporate open-source information from the *Training Manual for the UNESCO Foundation Course on the Protection and Management of Underwater Cultural Heritage in Asia and the Pacific* (Manders, 2012) and *The Manual for Activities directed at Underwater Cultural Heritage* (Maarvleveld *et al.*, 2013). Training presentations also reference information from *Underwater Archaeology: The NAS Guide to Principles and Practice* (Bowens, 2008) and, with specific consent, the guidance on sketching a site from the 3H Consulting website (3H Consulting, 2019).

As a free citizen science programme, it is important to keep the cost of delivering training down. As such, the initial training concept was developed to be delivered over one day in a six-hour face-to-face period with the option for people to ask questions afterwards. Five presentations are covered in the session (introduction; threats; why *in situ* preservation; the local UW archaeological assemblage; and monitoring) as well as a short practical workshop on survey methodology, sketching a mud map, and photogrammetry (Table 2).

Even at the earliest conceptual phase of this project the author recognized that a second day of training with an in-water component would be ideal; however, adding a second day would push the time for training to a four-day commitment for an instructor and some participants who would need to travel to a given training venue. To address both these issues and for

the future longevity of GIRT, a GIRT state-based tutor approach was conceived to be rolled-out when the programme went live.

A fundamental element of the GIRT programme is the association of training delivery with the support of the local jurisdictional authority. During the pilot-project training, GIRT members met and interacted with the senior maritime archaeologist in South Australia, Rick Bullers from SA Heritage. Bullers presented the session on the local underwater assemblage and discussed with pilot-project participants options for site adoption that also reflected his priorities. The value of making the connection between members and the appropriate authority for future communication of results and collaboration cannot be overstated.

GIRT'S eight-step method

The workflow proposed for GIRT members to record a site is referred to as the eight-step method. Step one is above water observations. Steps two to four encompass: making a mud map of the site; underwater observations of site and environment; and photo condition documentations (still, video and photogrammetry). Step five is optional as it relies upon the interest and knowledge of an individual member to also assess the marine life of the site. Recreational diver surveys have identified a gender trend between people with an interest in either cultural or natural heritage (Edney, 2012: 16). The inclusion of a marine science component is required to assess a site holistically as part of the environment, but it also enables individuals with different interests to participate together. A bolt-on approach was utilised for this step as it became quickly apparent that members could better utilise

Table 2. *GIRT Pilot Project suggested teaching timetable*

GIRT scientific diver - suggested teaching timetable: 9am – 3.30 pm

~ Timing	Activity/Content summary
9:00-9:15	Welcome - Handout information sheet, consent forms, the guidance document and survey sheets. - Participants add their details to attendance sheet (name and email). For large groups invite people to write their first names on tags. - Introduce yourself and advise people where toilets and emergency exits are located. Advise people that they can get up and grab coffee or tea through the workshop. - Ask participants to stand-up and briefly introduce themselves.
9:15-9:35	Introduction to GIRT - GIRT as part of PhD research and motivation survey. - How the 'Adopt-a-Wreck' model works in GIRT. - The Australasian Underwater Cultural Heritage Database and public researchers.
9:35-9:55	Threats to underwater archaeological heritage Physical, Chemical, Biological and Human
9:55-10:15	Activity- photogrammetry - Introduce photogrammetry and get participants to image a feature. - Download images and show the Metashape workflow to produce a 3D model. - Inform participants of the: photogrammetry section in the Guidance document; information on how to access Metashape program for members; and how to export a 3D PDF model to attach to Survey Report file
10:15-10:40	Why insitu preservation Preserved for the future; well-developed protection system by law; enormous amount of newly discovered sites; cost effective option for management; time gap between discovery and excavation; lack of conservation specialists and knowledge; and ongoing monitoring of sites vital to have informed science-based decision making.
10:40-11:10	The underwater archaeological assemblage - An overview of the local/regional UCH resource – To be presented by a person from the local heritage management agency members would need to contact about their sites. - Discuss selecting a site to adopt – cover elements of wood versus steel, buried, partly buried or sitting proud of the seabed.
11:30-12:00	Break – check processing of photogrammetry.
12:00-13:15	Monitoring a site Introduction – remote sensing options and analytical methods; GIRT versus a full conservation survey; subjective and objective data; selecting locations to longitudinally monitor a site's condition; data to be collected on the surface or during a dive; the importance of a mud map in GIRT; scaled condition photos; video transect survey; feature and site photogrammetry; and Step 5 - Linking GIRT with other marine citizen science programmes.
13:15-13:30	Making a mud map Introduce range of mud maps; discuss labelling and marking features and other information on mud maps; encourage research prior to diving; and demonstrate that everyone can make a simple mud map.
13:3-13:45	Break - check processing of photogrammetry.
13:45-15:00	Activity - practical session Go through equipment required discussing each item; dive slates and survey templates; doing a mud map; condition documentation; setting up cameras and or GoPro; taking a condition image with a scale; taking images for photogrammetry; saving data in the correct format, labelling and backing up; and uploading data into GIRT website.
15:20-15:30	Concluding remarks and closure

