FOUND A FOSSIL

Assessing Australian perceptions of heritage discoveries and conservation

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A thesis submitted in partial fulfillment of the requirements for the degree of
Master of Research

DECLARATION

I declare that this thesis, as a whole or in parts, has not been submitted for a higher degree to any other university or institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

I wish to acknowledge the following assistance with the research detailed in this thesis:

- Dr. Matthew Kosnik and Associate Professor Drew Allen for their assistance with R and the statistical analysis for the survey responses;
- Emily Hurst, for her incredible help with creating and designing the Found a Fossil website and communication formats;
- Fahad Muhammad for animating the video communication format.

All research carried out for this thesis was approved by Macquarie University Human Research Ethics Committee (HREC reference number: 10181) (see Table S1[a] & Appendix 1).

_____ DATE: 17 November 2022

Sally Hurst

This thesis is formatted to meet the requirements of Macquarie University. This includes an abstract of 200 words, 2 cm margins, 1.5 line spacing, and figures and tables embedded within the text. APA (7th Edition) author-date referencing has been used here.

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ACKNOWLEDGEMENTS

The creation of the Found a Fossil project has very much been a labour of love for the past two years (alongside the usual blood, sweat, and tears). I would undoubtably not have been able to complete this work without the immense support of a huge and incredible team that has helped me along the way. Firstly, it must be said that without the encouragement of my mum, Annie, or my sister, Emily, I likely never would have had the courage to pursue such a weird and wonderful field, or project. The ongoing love, encouragement, and at times, (probably) exasperation from you both, as I sign myself up for too many things, as well as the support from the rest of my incredible family, friends, and loved ones, means the world.

An immeasurable 'thank you' also must go to my supervisors Glenn Brock, Matthew Kosnik, and Linda Evans. Your wisdom, advice, and feedback have certainly made this thesis (hopefully) coherent, and something for me to be proud of. Additionally, to my unofficial advisors, Joe Perry, for helping me to navigate my deep dive into Indigenous studies and research; to Helen Suich, who helped me make sense of the qualitative survey responses; to Lorrae Dick, for helping me make sense of things when even I couldn't see the way; and to all others who have provided me with incredible feedback and wisdom.

Another shout out must go to the incredible experts who completed my early surveys and helped me to write the heritage handling guidelines now published on the Found a Fossil website. Your willingness to contribute to the project in its earliest days meant a lot. Without the participants for both my expert survey, and of course the main Found a Fossil survey (over 1300 people from even the remotest parts of the country!), this research would never have been completed, and indeed the Found a Fossil community would not be what it is today without you.

Acknowledgement of Country

I wish to acknowledge the traditional custodians of the land, waterways and skyways that I am privileged to work and reside on, both on Ngunnawal Country where I grew up, and on Wallumattagal Country where Macquarie University sits. I acknowledge Elders past and present, and the enduring connection to Country and care of the landscape by Australia's First Nations peoples that have undoubtably helped to preserve the incredible cultural and natural sites and objects that I have been able to discuss in this project. This land always was, and always will be Indigenous land.

Use of the word Indigenous

I recognise that some Aboriginal and/or Torres Strait Islander people do not endorse the use of the word 'Indigenous', as it can suppress the immense diversity of language groups and traditional practices present across Australia, and that it is a word that has traditionally been used by the Australian Government to exclude and discriminate again Aboriginal and/or Torres Strait Islander Peoples. within this publication, I have followed the guidelines set out by Roberts et al. (2021) for writing about Indigenous Peoples in Australia.

COVID STATEMENT

Dear Examiner,

Many of our HDR candidates have had to make changes to their research due to the impact of COVID-19. Below you will find a statement from the candidate, approved by their Supervisory Panel, that indicates how their original research plan has been affected by COVID-19 restrictions. Relevant ongoing restrictions in place caused by COVID-19 will also be detailed by the candidate.

Candidate's Statement

While the data for this Master of Research thesis was always going to be based on a survey disseminated to the Australian public, original plans for advertising the survey and promoting the project were cut short due to impacts of COVID-19 travel restrictions within Australia. In an attempt to be more inclusive of locations and communities who may not have had ready access to the internet, hard copies of the survey were originally going to be available at events where I would advertise. However, as the number of events/locations I could attend reduced, a decision was made to make the survey fully online.

Advertising at some locations and events occurred successfully in NSW and ACT, and included visits to regional fossil and cultural sites, including the Canowindra Fish Fossil Museum, Wellington Caves, Brewarrina Fish Traps and Aboriginal Cultural Museum, and the Australian Opal Centre at Lightning Ridge. Plans were also made to do similar road trips to fossil and cultural sites in Queensland, Victoria, and the Northern Territory, however, uncertainty over potential lockdowns and changing travel restrictions led to the decision to again move to online advertising.

While the number of survey participants that partook in this research far exceeded expectations, I do acknowledge the potential biases that online-only participation may have had on the sample, and certainly would have attempted to hear the perspectives from more people from around Australia if this had been possible.

ABSTRACT

Discoveries of natural and cultural heritage, such as fossils or Indigenous artefacts/sites, are often found not by scientists, but by ordinary citizens who are unfamiliar with heritage laws. However, the perceptions of these non-specialist members of the community, including how these perceptions may affect heritage conservation, have been poorly studied. To address this problem, the Found a Fossil project was created, with the release of an Australia-wide survey that aimed to understand how Australians perceive heritage material, what they may do upon its discovery, and their awareness of current heritage protections. Results show that while there is enthusiasm to report finds, confusion over the appropriate authorities to contact, a lack of transparency by government, and poorly communicated legislation are creating barriers to heritage protection in Australia. While survey responses helped to identify concerns and problems with current heritage protections, they also illustrated potential solutions that cater to the wants and needs of local communities. This project represents the first analysis to comprehensively cover Australian perceptions of both Indigenous artefacts and fossils, and provides recommendations for future initiatives that can contribute to the improved protection and celebration of Australian heritage, and the incredible stories it can tell.

INTRODUCTION

Imagine you're going on a bush walk, or maybe you're at the beach with your family, or you're walking across a farm paddock – and you find something.

Perhaps it's a fossil, the remains of a plant or animal from millions of years ago. Maybe your discovery is an Indigenous artefact, an archive of the oldest living culture in the world (Nagle et al. 2017). While the formation and origin of fossils and Indigenous artefacts is very different, they can both be found in modern Australian landscapes. So, what would you do with your find? Would you know what it was, or if it was significant? Would you tell anyone about it? Do you know if you are *supposed* to tell anyone about it?

Whilst the answers to these questions might be obvious to experts in the field who likely have considerable knowledge concerning protocols involving palaeontological and/or archaeological discoveries, how can we gauge the response of the broader Australian community to these questions? After all, many of these important heritage discoveries are not made by scientists, but by farmers, miners, bushwalkers or other curious "non-experts" exploring the Australian landscape (Ebach & Smith 2021). Key findings in the 2021 State of the Environment Report identified that Indigenous heritage and geoheritage required particular attention for their protection into the future, thus, an important discussion on how to improve the protection of these heritage materials is needed (McConnell et al. 2022).

Due to its global importance, cultural and natural heritage is protected by international treaties as well as national and state laws. Heritage material can be considered significant in a variety of ways, including cultural, scientific, historical, and/or social, and can range from local, to universal value (UNESCO World Heritage Convention 2022). Regardless of the level of significance that is assigned to an object or place, the common perception is that heritage includes "things" or places we have inherited and want to preserve (NSW Heritage Office 1996). Heritage archives our history and can help to tell us the stories of past time periods, landscapes, ecosystems, and people (Semeniuk 2019). These objects and places help us to understand our history and our present, our evolutionary and cultural pathways, and inform us about our collective human experience - of how we got here, and where we may go in the future.

In Australia, while the importance of heritage material is recognised at various levels, demonstrated by the existence of world, national, state, and local heritage registers, the legislation to protect this material does not always reflect this significance (Heritage Council of NSW 2008; Veale 2014). The legislation is often weak in its approach, with little detail provided on how

compliance is assessed (Hunt 2012; Packham 2014). Additionally, such legislation is often difficult to find, hard to understand, and rarely addresses the discovery and initial handling of heritage material (Hughes et al. 2016; Rappoport 2019; Hobbs & Spennemann 2021). Thus, heritage discoveries in Australia may not be being properly reported or adequately protected, simply because the legislative framework is not designed, written, or communicated in an accessible way.

This lack of accessible information potentially limits the ability of people making heritage discoveries to engage in heritage conservation processes (such as farmers, miners, etc.). Additionally, non-specialist groups are often excluded from conversations concerning heritage, their perspectives and attitudes rarely being considered (Amar & Armitage 2019). While there has been significant academic debate on the effectiveness of heritage legislation in Australia, less attention has been paid to non-academic audiences and their awareness of heritage laws/information, with little opportunity for the community to express their concerns or participate in heritage conversations. The lack of any research that incorporates Australian perceptions concerning both fossils and Indigenous artefacts means that there is also a lack of information regarding how different demographic factors may impact conservation behaviours, how best to include the community into heritage conservation, and effective strategies for communicating heritage content to non-academic audiences.

To address these knowledge gaps, this research utilises a structured online survey to gain empirical data of Australian perceptions of heritage objects and governance, decipher community concerns related to heritage protection and conservation, and recommend the best means of communicating heritage related issues to various demographics of the Australian community. This survey was housed on a dedicated website that was designed for this research, called the Found a Fossil project (www.foundafossil.com). The Found a Fossil website was built to be a central and accessible portal for information relating to fossil and Indigenous heritage finds, including information about legislation, reporting processes, relevant contacts, resources for identifying finds, and handling guidelines for heritage objects (Fig. 1). The Found a Fossil survey was open Australia-wide to everyone over the age of ten, and included between 25-50 multiple choice and direct response questions (varying depending on if participants chose to complete an additional optional section). All survey responses were anonymous. The questions asked respondents about what they might do if they discovered a fossil or an Indigenous artefact, how they rated their understanding of heritage laws/information, and about their preferred communication methods (Table S1[b]). This survey, its results, and the research presented here represent the first empirical data on Australian perceptions of both fossil and Indigenous heritage material, and the relationship between them.

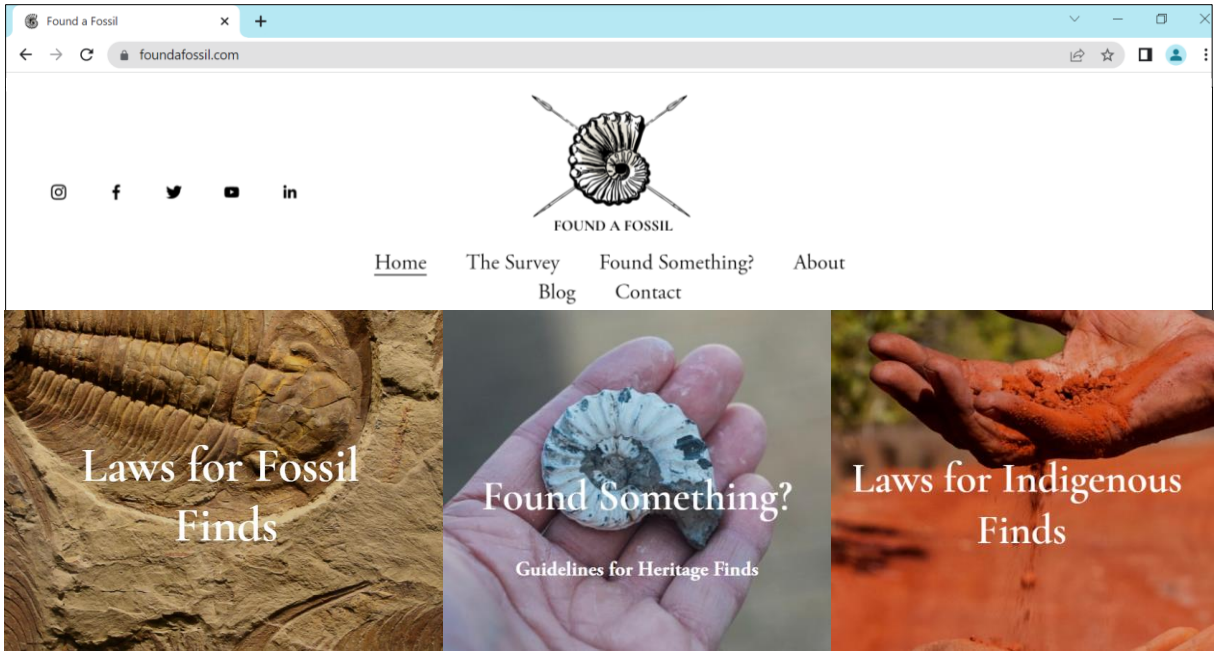

Fig. 1 – The Found a Fossil website, a central educational portal created for this project to address the lack of accessible and clear heritage information in Australia (Found a Fossil 2022).