Table 3. *Stages of threat assessment in GIRT*

GIRT Step 7

Stage 1 Identify observable threats.	A site is threatened if there is evidence of cultural or natural activity that has negatively impacted the potential preservation of the site, for instance: • the site has been totally or partially exposed by a major weather event; • timber appears newly exposed on the site; • evidence of visible anchor damage (loss of concretion, physical damage, furrows in sand near site, displaced coral); • lost anchors are present on site; • other human debris around site (bottles, cans, fishing nets, fishing line indicating activity over site); • evidence of marine borer damage on exposed timber; • the site has lost concretion cover; • there is visible evidence of significant active corrosion; or • artefacts are easily observable around the site or have been placed for diver inspection.
Stage 2 List threats in order of potential for significant negative consequence.	Minor, moderate, high, major, or critical.
Stage 3 Consider the likelihood of each threat.	0–10%, 10–29%, 30–59%, 60–79%, 80–100%
Stage 4 Identify each threats risk level.	Low, medium, high, or severe.
Stage 5 Ascribe overall threat level.	Use the threat with the highest likelihood and most significant consequence to the site's overall preservation—as the site's overall threat and risk level (low, medium, high, or severe).

existing marine citizen science programmes within a specific region, such as Reef Check, Eye on the Reef, Coral Watch or Redmap. Within the GIRT training, members are encouraged to utilise any skill they have with species identification and to work collaboratively to more completely document their sites. Members who are participants in other marine citizen science programmes were encouraged to add that data to the GIRT site record. Steps 2–5 all require diving.

Step six details how to save data so that every document or image has the necessary meta-data descriptors to facilitate their easy future interpretation and online data entry. It is emphasized during training that this step is often the hardest for any individual to get right and must be conducted as soon as possible after the fieldwork is completed—preferably the same day.

During the pilot project, it was proposed that each monitoring sheet was to be saved and titled to highlight the GIRT member's role in collecting the data. Because of the large number of images utilised in photogrammetry, GIRT will only include 3D models as PDF attachments in the survey record. Options are still being pursued to create an archive repository for images used to create the models.

A major aspect of the GIRT method occurs in step seven, which itself has five stages (Table 3). In this step each member fully participates as a citizen scientist and estimates the threats and risks to their adopted site. As a regular systematic observer of the site's physical

condition they will be best placed to assess the extent of change in the physical condition and surrounding environment and be able to support their assessments with observations, measurements, and photographic evidence.

To assist them in making assessments of low, medium, high, or severe risk in a systematic manner, a standard risk management framework was used. While some actions are indications of threat, the risk those activities pose to the site's preservation vary considerably.

GIRT members are taught that sites are in a dynamic equilibrium and it will take time and experience for them, or anybody, to know what a normal condition is and that their assessments will be moderated before finalization. Annual or cyclical events will change the micro-environment. Until a site has been observed for some time through winter and summer, initial assessments of risk may be wrong, but these will enable members to learn. Experience will refine member's assessment of condition, threat, risk, and likelihood.