Research Aims

To address the knowledge gaps in Australian heritage studies, this research has three aims:

1) to determine the perceptions and awareness of Australians concerning heritage discoveries, heritage laws, and explore their communication preferences;
2) to use this data to understand community concerns and problems related to heritage protection, including the poor communication of heritage information;
3) to provide recommendations for better conservation practices and communication methods for conveying heritage information to the Australian community.

How Australians perceive heritage

Perceptions are formed through past experiences, beliefs, knowledge, cultural, political, socioeconomic backgrounds, and other personal factors (Jefferson et al. 2015; Bennett 2016). While all these aspects mean that each person has unique perceptions and attitudes, including these insights into research can help to identify the common goals, wants, fears, and concerns of the community in relation to heritage conservation, and therefore provide solutions that are effective and cater to the needs of the community for whom this heritage legislation is meant to serve (Breakey 2012; Turner et al. 2016).

Within heritage conservation, the academic discourse is dominated by publications written by specialists within the field, with other academics as the intended audience (Kristensen et al.

2020). This information is disseminated through traditional peer-reviewed publications. While peer-reviewed publications help to foster good research practices, and can engender trust, integrity, and authenticity in research processes and results, they can also result in research becoming inaccessible for non-academic audiences, with access hampered by expensive journal subscriptions or paywalls (Teixeira da Silva & Dobránszki 2015; Tennant & Lomax 2019). If a person does gain access, then technical jargon and 'linguistic walls' may be another obstacle (Crofts et al. 2021; Freeling et al. 2021). These issues all assume that a member of the public even knows about academic publications and how to access them. However, this is not often the case; exposure to this kind of academic research frequently comes with enrolment/training during a university degree (Kristensen et al. 2020). If a member of the public has not enrolled into a university system, then the information that they are searching for can easily be missed (Buhrich et al. 2019).

Traditional publications rarely allow for any two-way communication and generally excludes non-academic audiences from the discussion, thus failing to be inclusive or account for the heterogeneous worldviews and diverse communities they are discussing, even when these groups are potential stakeholders (Hughes et al. 2016; Cvitanovic et al. 2018). There are a limited number of publications that have summarised and included the perspectives of the Australian community in relation to some forms of heritage, which are discussed below. The specific perspectives of farmers have also been included here as they are a key stakeholder within heritage conservation, whose opinions have rarely been considered. This group, as well as Indigenous peoples, the recognised owners of the Indigenous heritage being considered here, will also be the focus of further analysis within the survey results/discussion of this thesis.

Context & previous work

Indigenous Artefacts

The perceptions of heritage professionals surrounding the protection of Indigenous heritage, and the communication of heritage legislation are addressed by a significant published literature and through independent surveys of specialists within the field (Rowland et al. 2014; Brown 2020; Wensing 2020; Bennion & Kelly-Mundine 2021). Independent surveys of experts (including Aboriginal Traditional Owners, heritage consultants, museum curators, archaeologists, etc.) established the consensus that legislative improvements are clearly required, and poor translation and circulation of information further impacts meaningful change and action (Beckett & McDermott 2016; Australia ICOMOS 2017). Other surveys have found that, overwhelmingly, Australia's Indigenous heritage is inadequately protected under the current state and federal

legislation (McConnell 2022). An initial survey of thirteen invited heritage experts (completed to help frame the scope of this thesis) also indicated that the communication of heritage legislation to the public was insufficient, and that clear messaging around the discovery of Indigenous heritage material was necessary (with the experts similarly agreeing that palaeontological legislation and its communication were also inadequate) (Found a Fossil 2021).

While most state legislation requires consultation with local Indigenous communities, Indigenous stakeholders have very little power in the decision-making process, and this consultation is often tokenistic, and a 'box-ticking' exercise, where the suggestions of the local Indigenous community have no legal requirement to be implemented (Soderland & Lilley 2015; Costello 2021). This lack of power by Indigenous communities to manage and control their own heritage is in direct violation of the United Nations Declaration of the Rights of Indigenous People (UNDRIP) (2007), which states that *'Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage'*. Australia was one of the four nations that voted against the adoption of this declaration (Hobbs 2019). While the Australian Government has since said that it supports the UNDRIP, there has been little supportive action or legislative change undertaken (Australian Human Rights Commission 2021).

Another recurring theme is that the reporting of Indigenous heritage materials often comes with the completion of a significance or impact report, which caters only to Western notions of significance (i.e., with an emphasis on the importance of tangible, built structures), and leaves little room for Indigenous beliefs and values of significance, where objects and sites, their interconnections to landscapes, ancestors, Dreaming, and intangible heritage elements are the focus of significance (Thorley 2002; Pollard et al. 2020; Tutchener et al. 2021). While the Australia International Council on Monuments and Sites (ICOMOS) Burrra Charter (2013) has helped to include these definitions of heritage into the wider heritage discourse, more needs to be done at a local and state level to include Indigenous values, voices, and opportunities for self-determination into the administration and management of Indigenous heritage (du Cros 2022).

Fossils

There are very few sources of information that relate to the legislation surrounding fossil material in Australia. A seminal publication by Percival (2014) provides a breakdown of legislation that protects fossils for every state and territory of Australia. Almost a decade on, this publication remains the most comprehensive review of the topic. One issue outlined by Percival and several other authors (i.e., Henriques & Pena dos Reis 2015; Delvene et al. 2018; Cresswell 2019) is that fossils are rarely specifically mentioned in any legislation, but are sometimes instead included under

a broader array of protected materials, thus issues of fossil reporting, ownership and the legality of collecting are frustratingly ambiguous.

While fossils often spark imagination, curiosity, and wonder, it appears that they are rarely considered as 'heritage' (Lepore 2019; Chorell 2021). In a survey by the (then) NSW Office of Environment and Heritage (OEH) (2016) about Australian attitudes towards heritage, participants were asked to select the top five words/phrases that they related to heritage. Out of 27 different options provided by the authors, palaeontological and geological sites/objects were omitted, with the closest option being the abstract phrase/concept of 'history' (Fig. 2).

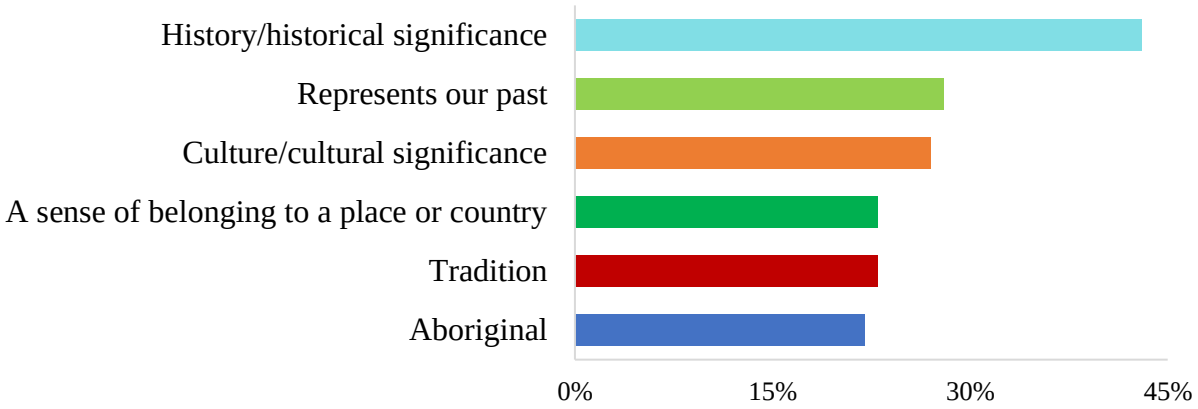

Fig. 2 – Top six words/concepts associated with heritage by the NSW community (n=1000). Participants were able to select up to five options from a list of 27 words/concepts. Apart from abstract concepts that may include fossils, such as 'History' or 'old', the closest term relating to fossil heritage is 'naturally occurring', of which only 8% of participants selected as associated with heritage. The word 'Aboriginal' was associated with heritage to a much higher degree (22%). The rationale behind the selection of these words/concepts by the authors remains unknown (OEH 2016).

This perception that fossils are not heritage is also present at a federal level, with many publications, such as the Australian Heritage Strategy (2015), not containing a single mention of fossil or palaeontological material or its protection (Johnston 2012; Spearitt 2012; Tonkin 2012). Other publications concerning community and heritage experts' perceptions of heritage similarly lack any mention of fossil material or natural heritage (Heritage Council of Victoria 2014; Beckett & McDermott 2016).

This exclusion of palaeontological material is at odds with definitions of heritage included in National Heritage List publications (e.g., Commonwealth of Australia & Australian Heritage Council 2017), and the State of the Environment Reports, all of which specifically list fossil sites and comment on the importance and value of the protection of palaeontological heritage (Mackay 2016; McConnell et al. 2022). While 'natural heritage' is mentioned more broadly in the literature,

there has been an evident disregard for fossils as heritage (NSW OEH 2016; Australia ICOMOS 2017; Page 2018). As such, this likely explains why the legislation surrounding the protection of fossils in Australia is so vague and weak. How can we expect the public to value and help preserve fossil material when even experts and academics within the heritage field don't always consider it heritage, or award it the same significance as other heritage materials?

Tell us what you really think: including community voices into heritage research

While previous surveys and research have incorporated the perceptions of academics and heritage professionals, there has been little opportunity for the Australian public to have a say in heritage discourses. The study and inclusion of community perceptions in heritage research may be fraught with clashing beliefs and opinions, yet an inclusive approach to heritage management and conservation that involves the entire community and all potential stakeholders in decision-making has many potential benefits (Singer et al. 2015; Viduka 2020).

An open discourse allows opportunities for sharing local knowledge, both from a farming or Western perspective, and from a traditional Indigenous perspective (Greer 2010; Veale 2014). An appreciation of the knowledge, lived experiences, histories, and stories of each of these groups can not only help to protect the physical heritage material, but can also empower communities and aid in local reconciliation efforts (Strickland-Munro & Moore 2013; Gaymer et al. 2014; McGinnis et al. 2020).

This local approach to heritage and protections can create a greater sense of trust between stakeholders as they find common ground and acceptance of different world views (Isidiho & Sabran 2016). While having these conversations may not be easy, and it is likely that parties will disagree with each other at times, these discussions are well worth having if it leads to the increased protection and appreciation of natural and cultural heritage, and the creation of better relationships and partnerships between stakeholder groups, based on mutual trust and respect (Bennett et al. 2017; Rawlings et al. 2021).