Once a baseline of observations and images has been collected and following the completion of the second survey, GIRT members will be able to start comparing records for their adopted site (written and photographic) and assigning a score of change (1–10) against certain observations. This will help fine tune the assessment of threat, consequence, and likelihood. The refinement of this process both practically and methodologically is at the core of this research and

is expected to be an iterative process, building on knowledge, experience, and input of GIRT members as citizen scientists.

The eighth and final step in the process is for GIRT members to add their data into a statutory database, such as the AUCHD, so that information becomes available for decision making in relation to a site's preservation. It also is an opportunity for GIRT members to be permanently recognized for having collected that data. Recognition, meaningful participation, and effective and friendly peer-to-peer communication are recognized as vital components to a successful citizen science project (ACSA, 2018).

South Australia case study

The GIRT pilot project was conducted in South Australia between 24 July and 9 December 2018. South Australia was chosen as the location of the pilot project for one reason. In 2017 at the AIMA annual conference hosted at Flinders University, Britt Burton, then President of the avocational maritime archaeology group the South Australian Archaeology Society (SAAS) and Phyllis Coxhill, Treasurer, jointly presented a paper titled 'SUHR/SAAS: Preserving the Project' (AIMA, 2017: 66). This presentation outlined the folding of the SAAS organization due to lack of membership. Indeed, they were the only two members at the time of the conference.

The SAAS had been formed in 2012 from the long-running Society for Underwater Historical Research (SUHR), which started in 1974. South Australia, through the efforts of individuals in the SUHR, has a very rich heritage of public engagement in maritime archaeological research in conjunction with government officers, but, by 2017, the SAAS had all but ceased to exist from lack of community participation.

The purpose of the pilot project became twofold, to encourage community participation in UCH again in South Australia and to obtain feedback from participants on the proposed 39 fields of data to be collected in a GIRT site survey. Members were requested to comment on any perceived issues around the design of the survey sheets, the efficacy and appropriateness of the pedagogical approach to teaching GIRT, on their experiences of collecting data and any issues, concerns, or general feedback on the guidance documentation. They were also asked to complete a 'motivation survey'.

Timed to coincide with the start of the pilot project, a GIRT logo and Facebook site were launched. Australian diving magazine *Dive Log Australasia* provided media coverage on the project in its June 2018 issue which included a citizen science section.

GIRT pilot-project training

Two one day training workshops were conducted on 28 and 29 July 2018, with support from South Australian

Maritime Museum (SAMM) and Heritage South Australia. Forty people initially expressed interest in participating but 11 people were unavailable on the weekend due to previous commitments, travel, or illness. In addition, five people pulled out entirely from the pilot project before the training started. Training was delivered to 24 people by both Rick Bullers and the author. The pilot project formally concluded with a half-day finalization workshop on 9 December 2018 at the SAMM. During the finalization workshop members were offered feedback on any collected data through the lenses of maritime archaeology, conservation science, and biological sciences. In the future this feedback opportunity is proposed to be available to members in three ways, through direct communication with a state-based GIRT tutor (GIRT members who are experienced in maritime archaeology), assistance from other members with expert knowledge in particular fields, or during a session on public archaeology within an annual relevant maritime archaeology conference.

Fourteen wrecks were adopted by 23 of the 24 participants, with several adopting the same wreck due to its location, depth, and ease of access (Fig. 4). One pilot-project participant chose not to adopt a site themselves but was happy to support other members. Of the 24 individuals trained for the pilot project, a 1:2 ratio of female to males participated: eight female and 16 males. A similar female to male ratio was in the group of 11 interested participants that were unable to attend on the weekend, four females and seven males.

Ten GIRT pilot-project participants attended the finalization workshop and one new individual who wanted to become a member. Six participants sent apologies in advance stating conflicting activities, one called in sick on the day, and the rest of the participants did not respond to the meeting request. Of those who did not respond, four participants did not continue with GIRT. Two of those individuals were newer divers that found it over-tasked them and two others were required to move from South Australia during the pilot-project period. In summary, 20 of 24 members remained at the end of the pilot-project period.

Feedback on pilot-project experiences

A major issue experienced by all participants over the pilot-project period was bad weather. Only seven of the 24 participants reported that they had managed to get into the water and monitor their sites (*Star of Greece*, *Sea Wolf*, *Nashwauk*). Four members were blown off site by bad weather at least twice (*Clan Ranald*, *Grecian*, *Solway*) and one group mapped a site during the pilot-project period that they had not initially adopted simply because it was weather accessible (*Ellen*).

General comments from members who managed to get on site and from those who did not were that by the time the weather improved they had forgotten some of the things learnt at the training. Members

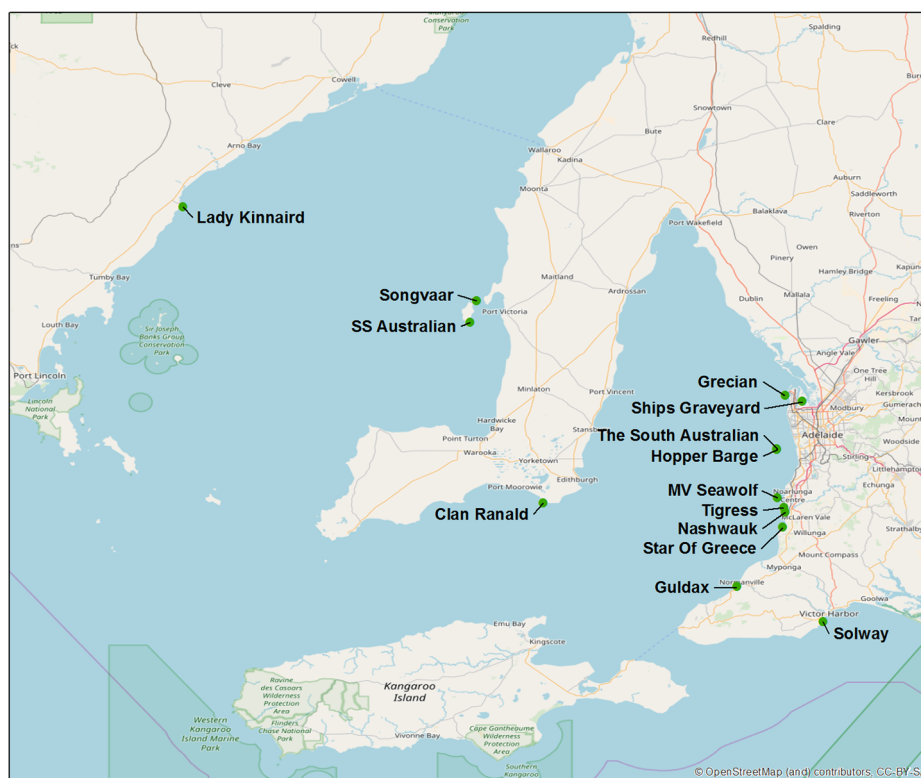


Figure 4. Map showing location of the initially adopted wrecks by GIRT pilot-project participants in South Australia. Members were to later adopt SS Ellen (AUCHD 5313), Josephine Loiseau (AUCHD 5470), Flying Fish (AUCHD 5366) and the Daring (AUCHD 5281).

requested instructional videos be available as a way to refresh what they had learnt. This idea is currently being developed and videos will be made available to members via the GIRT website.

Members raised, either at the pilot-project-finalization workshop or separately, a range of issues they faced during the pilot-project period (Table 4).

While none of the feedback will shock anybody who has done fieldwork, it indicates that pilot-project participants came to realize the complexity of the GIRT citizen science programme and provides their thoughts on their requirements to better deliver these outcomes. Perhaps the most telling feedback of the pilot-project period is that 20 of the 24 pilot-project participants have stayed on with GIRT. In this regard GIRT members can be considered 'super-volunteers' even though they do not necessarily meet the definition of weekly hours of activity used by some authors (Einolf and Yung, 2018: 4–5).