The benefits and pitfalls of surveys

An effective way of collecting and empirically assessing the perceptions and opinions of a community is through surveys (Santucci et al. 2016). Surveys allow for the collection of both quantitative and qualitative data, are generally time and cost-effective, and are conveniently disseminated and advertised through online platforms (Sinclair et al. 2012; Callegaro & Yang 2018). Surveys have been used across a range of conservation topics, from assessing trust in

governments to evaluating the relationships between stakeholder groups, and have proved to be a dynamic tool for examining the characteristics, motivations, and experiences of individuals and stakeholder groups in heritage conservation (Breakey 2012; Cvitanovic et al. 2018).

Encouraging participation in a survey can be difficult as the Australian public may not want to dedicate time to complete a lengthy or mentally taxing questionnaire (Chorell 2021). Surveys also have the caveats of poor response rates, substantial time required to establish rapport with a target community, and 'trolls', or people who submit fake/offensive answers to influence the results (Nayak & Narayan 2019; Tomaiuolo et al. 2020). In topics such as the discovery of fossils and Indigenous artefacts (a niche topic already within a narrow field), knowing the right questions to ask the Australian community to produce valuable results can be difficult (Jones et al. 2013). However, as there has been no survey that aimed to assess the perceptions specifically related to the *discovery* of heritage, the community's awareness of heritage laws, or their preferred ways of receiving this information, any survey of this type is likely to produce a valuable baseline about the Australian community and their perceptions about heritage.

METHODS

Survey Design and Structure

The Found a Fossil survey was created using LimeSurvey (version 3.28.0) and constructed using easy to understand multiple choice questions (total 40 questions) and open-ended questions (total 10 questions) (the total number of questions was variable, as specific answers to certain questions resulted in follow up questions) (LimeSurvey Development Team 2022). The online survey was open to anyone living in Australia over the age of 10 with internet access. The accessible plain English used, definitions provided, structure and short time required to complete the survey (under 10 minutes), were all designed to make the survey more engaging and relevant to the reader, and thus produce a higher rate of completion (Woods-McConney et al. 2013; Australian Bureau of Statistics 2022a). The survey was also designed to ensure that all participants were anonymous, with the aim of encouraging honest and forthright responses, and hence more likely to capture unexpected results (Busetto et al. 2020). Anonymity in surveys has also been shown to encourage participation from people who may not have previously engaged in heritage conversations due to fear of being judged (Nayak & Narayan 2019).

Most survey questions were designed to be mandatory closed inquiries (i.e., yes/no answers, or choosing an answer from a pre-determined list) to make the completion of the survey faster for participants, and to allow for streamlined quantitative analysis and output. Five-point Likert-type

scales were also used to measure responses (i.e., strongly agree/strongly disagree) to relevant statements; 'I don't know' was also an option on these scaled questions (Joshi et al. 2015). Some questions were coded so that they were only visible to respondents who selected specific answers to previous questions. The inclusion of a limited number of optional open-ended questions was intended to provide an opportunity for participants to expand on their responses, and to increase understanding of the concerns, perceptions, and opinions of the participants.

Participants were asked questions covering five broad categories: (1) generic information about themselves and their demographic background (e.g., age bracket, gender, occupation); (2) Indigenous artefact (henceforth shortened to artefacts) discoveries; (3) fossil discoveries; (4) heritage laws and trust in information sources; and (5) preferred media/communication formats. An additional optional section asked participants to choose from five different communication formats (social media post, blog, brochure, video, or webpage) that showed information about fossil and artefact discoveries and to answer questions about them relating to how effective they were at changing people's perceptions of fossil/artefact discovery, reporting, and protection. The full list of questions (as well as consent documents, project information given to participants, and definitions) included in the survey can accessed through Table S1[a].

Human Ethics

The survey questions and project design followed the guidelines set out by the *National Statement on Ethical Conduct in Human Research* (2018) and *Ethical conduct in research with Aboriginal and Torres Strait Islander Peoples and communities: Guidelines for researchers and stakeholders* (2018). The survey questions and research design were approved by the Macquarie University Human Research Ethics Committee under the Humanities and Social Sciences research application on the 30th of November 2021 (application No. 10181).

Questions were first tested through a pilot study of Macquarie University students in October 2021, with 238 respondents. Survey questions were revised and updated based on participant feedback to make language more accessible, questions faster to answer, or data analysis more streamlined. The ethics application was amended and re-approved to reflect these revisions.

Survey Advertising

Online advertising

The survey was hosted on the Found a Fossil website and open for approximately 5 months, from the 17th of January to the 30th of June 2022. The survey was advertised through a wide range

of online platforms to try to capture a wide diversity of participants who may be more representative of the heterogeneous experiences and opinions of the Australian population (Cvitanovic et al. 2018). Social media posts were published on an approximately fortnightly basis, with direct links to the Found a Fossil survey, and shared via LinkedIn, Twitter, Facebook, and Instagram. Several of these social media posts were also sponsored (i.e., paid advertising) to increase audience engagement and awareness of the survey. My own personal social media profile was used to post in relevant Facebook community groups to encourage a wide demographic spread of survey participants (e.g., hiking groups; lapidary clubs; farming groups; 'buy, swap, sell' groups, and community noticeboards for cities/towns across all states).

Direct emails were also sent to relevant groups who were asked to complete the survey and share it with their audiences. These groups included land care groups, Aboriginal land councils, government departments, farming networks/publications, geological societies, museums, local land services, etc. At times, this advertising led to features in local group newsletters, shares on social media, website features, or interview/article pieces (Fig. 3).

Fig. 3 – Examples of different advertising undertaken for the Found a Fossil survey. Left: Social Media post about a radio feature on ABC Central West; centre: in-person talk at the Australian Museum during the annual Dinosaur Festival; right: an online article and interview published by the Australian Government's National Indigenous Australians Agency (indigenous.gov.au) (2022).

In-person events & other advertising

To further promote the survey, in February and April I travelled through rural NSW to visit local museums (such as the Australian Opal Centre, Age of Fishes Museum, Wellington Caves, etc.), and connect with local communities. Plans were made to travel to other states of Australia to visit additional museums and communities, however, time, budget, and changing COVID restrictions hampered more extensive travel. Multiple radio interviews across three different states (NSW, SA, WA) helped to further promote the survey. I also gave several talks and presentations (both online and in-person), in which I discussed the project and encouraged survey participation,

such as at: the University of New England (Life, Earth & Environment seminar series, May 2022); the National Trusts' Annual Heritage Festival (May 2022); and at the Australian Museum's annual Dinosaur Festival (four talks over four days, April 2022). Business cards and flyers with a QR code to the Found a Fossil website survey page were handed out at these events where possible, and were also handed out to interested individuals during any personal interactions and travel. A full list of targeted survey promotion efforts (i.e., online groups contacted, presentations conducted, etc.) can be found on the Found a Fossil website (Table S1[c]).

Data

Upon closure of the survey, the completed survey responses, a total of 1379, were downloaded from LimeSurvey into a spreadsheet; as a xlsx file for qualitative and summary statistical analysis in Microsoft Excel (version 2207), and as a csv file, imported into R (version 2022.07.0) for statistical analysis. Responses where participants were able to select 'Other' and type in a response were organised into existing categories where possible, or sorted into new categories when enough responses were present in the dataset. Qualitative free-text responses were assigned to specific categories depending on the themes or attitudes they mentioned. These results were quantified to show a proportion of participants who raised similar issues within different themes/categories. Datasets will be available by request through the Macquarie University Research Data Repository (Table S1[d]).

Analysis

Summary statistical analysis was performed on most closed questions, however, due to time constraints and strict thesis word limits, only questions that related directly to the aims of this project are reported.

Selecting sub-groups for further analysis

Participants who selected 'Farmer/agricultural industry' as their occupation or who answered that they had Aboriginal and/or Torres Strait Islander ancestry were identified as sub-groups for comparison to the rest of the population for relevant questions. There was no overlap between these groups (i.e., there were no farmers with Indigenous ancestry).

Statistical Analysis

Statistical analyses were conducted to determine if demographic traits were significant predictors of fossil and artefact reporting. Here, significance was taken to mean $p<0.05$. The total

number of participants who answered each question is represented by 'n'. Fisher's exact tests were used to test for significant categorical predictors (e.g., Indigenous ancestry, gender, occupation) of a binomial outcome (i.e., 'yes' [I would report a fossil] vs 'no' [I wouldn't report a fossil]. Binomial generalised linear models (GLM) with a logit transformation were conducted on continuous predictors (e.g., age, education) of a binomial outcome to test for significance; Pearson's Chi-Square tests were used to corroborate significant results for these continuous predictors. When multiple comparisons were made, p-values were adjusted using the Holm Method (calculated using p.adjust function in R) to avoid false positives (Holm 1979). Pairwise prop-tests were used to test for significant relationships between pairs of proportions in group comparisons (e.g., if there was a significant difference between various occupations and reporting a fossil).

Representativeness of sample: Survey respondents vs Australian population

Population proportions for the survey were compared with the wider Australian population using data from the Australian Bureau of Statistics (ABS) and from the 2021 census (ABS 2022b). These comparisons (presented below) revealed that while parts of the survey sample are not representative of the Australian population, a number of demographic variables are comparable (ABS 2022b). While state of residence, age, and gender tend to be similar to the spread of the wider Australian population, Indigenous ancestry, education, and occupation are less representative. While this is not an unexpected outcome from an online-only survey, it does mean that caution must be used in regard to generalising from the results presented below for the entire Australian population. The high proportions of bachelor's degree and higher educated participants, people in education and training, and the science and technology sector, likely reflect my own personal networks within these industries, and the high visibility of the survey to people already linked to me on online platforms and social media. This high number of higher-level education attainment (over 65% of the sample) may mean that the sample population has more trust in, and a better understanding of academic institutions and research processes (including Master of Research theses), potentially leading to higher levels of participation from these university-educated groups in this survey.

Participant Bias

As participants of this survey were voluntary respondents it is important to consider that they may have already had an interest in fossils, Indigenous artefacts, or heritage, and thus may have additional knowledge of their protection and the reporting protocols that were the focus of several of the survey questions. The time/energy required to complete the survey, the fear of

potential prosecution for opinions (despite the anonymity of the survey), and perceived lack of personal relevance may have been reasons why more people did not complete the survey. Additionally, as the survey was online only (as a result of COVID) and mostly advertised through online platforms, people without an online presence or with limited/no access to internet (e.g., in remote communities) would likely not have seen the survey advertised or been able to complete it.

RESULTS & DISCUSSION

A total of 1379 people completed the Found a Fossil survey. Participants resided across Australia, with nine respondents being from overseas (most of whom specified that they had either previously lived or worked in Australia) (Fig. 4). The results presented and discussed here have been chosen due to their relevance to the project aims, and their ability to demonstrate important insights into the perceptions of parts of the Australian public. Detailed analysis of every survey question was unfortunately out of the scope of this thesis due to time and page limit constraints.