Feedback on documentation

GIRT pilot-project members commented on the five survey sheets, their design, data fields and the draft supporting documentation to help members after training (Table 5). Their comments ranged from design ideas through to suggestions on how to improve data

collection and how to give better support to members post training, such as interpreting their data. Feedback also included how to improve the accuracy of some data being collected. The active participation by members in this co-design exercise is at the heart of effective citizen science and was one of the most rewarding moments of the pilot project.

Going beyond the scope of the exercise one member suggested seeking approval to attach a tag to an adopted site to indicate that it is adopted and where interested divers could get more information. This recommendation is a fantastic example of positive input into design, aligning with the fourth principle of citizen science (ACSA, 2018: 1), and is similar in methodology to a citizen science project called STAMP, developed to track the degradation and movement of shipwreck timbers washed up on a beach over time (Burkhard, 2016: 13–18).

Feedback on the motivation survey

The motivation survey comprises 39 questions in five sections: personal demographics, volunteering, diver motivation, heritage protection, and science and conservation. For the pilot-project period, the focus of feedback was not on what information people provided in the survey, though that will be considered elsewhere,

Table 4. *Issues raised by GIRT members at the pilot-project-finalization workshop or separately*

Issue	Comments
Research challenges	'Failed to find a mud map for our site on the internet', or issues with the accuracy of GPS points in SA database – 'Need for better location information'.
Need for pre-dive planning	'Figured out we needed to talk more and plan the activity', 'needed to break down the tasks more and plan where we would select survey points'.
Better guidance on how to take condition photos	'Took photos but weren't sure that they actually show anything useful. The photo scale was moving in the current, and we weren't really sure how to set up the photo in a meaningful way'.
Requested guidance on data collection prioritization	'I only could collect half the data in the available weather window', 'indicate priorities on underwater survey if you only have limited time on site'.
Lack of experience	'Difficulty in selecting survey point locations over a big site'.
Recognition of the level of commitment required to do the survey	'Not trivial to get prepared'.
Post processing challenges	Members emphasized the 'time and commitment required to finalize data after fieldwork', 'need to take mud map 'working copy' and produce a 'fair copy' as soon as possible after diving', and the 'importance of doing a legend for locations monitored'.

Table 5. *Ideas by members to improve GIRT methodology or communication*

Issue	Comments/ideas
Design	• Add page numbers on survey sheets. • Add version control to all documentation. • Add 'AUCHD Wreck Code' and 'depth to bottom' on surface sheet. • Increase the size of boxes for people writing. • Remove reference to a sea state from waters above 1.25 m on surface sheet. • Remove excessive wording in underwater survey sheet. • Prepare one set of survey sheets for new members and a cleaner set for experienced divers. • Add a column in the photo condition survey sheet for 'time taken for photo' to help align images with record. • Mud map sheet –add light coloured squares or cross hairs to help people scale their drawing - add on the bottom corner of the mud map a circle with an N (North) under it or alternatively have a line with the words magnetic bearing.
Clearer instructions	• Indicate a priority order of activities for divers. • Supply clarity around preferred placement of scales for condition images and for photogrammetry, "the difference between listening to your bubbles and taking happy snaps and taking photos for data". • Create instructional videos to help instruct people who have forgotten or who are learning. "base training videos on lowest common denominator and offer SKYPE support." • Requires members to setup their camera's date time stamp accurately prior to fieldwork.
Robustness of data	Consider adding confidence to some things like visibility – note one member suggested just holding the tape and swimming away. When you cannot see each other, you have an exact measure of visibility.
Technical advice	Recommend that people set their Go-Pro or camera to continuous shot at 0.5 second intervals at 12 MEG, rather than video due to algorithm compression.

rather their views on the survey as a whole. Pilot-project participants were able to communicate feedback at any time through the pilot-project period and were also offered an opportunity for feedback during the finalization workshop.

Of the 39 questions in the motivation survey, six questions received suggestions for improvement.

Comments received ranged from suggesting an extra category in a question, identifying similarity in two questions and refining wording by adding 'all of the above' or 'not applicable' options.

A separate bit of feedback related to how the survey was implemented in Survey Monkey. In this case the selection of a negative response in one question did not

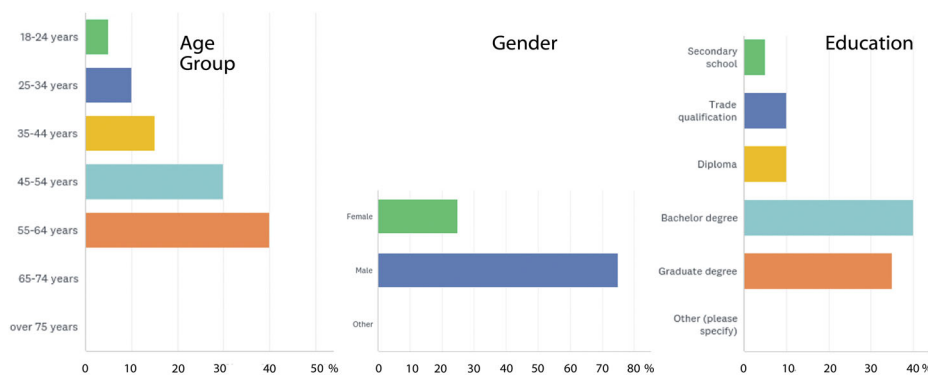


Figure 5. Some of the demographic results from the 20 respondents of the pilot-project motivation survey.

enable the person to move to the next relevant question. This was identified as a failure by the author to develop the survey question logic properly when setting up the survey.

Observations

Even with regular reminders sent out to all participants, only 20 of the 24 participants completed the approximately 15-minute online survey. The gender split in the responses indicates that they were not solely from the 20 individuals who have chosen to continue on with GIRT past the pilot-project phase.

As with other surveys of this type, data collected would not be interpretable without associated demographic information. Due to the survey only being conducted on GIRT members there is an inherent voluntary response bias that is important to remember when considering the data (Fig. 5). Of those 20 that responded within the self-selected pilot-project group, 70% of participants are over 45 years of age, 75% of respondents were male, even though 66% of total participants are male; and 75% have a bachelor's degree or higher. These results are in line with the initial hypotheses about the age of potential participants and the idea that GIRT members could be characterized as super-volunteers.

Observation on participation

One interesting result from the pilot project was the number of new individuals engaged through the use of the term 'citizen science' as versus 'public archaeology'. The AIMA is the pre-eminent maritime archaeology association in Australasia and its associated AIMA/NAS public archaeology course had been operating throughout Australia since 1997 (AIMA, 2019; Moran and Staniforth, 1998: 137). Approximately 1000 individuals from Australia and New Zealand are reported to have participated in the AIMA/NAS Part 1 training course (Philippou pers. comm. 2018). As stated earlier, the long-running

SUHR/SAAS maritime archaeological association closed in 2017 due to a lack of members, which was affiliated with the AIMA/NAS training programme. Only three of the 24 GIRT pilot-project members had previously taken part in AIMA/NAS training and only one of the pilot-project participants was an AIMA member.

Recognizing that an objective of conducting the pilot project in South Australia was to re-invigorate public archaeology in that jurisdiction, GIRT training incorporated an opportunity for the AIMA/NAS senior tutor in South Australia to talk to members about the programme. Following GIRT pilot-project training five participants expressed interest in doing AIMA/NAS part 1 training, which will automatically include them as an AIMA member for a year.

Another observation from the pilot project is the difference between the total number of pilot-project participants and the number of people who tried and succeeded to collect site data in the period. Rather than view this percentage of 50% as an anomaly, I initially interpret this as the possible systemic reality for a citizen science programme that requires 'super-volunteers'.

Summary

The GIRT pilot-project achieved its intended outcomes as a testing phase for the citizen science programme. The approximately six-month period allowed the 24 GIRT pilot-project participants to consider: the effectiveness of the information supplied during training; the effectiveness of the pedagogical approach; the individual data fields in the five survey sheets; any methodological issues in collecting required data; issues around the survey-sheet designs; comments on the guidance documentation; and their views on the motivation survey questions and how the survey worked mechanically.