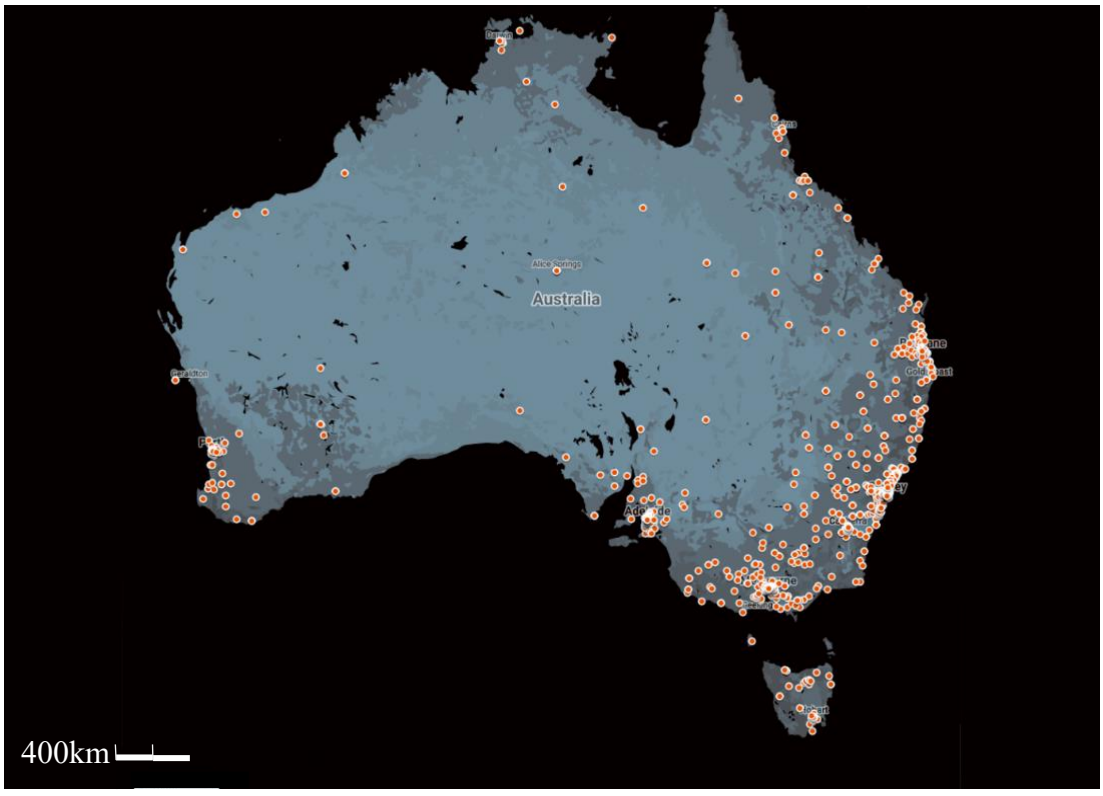

Fig. 4 – Distribution of Found a Fossil survey responses from around Australia (n=1284). An additional 86 respondents were from Australia, but did not provide a postcode; the remaining nine participants were not currently residing in Australia, but specified that they had previously lived or worked here. Image credit: Google Maps 2022. Scale = 200km.

Section 1: Demographics

1.1 Comparisons with Census data

When compared to population data from the ABS 2021 Census (Table S2), the spread of survey respondents was proportional to the population size in each state, with NSW being the most populous state both for the survey, and the wider Australian population, followed by Victoria and Queensland. There was a slightly higher proportion of females compared to males in the survey respondents (54.6% versus 42.5%), with the rest of the participants identifying as 'Other' (2.9%). This generally aligns with the census data, with females having higher representation than males (50.7% versus 49.3%).

The Australian population tends to have a relatively even spread of age categories (between 12-17% of the population in each category over 10), with a median age of 38 years old; the survey sample was skewed towards 50–69-year-olds (the 50–59-year-old group being the median), with people in the 10-19, and 70+ year-old categories being the most underrepresented (4.4% and 8.9% respectively).

Of the survey respondents, 8.5% of participants identified as having Aboriginal and/or Torres Strait Islander ancestry; this is a higher proportion than the Australian population (3.2%).

Concerning the current occupations of the survey participants, retirees were the most highly represented (19%), compared to around 15% of the Australian population (Retirement and Retirement Intentions 2018-19, ABS 2020). Workers in Education and Training (12.3%), followed by Science and Technology, and Students (both 8.3%) were the next highest represented occupations. Of interest for this research is also the proportion of Farmers/agricultural workers (5.6% of sample), and those working in the Heritage Sector (4.9%).

The education of the participants revealed that a majority held a bachelor's degree or higher (65.5% of sample), followed by technical college qualification/diplomas/certificates (22.3%). Compared to the Australian Census data, the survey sample has a considerably higher level of educational attainment, with only 26.3% of the Australian population having a bachelor's degree or higher (Table S3).

1.1.1 Limitations

While these comparisons between the Australian population and the survey respondents may show some similarities in certain demographic categories (i.e., gender, state of residence), the potential biases discussed above limit the ability for this data to be generalisable across the rest of the Australian population.

1.2 How did you find out about this survey?

Most of the survey participants came across the survey through social media (over 77%), followed by direct email advertising to relevant stakeholders (11.6%). Circulation of the survey through word of mouth, radio interviews, advertising at in-person events/talks, on the Found a Fossil website, and in local newsletters and magazines were also listed.

Section 2: Indigenous Artefacts

2.1 If you found an object that you knew was an Indigenous artefact, would you inform anyone (other than friends or family)?

Most participants indicated that they would report the discovery of an Indigenous artefact (78.2%) (shortened to 'artefact' here after). When exploring if any demographic variables were significant predictors of reporting (Tables S4-S7), gender was a significant predictor of selecting 'yes' to reporting an artefact find (Fischer exact test, $p<0.001$), with women 0.53 times more likely to report artefacts than men.

Age was also a significant predictor for reporting artefacts (Chi-square test, $p=0.008$) with younger people (i.e., 10–39-year-olds) more likely to report an artefact compared to people over the age of 40.

2.1.1 Demographic predictors of reporting

While the higher rates of reporting for younger people may be due to them being more aware of Indigenous social concerns (with the role of social media and increased exposure to politics and social issues likely playing a part), it may also be because older people (i.e., 40+-year-olds) have more familiarity and memory of the introduction of the *Native Title Act* in 1993, and the resulting discussion and fear of land reclamation and restrictions (discussed more in section 6.2) (Toone 2016; Hobbs & Spennemann 2021). Differences between genders and conservation attitudes are discussed more in section 3.3.1.

2.2 Who would you tell about an Indigenous artefact find, and why?

Contacting the local Indigenous community was the clear choice for Indigenous artefact finds, with 29% of people selecting this option (followed by museums, at 16%). When people were asked *why* they would contact these groups, the local Indigenous communities were thought to be the most knowledgeable about what to do with a new discovery, and participants acknowledged that Indigenous artefacts do not belong to them (Fig. 5). Seven percent of people selected the state

heritage body option (on par with Parks and Wildlife), with the main reason being that they were likely to know what to do with a find.

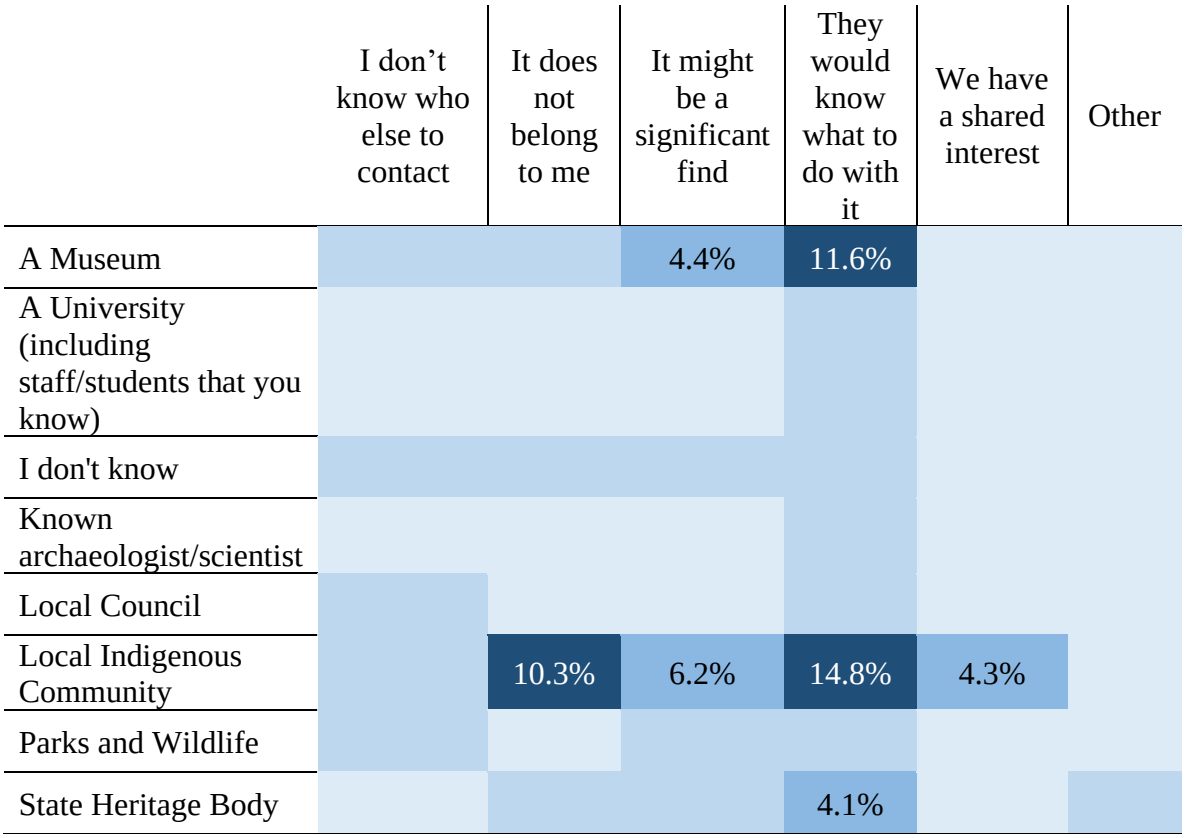

Fig. 5 – Survey results showing the most popular contacts for Indigenous artefact finds, and why they were selected (n=1078). Percentages displayed represent the highest proportions of survey participants that selected this combination of answers. Local Indigenous communities were a clear choice due to their knowledge of finds; people also considered such heritage material as belonging to local Indigenous communities. Museums were also considered knowledgeable about handling finds. 'Other' and 'Social Media' options were removed as all 'why' categories were <1%. Colour key: <1%; 1-3.9% 4-6.9%; 7-9.9%; >10%.

2.2.1 Local vs state processes

Whilst one would think that contacting the local Indigenous community would be the logical answer (who better to advise on the Indigenous heritage material of an area), in most jurisdictions, new artefact discoveries are generally meant to be reported to the state heritage body. While contacting the state heritage body can be beneficial, as these agencies can hopefully liaise with relevant leaders of Indigenous communities, the disadvantage is that many stakeholder groups, including both farmers and Indigenous communities, tend to have deep-seated mistrust in state/federal governments (Hobbs & Spennemann 2021; McConnell et al. 2022).

While the scenarios presented in the survey were hypothetical, and may be limited in their conversion to actual behaviours, this preference for contacting the local Indigenous community may

reveal a wider desire to manage heritage at a local level. Top-down and state-controlled heritage processes have been previously perceived as lacking care or personal connection to the local heritage they are making decisions about (Perkin 2010; Brown 2016; Liebelt 2020). These factors have led to a distrust in state governments by many stakeholders, with people believing that governments are much more likely to pursue their own agendas, policies, and curated stories, rather than pursing truth-telling initiatives, or what is wanted by the Australian community (Aplin 2009; Waterton 2018; Dellios 2019; Evans et al. 2020). This distrust in governments was expressed frequently within the qualitative responses within the Found a Fossil survey (Table 1).

Table 1 – Issues repeatedly raised by survey participants in qualitative free-text questions.

Issue	**Comments**
Lack of transparency and accessible information	*'Who gets to decide what happens to it once it is donated? Can I stipulate that it can never be sold to a private collector? I would hate for one to ever be restricted from the public out of greed'* [Survey ID: 25]. *'Looking up the laws about fossils and artefacts isn't hard…but they tend to be vague and very open to interpretation, the websites aren't always easy to navigate, the laws are often changed based upon what politicians are in charge…so it's really hard to follow, understand and keep up with it all'* [Survey ID: 513].
Mistrust in governments	'*I know there are intersecting laws under different government authorities that makes it confusing, especially for Indigenous finds. I don't trust government to respect those finds if they are politically inconvenient'* [Survey ID 145].
Mistrust in Museums	*'Once items disappear into the coffers of state museums they are rarely seen again'* [Survey ID: 49].
Fear of land restrictions	*'In general, private landholders are aware of obligations if fossils or artefacts are found, however, most do not report their findings as they see a risk in loss of control over their land'* [Survey ID: 320]. '*I think if I found an Indigenous Artefact I would be in a real bind as what to do. As I would love to see it preserved and learn more about the local culture and practices but I would also be scared that our land would have restrictions placed on it*' [Survey ID: 587].

Other disadvantages with state heritage bodies are that despite being the dedicated government bodies for heritage information, they suffer from a lack of funding and staffing (Fig. 6). The lack of funding may reduce their ability to respond to enquiries regarding heritage discoveries in a timely manner; consequently, increasing the accessibility and transparency of information on their websites and to the public should be a priority, especially as this was a recurring concern

expressed in the qualitative responses within the survey. While changes to state heritage legislation may be the more highly desired outcome to improve the protection of heritage material, the time and resources required to make this happen may not be within the means of many underfunded state heritage departments. Thus, by making the current heritage information and legislation easier to understand, by doing something as simple as editing a website, greater accessibility and transparency of information could surely be achieved.

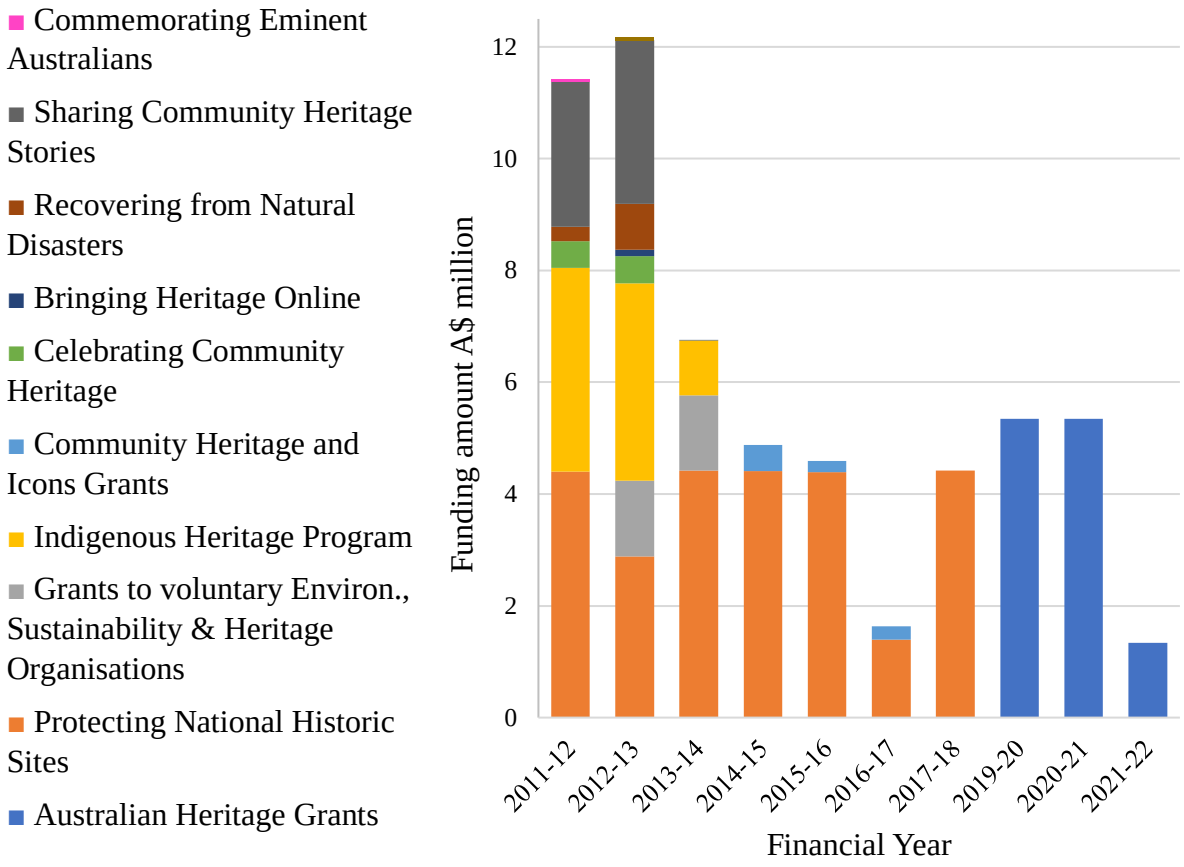

Fig. 6 - Commonwealth heritage projects funded by the Australian Government, 2011-12 to 2021-2022. Note: Protecting National Historic Sites grant was replaced by the Australian Heritage Grants in 2019, but the criterion for nomination ultimately remains similar (i.e., funding to go towards protecting already listed National Heritage places). Data from Jackson et al. (2016); Australian Government (2022a). *After speaking to an agent from Business.gov.au, they confirmed that the funding from 2021-2025 was 5.47 million spread across 2021-2025 (Pers. Comm. 30/08/2022).

2.3 What would stop you from telling someone about an Indigenous artefact find?

Not knowing who to contact was the dominant response for Indigenous artefacts (28% of people), followed by not knowing if the find was significant or worth reporting, with 25% of people selecting this option (Fig. 7). Many people expressed their lack of familiarity with heritage material

and thus lacked the confidence to identify finds, let alone the difference between something considered significant or not. This sentiment was expressed by one participant stating '*depending on the type of artefact, I might not recognise it as a human-influenced object in the first place - if I thought it was a rock or stick shaped by accident with natural processes, especially if it was a broken PART of an artefact rather than a whole artefact, the archaeological significance would not come to mind*' (Survey ID: 157). Qualitative responses also revealed the concerns of the community surrounding heritage discoveries and conservation, with lack of transparency and mistrust in governments repeatedly mentioned (Table 1).

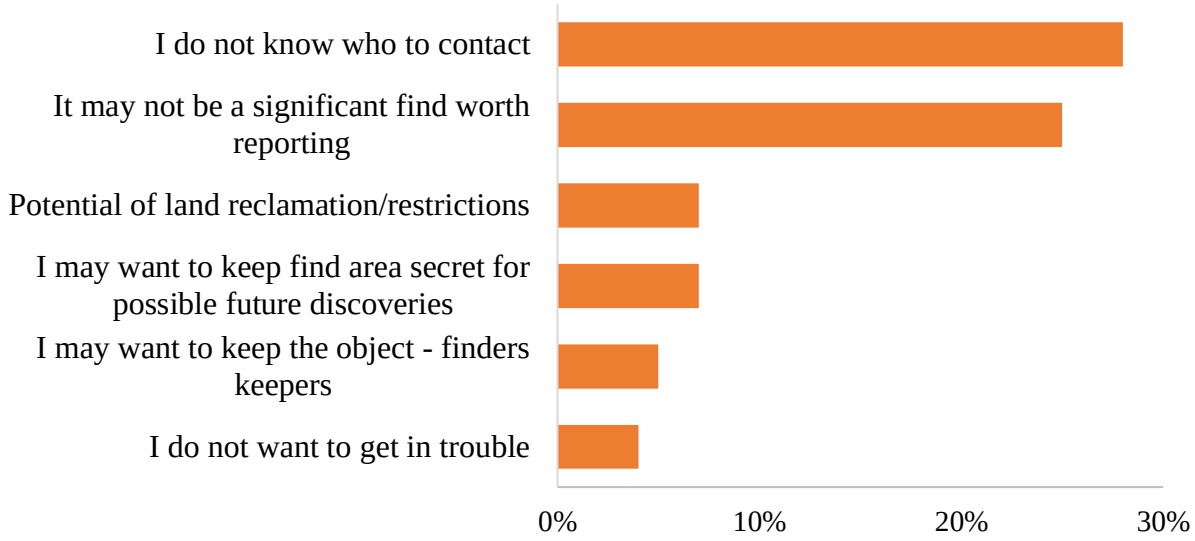

Fig. 7 – Reasons preventing people from reporting an Indigenous artefact find (n=1379). Reasons with less than 4% have been excluded.

2.3.1 Improving information

That artefacts have such a high proportion of people selecting the 'I do not know who to contact' option is interesting since there are entire state government departments dedicated to the protection and reporting of Indigenous heritage finds and sites (e.g., Heritage NSW, State Relations – First Peoples Vic). It is also interesting because a relatively high number of people who currently work in the heritage industry completed the survey (4.9% of respondents), yet the proportion of people selecting the 'I don't know who to contact' option was still very high. This result shows that current reporting processes, protections, and other heritage information are poorly communicated. While information such as relevant legislation, reporting processes, who to contact upon a find, etc. may be present on various government websites, it is often buried amongst other information, that at times, may be outdated or conflicting (Hobbs & Spennemann 2021). Similarly, while information on how to identify Indigenous artefact finds or sites exists, it can again be difficult to find, or this knowledge comes with specialised training (especially concerning assessing the significance of

such finds). Therefore, it is not unexpected that a considerable amount of people also considered that their potential finds would not being worth reporting. The other fears of land reclamation and getting into trouble also likely stems from the lack of accessible and effectively published information about heritage finds. So, interested members of the public, or those who have discovered heritage items, would likely have to be dedicated to digging for this information themselves.

Section 3: Fossils

3.1 If you found an object that you knew was a fossil, would you inform anyone (other than friends or family?

Most participants selected that they would report a fossil find (70.6%). Only gender was a significant predictor for answering 'Yes' to the question of 'would you tell anyone about a fossil find?' (see Tables S4-S7 for proportions of reporting across demographic variables). Females were significantly more likely to report a fossil compared to males (Fischer exact test, p=0.009), with women 0.72 times more likely to report. Pairwise comparisons of proportions also revealed a significant difference (p=0.037) in the reporting behaviours of students and farmers, with farmers significantly less likely to report a fossil (see section 6.1 below for discussion).

3.1.1 Conservation & gender

This higher proportion of reporting by females (for both fossils and Indigenous artefacts) is mirrored in a study by Cvitanovic et al. (2018) who found that women were more trusting of scientific and natural management processes than males (in the context of marine park management in Ningaloo Marine Park, WA). In the context of the Found a Fossil study, women may therefore be more trusting in the people they may report fossil finds to, compared to men. Kim and Weiler (2013) also found that women were significantly more likely than men to have a 'high environmental attitude' (i.e., were much more likely to think that fossils were important to protect for future generations, and were more aware of potential negative outcomes of fossil collecting), based on responses from visitors to the 'Jurassic Coast' fossil region in England.

3.2 ***Who would you tell about a fossil find, and why?***

For fossil discoveries, museums were chosen by 25% of the survey participants, with the rest of the population spread across a wide number of other contacts (e.g., Parks and Wildlife, a known scientists/palaeontologist [both 9%], and a university [8%]). Fossils are generally not required to be reported by law, but it is instead up to the interest and curiosity of the discoverer to

reach out to a relevant institution/individual (e.g. a museum) for identification of the find – even if it is potentially an important or new species. When survey participants were asked why they would contact their selected institution, museums were considered the most likely to know what to do, and how to treat significant finds (Fig. 8).

A later survey question about what sources of information people were most likely to trust, revealed similar results, with 90.5% of respondents agreeing that they trusted information provided by museums (this compared to 74.1% for government websites, and 10.9% for social media) (Table S1[b]).