Comments from participants have assisted in the co-design of the GIRT citizen science programme and extended to suggesting an excellent communication/promotional idea and a

recommendation to produce video content to assist members to remember the data collection methodology. Comments have also helped in developing the GIRT programme's proposed website with ideas on how to create effective horizontal and vertical communication and a feedback loop so that members know their inputs have real value. The pilot-project phase reinforced the importance of ensuring that the data collected in a citizen science program, such as GIRT, is robust and meaningful, and that members know their contribution is valid. It also emphasized the need to have 'science champions' to help members interpret data and foster peer-to-peer learning, support, and social activities. The public accessibility of data is not only an opportunity to democratize site-formation data that would normally be seen only by a few, but as a way of recognizing the invaluable contribution of members.

At this stage of the research, it is too early to quantify the value of data being collected by participants for the purpose of UCH management outcomes and whether the data collected by these citizen scientists is as scientifically robust as data collected by maritime archaeologists or diving conservators. Equally, the limited number of participants who were able to complete surveys during the pilot-project period limits the potential to clearly understand if these citizen scientists are being asked to perform unrealistic tasks. Certainly, feedback has enabled the programme to be modified so that more and clearer instructions are given to assist members to participate.

Beyond the pilot project, GIRT will continue to be modified and developed with input from members and other researchers. GIRT is unashamedly ambitious in terms of the data participants are expected to gather. The depth and detail of data being asked from members is significant, but people find the challenge of gathering a range of data that can inform site management in a very meaningful way to be an enriching and meaningful experience.

It is important to emphasize that GIRT has an in-built scalability, which is discussed with members during training. Not all data fields need be populated during a survey. For example, members are advised that in low visibility, video transects, condition photos, and photogrammetry are not always achievable. At these times members should concentrate on populating the surface data sheet, underwater survey sheet, and in creating a mud map to identify future survey points. While the acquisition of all the data is ideal to inform a baseline condition report, depth, visibility in the water, weather, access to air, and available survey time can preclude capturing all data in every survey.

As has been referred to, members are also taught that their observations and understanding of threats, their likelihood, and consequence will improve as they build experience and their assessments of risk will be moderated prior to being made public. Members are encouraged to work with other members who have

different skill bases. Diving is intrinsically a buddy activity. When teaching GIRT, the value of working in a small team to undertake surveys is highlighted. This approach has the great benefit of not only making the survey more achievable but increasing the social side of GIRT, which is so important for any project's long-term survival.

Without doubt, the pilot project has clearly demonstrated the UCH management value of positively engaging the public. The senior maritime archaeologist in South Australia has reported a positive connection with GIRT members and has received reports of previously unlocated sites, improved location data than he previously possessed, and images of sites he could not possibly access within his current workplace parameters (Bullers, pers. comm. 2019). These are all positive early indicators of the potential for GIRT to deliver positive social-value outcomes and support for statutory compliance through enhanced engagement.

Martin Brocklehurst, founding instigator of the European Citizen Science Association, gave a lecture to the Australian Citizen Science Association on 11 September 2018. During this lecture he stated that a citizen science project that impacts positively on daily life and an individual's health will have greater effectiveness and more mass support. He also said that a program is only as good as the scientists who designed it.

Many factors must be considered before understanding why a particular citizen science project gains mass appeal and others do not. One of those factors is the ability for members to participate. GIRT is not designed as a mass-member programme though it is designed to impact positively on the life of participants, with clear outcomes for the public good. Rather the level of commitment and intellectual input from members aligns this project with the concept of the super-volunteer. As such, this project will not suit every person. Even of those that do the training, the author expects a significant number will not continue on. Hopefully the motivation survey will enable some insight into why this is. In the interim, the focus on working in teams and recognizing and drawing on other members skills will hopefully contribute to GIRT's longevity as a citizen science programme.

In regards, to the idea that a programme is only as good as the scientists who designed it, it must be re-emphasized that this programme has been built on variables utilised by many maritime archaeologists, archaeological conservators, and conservation scientists. With this scientific foundation, public participation using the GIRT method will not only address the research hypothesis 'Citizen science data collection can productively inform underwater cultural heritage management' but could potentially produce sufficient data to refine or redefine site-formation models.

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