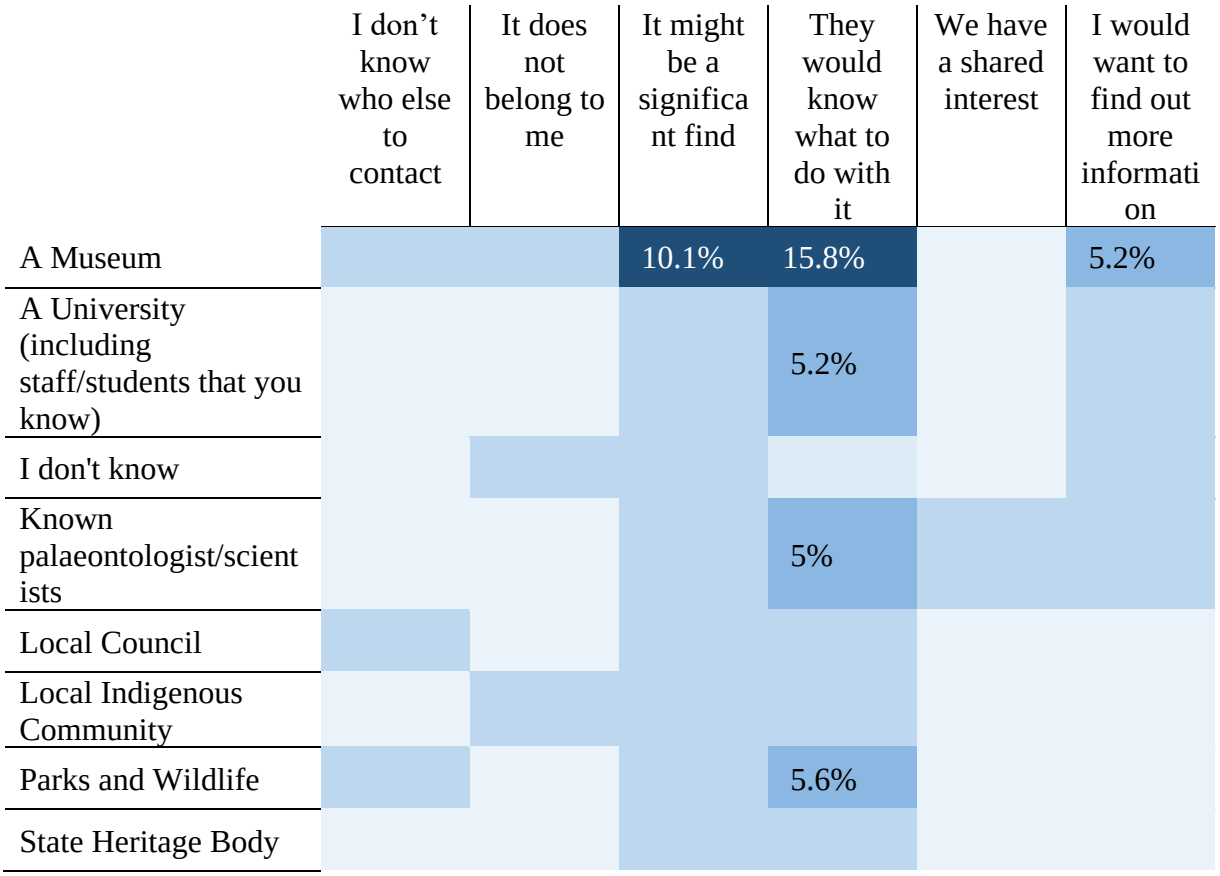

Fig. 8 – Survey results showing the most popular contacts for fossil finds, and why they were selected (n=935). Percentages represent the proportion of survey participants who selected this combination of answers. 'Other' option has been removed as all categories were <1% (n has been adjusted to account for this). Colour key: <1%; 1-3.9% 4-6.9%; 7-9.9%; >10%.

3.2.1 Trust in museums

This trust in museums is supported by a recent study (Evans et al. 2020) that showed that over 70% of Australians would put their 'political' trust and confidence in information disseminated by museums; this was much higher than information provided by, for example, federal governments (54%) and social media (only 20%). Being an established and trusted source of scientific

information, museums have been able to create many successful community engagement programmes and build positive perceptions and relationships between the public and scientists. Innovative and inclusive citizen science programs, volunteering opportunities, and the fact that museums tend to have the staff, facilities, funding, and government support to run many hands-on, and fun community engagement programs, means that museums will continue to play a central role in future communication, protection, and celebrations of Australian heritage (Cvitanovic et al. 2015; Clary & Wandersee 2014).

However, people not knowing that they can contact a museum (or other institution) about finds, or not considering their finds significant enough to report (Fig. 7), as well as a general distrust in museums (and government) due to lack of transparency (Table 1) will be barriers to overcome in future heritage conservation initiatives. For example, the Australian Government's Cultural Gifts Program may offer tax incentives to those who donate cultural items (at times including fossils) to museums, libraries, art galleries, etc. (Commonwealth of Australia 2022). This initiative has helped museums like the Australian Opal Centre in Lightning Ridge, NSW, to acquire important opalised fossils from miners that may have otherwise been destroyed to make opal jewellery (Australian Opal Centre 2023). Yet, in places like Queensland, it has, at times, been used by farmers/miners/people who found the object to keep fossils and cultural objects further out of reach of state museums, likely due to distrust in museums and the perceived lack of ownership and decision-making power once objects are donated (S. Salisbury Pers. Comms. 24/01/23).

3.3 What would stop you from telling someone about a fossil find?

Not knowing if a find was significant or not was the dominant response for fossils (25% of people), followed by not knowing who to contact (22% of people) (Fig. 9). Wanting to keep the object, wanting to keep the find area secret, and the potential of land reclamation were also the next most popular responses, similar to artefacts.

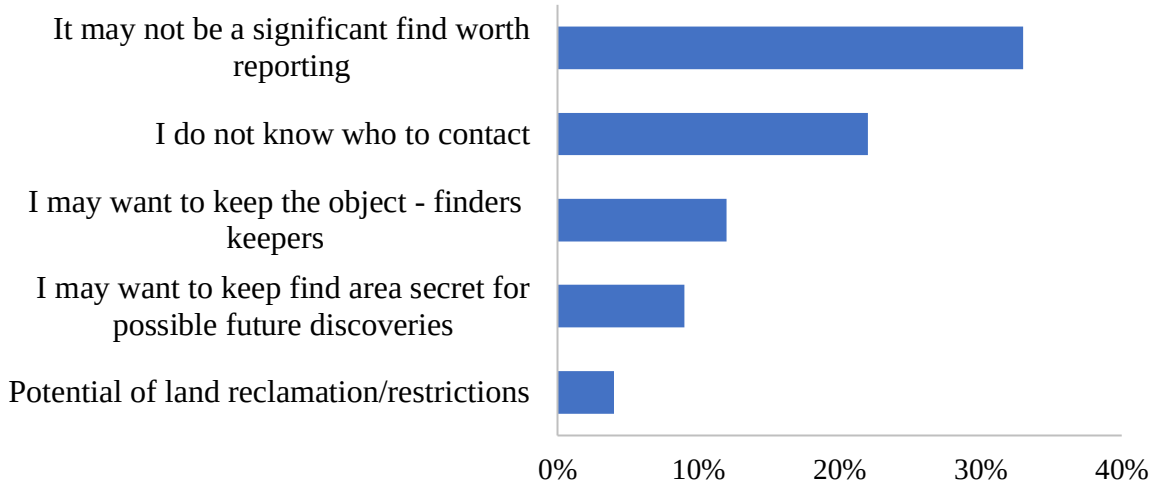

Fig. 9 – Reasons preventing people from reporting a fossil find (n=1379). Reasons with less than 4% have been excluded.

3.3.1 Understanding significance

Similar to artefacts, survey respondents expressed a lack of familiarity with fossil material and its identification, with one respondent stating '*I would convince myself it's probably just a rock*' (Survey ID: 487). However, other participants expressed that contacting someone about every potential find could be a waste of time, both for the discoverer, and for the person/institution they contact for identification, especially for known sites, or common fossils. When compared to Indigenous artefacts, fossils have none of the dedicated government departments/resources associated with their reporting or protection (unsurprising as there is generally no legal requirement to report finds). Yet, more people indicated that they did not know who to contact concerning Indigenous heritage (25% of people) compared to fossils (22% of people), revealing that the current reporting processes, protections, and other heritage information are poorly communicated to the Australian public. If Indigenous artefacts/sites are already considered unfamiliar to the public, despite the protections, legislation, and resources dedicated to their protection and celebration, then fossils, and their comparable lack of protections or resources means that many finds are likely hidden in drawers or sitting on mantlepieces, unidentified, if indeed they are picked up or recognised as something special at all.

Section 4: Heritage Laws

4.1 Are you aware of laws in your state that protect fossils/Indigenous artefacts or sites?

For Indigenous artefacts, 54.6% of people said that they were aware of laws in their state or assumed that they existed, compared to 41.5% for fossils. People who indicated they were aware of

laws relating to the protections of both fossils and Indigenous artefacts were significantly more likely to report them compared to people who said they were unaware of laws (1.3 times more likely for artefacts, and 2.2 times more likely for fossils (Artefacts $p=0.04$; Fossils $p<0.001$).

4.2 Are the laws accessible, or adequate?

When asked about their ability to provide details about heritage laws, participant responses are generally spread across the spectrum, from strongly disagree to strongly agree, with most responses spread around the middle (i.e., from somewhat disagree to somewhat agree), and a trend toward agreeing that they can provide details about both fossil and artefact laws (Figs. 10 and 11). However, when asked if they thought that laws were easy to access and understand, the proportion of 'I don't know' responses increased considerably (e.g., from 8.3% to 21.2%). Another substantial increase in 'I don't know' responses occurred when asked if laws were adequate, with 37.1% for artefacts and 47.2% for fossils of people selecting this option. The number of people agreeing that laws were adequate were by far the minority, with only 23.1% of people for artefacts and 22.9% for fossils agreeing that laws are adequate in their state.

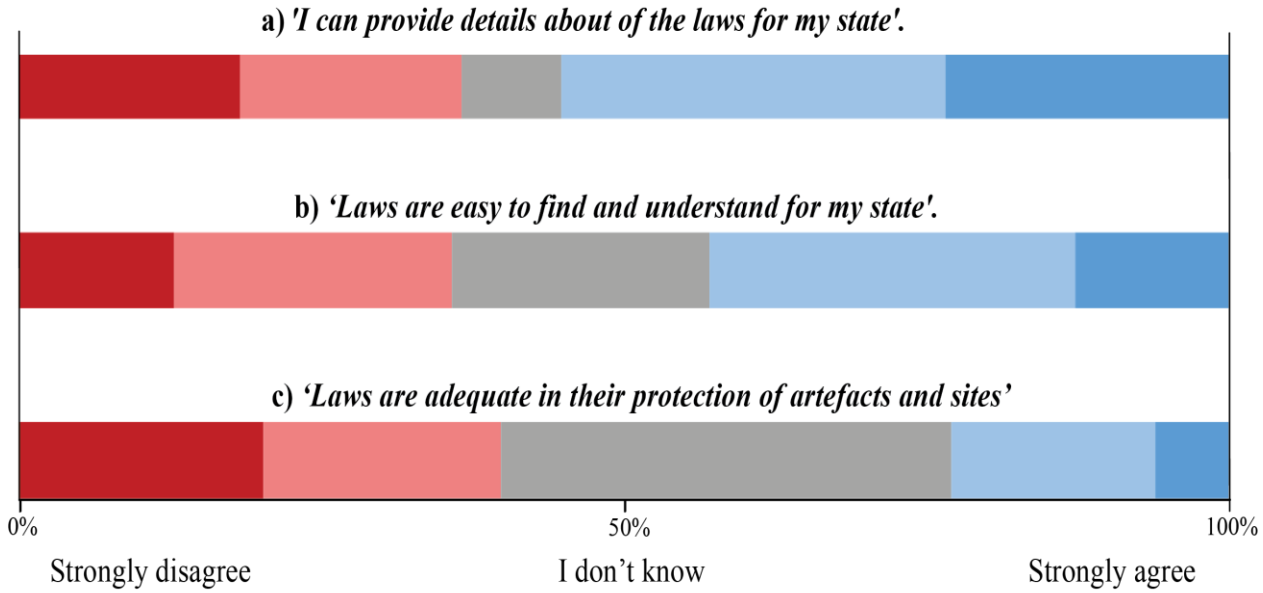

Fig. 10 – Proportions of agree/disagree/I don't know responses to questions about Indigenous artefacts in the Heritage Laws section of the survey (n=739 [a/b], n=1379 [c]). Questions a) and b) were only available to those people who answered 'Yes, I am aware of laws that exist in my state or assume they exist' to the previous question. Question wording does not reflect exact wording of survey – it has been shortened here for clarity.

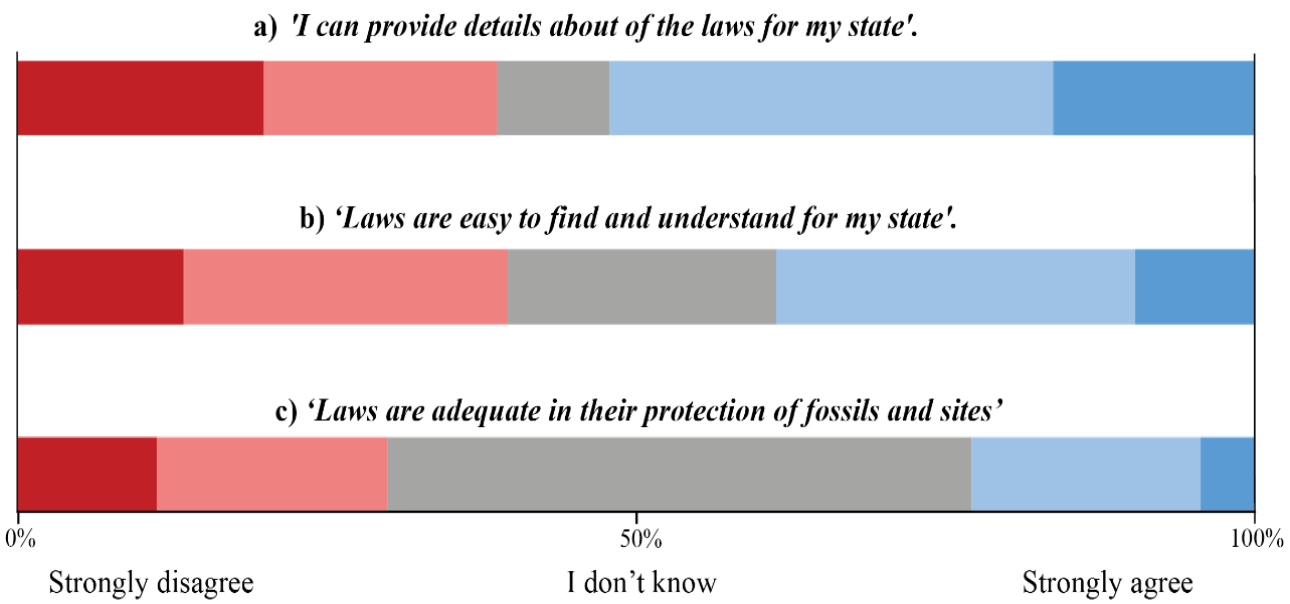

Fig. 11 – Proportions of agree/disagree/I don't know responses to questions about fossils in the Heritage Laws section of the survey (n=558[a/b], n=1379 [c]). Questions a) and b) were only available to those people who answered 'Yes, I am aware of laws that exist in my state or assume they exist' to the previous question. Question wording does not reflect exact wording of survey – it has been shortened here for clarity.

4.2.1 Awareness and communication of legislation

A study commissioned by the NSW Office of Environment and Heritage in 2016 showed a similar result that, '*more than 1 in 2 neither agreed nor disagreed that heritage protection is well managed in NSW. Similarly, 2 in 5 did not know if the protection of heritage in NSW and their local area is adequate or not'*. More than five years on from that study, this new result shows that it is still not being effectively communicated to the public, and that the laws themselves are perceived to be inadequate.

In Australia, both fossils and Indigenous artefacts are protected under the *Protection of Movable Cultural Heritage Act 1986*. While this Commonwealth Act does protect heritage materials from being internationally exported, it provides no course of action for handling heritage objects upon their initial discovery (Office for the Arts 2020). Each state and territory in Australia have legislation that protects heritage material (Percival 2014; Heritage Chairs of Australia and New Zealand 2020). Yet, the legislation that details these protections and reporting requirements is often lengthy, uses technical jargon and, unless you are aware of the specific act relevant to the location of your discovery, it can be a challenge to even find (Table S8) (Packham 2014). Each state tends to have a government department or team dedicated to Indigenous heritage management and

protection. However, if fossils are protected, it is often confusing and frustrating trying to find information about who you can contact for more information. Thus, it is no surprise that people are less aware of fossil laws compared to Indigenous heritage laws when they are rarely explicitly protected under any state legislation, especially when compared to Indigenous heritage, which is protected in every state.

This confusing patchwork of legislation and its communication was raised in the Australian Heritage Strategy (the Strategy), published in 2015, which aimed to provide national direction for heritage management, conservation, and communication across all levels of the Australian government and community (*Australian Heritage Strategy*, Commonwealth of Australia 2015). The Strategy mentions the inconsistencies across state and federal policy, the lack of funding dedicated to heritage, and the absence of community input, understanding, appreciation of heritage and its protection. Yet, the publication puts much of the responsibility for addressing these issues onto local government, community groups, and stakeholders. While it does state that the federal government will be a leader in implementing this strategy, the document fails to provide details or actionable plans for *how* the federal government (or any other stakeholders) will resolve these challenges (Mackay 2016; National Trust 2021). Almost seven years on, it is unclear if any progress has been made (Cresswell 2019; McConnell & Fletcher 2020). The Strategy itself seems to have been only narrowly adopted, and many of the initiatives/solutions introduced have not met their deadlines or have been neglected altogether (Commonwealth of Australia 2016). For example, the 'Australia's Community Heritage' website, touted in the Strategy as an engaging platform to share heritage stories and information in an accessible way (funded by the Australian Government), no longer exists, and the link provided in the Strategy is now owned by an unrelated superfund company (Community Heritage 2022). Additionally, the Strategy has no legal jurisdiction and instead acts as a set of guidelines; thus state governments, communities and other stakeholders have little incentive to adopt the Strategy (Waterton 2018).

Section 5: Communication Preferences

5.1 Which of the communication formats did you view?

In this survey section, participants were able to opt in to watch/read one of five different communication formats (Fig. 12, Table S1[e]). Available formats included a social media post, a webpage, a video, a brochure, and a blog. Each of these formats had the estimated reading/watching time listed in the survey, with the social media post being the shortest (approx. 1 minute) and the webpage being the longest (approx. 7-8 minutes).

After watching/reading their selected format, participants were asked why they chose that format (Fig. 13) and how informative and engaging it was. The social media post was the most popular option (31% of people choosing it) and was considered the quickest to view, and one of the most easily accessible formats. Videos were also considered similarly accessible and easy to understand, and were also considered visually engaging and interactive. When participants were asked if they found their chosen format engaging and/or informative, over 45% of people said that they found it 'Very Engaging', and over 55% of people said it was also 'Very Informative'.

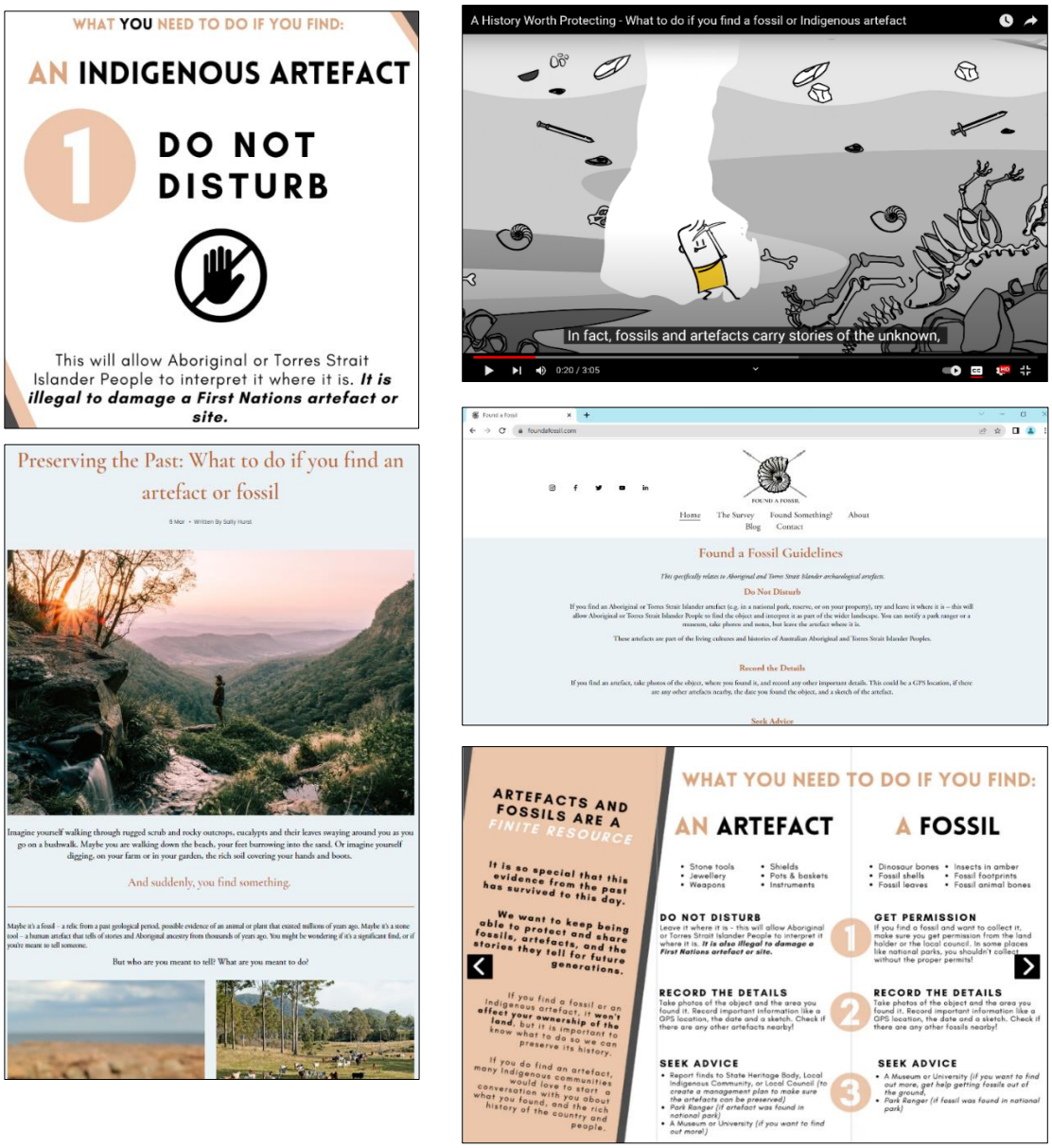

Fig. 12 - Snapshots of the communication formats created for the Found a Fossil survey, and now permanently available on the Found a Fossil website. Formats included a social media style post (top left), blog (bottom left), a video (top right), a webpage (centre right), and a brochure (bottom right).

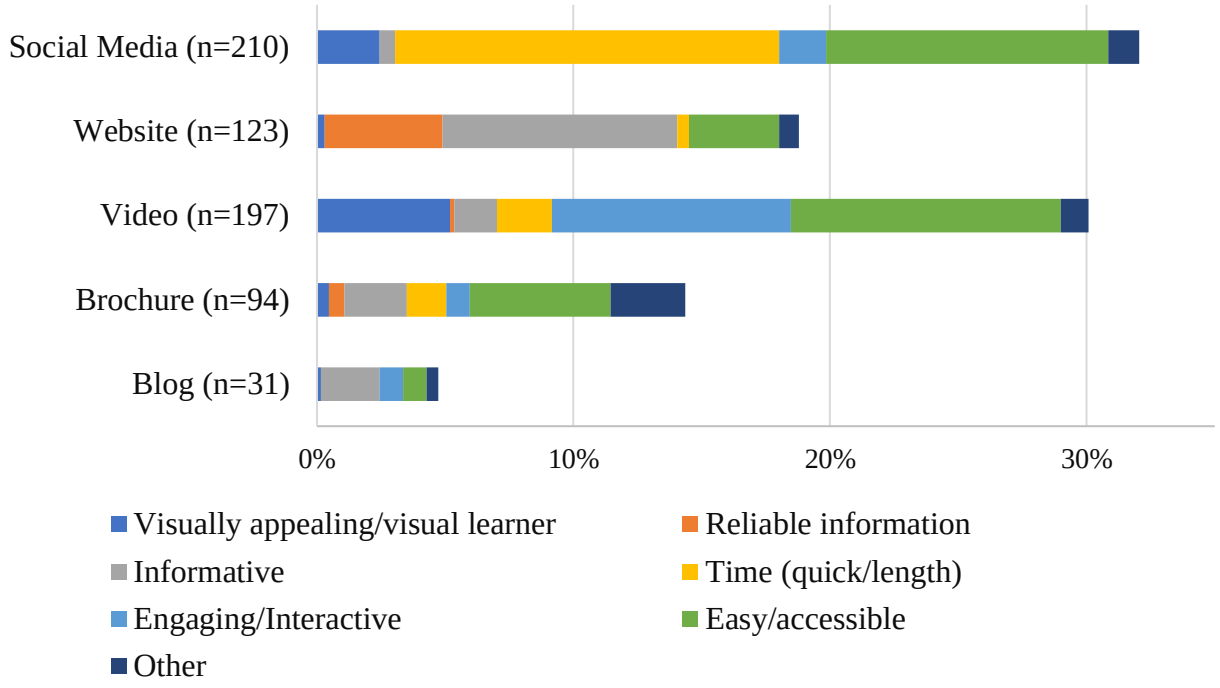

Fig. 13 – Reasons why participants chose different communication formats to read/or view within the survey (total n=655).

When breaking down communication preferences by demographic variables, such as age (Fig. 14) there is some variation between age brackets, where 30+ year-olds prefer webpages, but 20–29-year-olds prefer social media style posts.

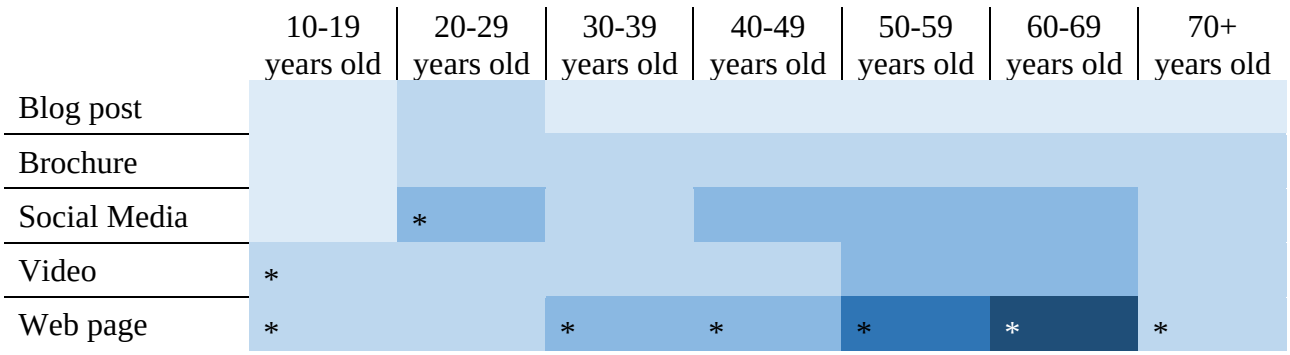

Fig. 14 – Communication format preferences/choices of different age groups. Data collated from optional section after participants viewed/read a chosen communication format, and from the rest of the survey participants who were asked a hypothetical question regarding what format they would choose to view (total n=1365). Inclusion of '*' indicates format with highest percentage for that age group, scored across all variables. 'Other' option has been removed from format choices as all groups were <1%. Colour key: <1%; 1-3.9% 4-5.9%; 6-7.9%; >8%.

Participants were also asked to rate how important they found specific characteristics of content they consume (assuming this content was about fossils/Indigenous heritage discoveries). Results showed that the author/publisher/sponsor of the content was clearly considered the most important out of all features listed (other characteristics included publication date, engaging voice, good aesthetics, etc.) (S. Fig. 1). Being concise and having a reference list/supporting evidence were also rated as very important by most people. Having a catchy title was considered the least important feature.

5.1.1 The power and accessibility of social media

The sponsored social media posts on the Found a Fossil profiles were the most effective way of reaching audiences around Australia that was both cost effective and time efficient. Over the course of the survey advertising period, a total of 14 advertisements were sponsored on Facebook, Twitter, LinkedIn, and Instagram. The estimated reach (i.e., the number of people who saw the ad at least once) of the Facebook ads alone was over 150,000 people.

Social media platforms have become powerful tools for information dissemination across the globe. Within Australia, there are over 20 million social media users — over 80% of the total population (Yellow 2020). While information dissemination through social media does face several challenges, such as the requirement of audiences to have social profiles and access to the internet, time-consuming planning/content creation and negative feedback/trolls, these are outweighed by the benefits of raising awareness about topics like heritage conservation (National Co-ordinating Centre for Public Engagement 2018; Chiang et al. 2019). The immediacy and free access of social platforms, and tools such as ‘stories’ on Facebook, Instagram, LinkedIn, etc., allow audiences to see beyond the polished publications (which they may not be reading anyway), to the exciting behind-the-scenes of science, and the human stories behind research (Riesch et al. 2017; Klar et al. 2020). Additionally, with the effects of the COVID-19 pandemic and the subsequent inability to teach or work in-person, digital media have become an even higher priority for information accessibility and dissemination (Yuan et al. 2018). In the context of Australian heritage protection, social media platforms provide an excellent opportunity to connect with audiences of different demographics and interests around Australia (Kelly et al. 2010; Liang et al. 2021). However, the limited access to internet by some communities, especially in rural and remote locations (who may indeed be more likely to come across heritage finds), will likely affect their ability to access digital information, or report finds (as many portals require online submissions). These limitations will need to be considered in future communication strategies of this content throughout Australia.

Concerning the results for the individual communication features, the high number of university-educated participants in the survey may account for the perceived high importance of the author/publisher of content and having a reference list, compared to other features listed. However, the ease of sharing blogs, videos, infographics, etc. and the ability to incorporate the features that different audiences consider important within social media platforms and posts provides further evidence for their value, and the wide reach they may have, especially compared to traditional platforms (Tennant & Lomax 2019).

5.1.2 Preferences by demographics

Differences among demographic groups (Fig. 12) show how heterogeneous the Australian population is, and may provide guidance for targeted messaging to different demographics in the future (Jakopak et al. 2021). Tailored messaging to specific audiences is a foundation of strategic communication, and considers the different backgrounds, perspectives, experiences, worries, and concerns of these diverse groups that are trying to be reached (Dudo & Besley 2016; Medeiros & Garcia-Fernandez 2020). In the context of Australian heritage, tailored messaging may be required to create positive connections and perceptions of heritage, and will be a key to the effective engagement and involvement of different communities and groups in the protection of heritage (Jefferson et al. 2015). From the variable preferences of different age demographics to the distinct concerns of farmers, or Indigenous communities to the rest of the Australian population (discussed below), recognition of the differences and similarities between these groups will be key to their enhanced inclusion and agency in heritage conservation in Australia.

5.2 Would you attend an outreach event about fossils and/or Indigenous artefacts if there was on in your local community?

A clear majority of the survey participants said that they would attend an outreach event in their local communities, with over 73% of the survey respondents agreeing that they would be interested in such an event.

While the survey itself and the communication formats within were only available online/digitally, this question reveals that many people would also be interested in attending in person events, with qualitative responses mentioning that hands-on opportunities to interact with heritage material, and connecting with local Indigenous communities would be of interest. The potential for these public engagement sessions to be run by local Indigenous communities and individuals would not only amplify Indigenous-led programs and initiatives (discussed more in section 6.1.1), but would provide a visible platform for people to connect with their local

Indigenous communities, form relationships, break stereotypes, and hopefully provide pathways and local processes for Indigenous artefact protection, safekeeping, and recording, as dictated by the local Indigenous community. An interest in heritage is clearly present in the Australian community, so capitalising on this attraction, and transforming it into tangible positive actions and perceptions will be an important step for future heritage conservation (Soderland & Lilley 2015; Crofts et al. 2021).

5.3 Has this communication format changed your mind about reporting heritage finds?

The optional survey section also asked those participants who had originally selected that they would not report a fossil and/or artefact if they had changed their mind since watching/reading the communication format they chose (Table 2).

Table 2 – Proportion of survey participants who originally said they would not report a fossil and/or an artefact, and their responses after watching/reading a chosen communication format (Artefact n=112; Fossil n=165).

Would you now report a find?	**Artefacts %**	**Fossils %**
No, I would still not report	58.9	49.7
Yes, I would now report	41.1	50.3

When asked *what* made them change their mind concerning artefacts (i.e., the 'Yes' responses in Table 2), 55.6% of people said it was because they now know who to contact. However, the most cited reasons for still not reporting artefacts were because 1) the find may not be significant (21%), 2) they are still unsure who to specifically contact (15.2%), and 3) a fear of land reclamation/restrictions deters them (13.6%). Compared to fossils, there was a greater diversity of responses for why people still wouldn't report an artefact, including several racist comments, with participants potentially empowered to share these views due to the anonymity of the survey.

For fossils, people that said that they would now report because they are better informed about who to contact, and why reporting is important (76% of people citing these reasons). The majority of people who did not change their minds (the 'No' responses in Table 2) said that they still would not report as they considered that their find was unlikely to be significant.

5.3.1 Changing minds

While the rate of changing minds in these questions only hovers at around 40-50%, this still equates to over 100 people who would now report a fossil or artefact, and thus, over 100 future heritage finds that could be protected. If participation in this 8-minute survey alone can obtain that result of change, then a state government funded or supported awareness campaign could go a long way to improving the protection and appreciation of heritage material across Australia.

Section 6: Sub-groups

6.1 Indigenous Respondents

Of the 1397 people who completed the Found a Fossil survey, 117 (8.5%) identified as Aboriginal and/or Torres Strait Islander. Indigenous respondents had similar, albeit slightly higher, rates of reporting artefacts and fossils compared to the rest of the population (82.1% said they would report an artefact, 76.1% said they would report a fossil). The overall selection of people/institutions that Indigenous respondents would contact about an artefact find were similar to the rest of the survey participants, however, contacting the local Indigenous community was a markedly more popular choice for artefact finds (56% versus 29%), followed by a state heritage body (18%) and then museums (9%). For fossils, museums were also the top choice selected by Indigenous respondents, however, only by a small margin (22%), closely followed by the local Indigenous community (20%).

When asked what may stop them from contacting someone about an artefact find, not knowing who to contact was the most selected reason (19% of people selecting this), followed by the desire to keep the area secret for future discoveries (14%). Indigenous participants were also almost three times more likely to fear plundering/looting/site damage (Fig. 15). Similar to artefacts, the top three reasons for not reporting a fossil were also not knowing who to contact (20%), that the find may not be significant (18%), and that they may want to keep the area secret (15%).

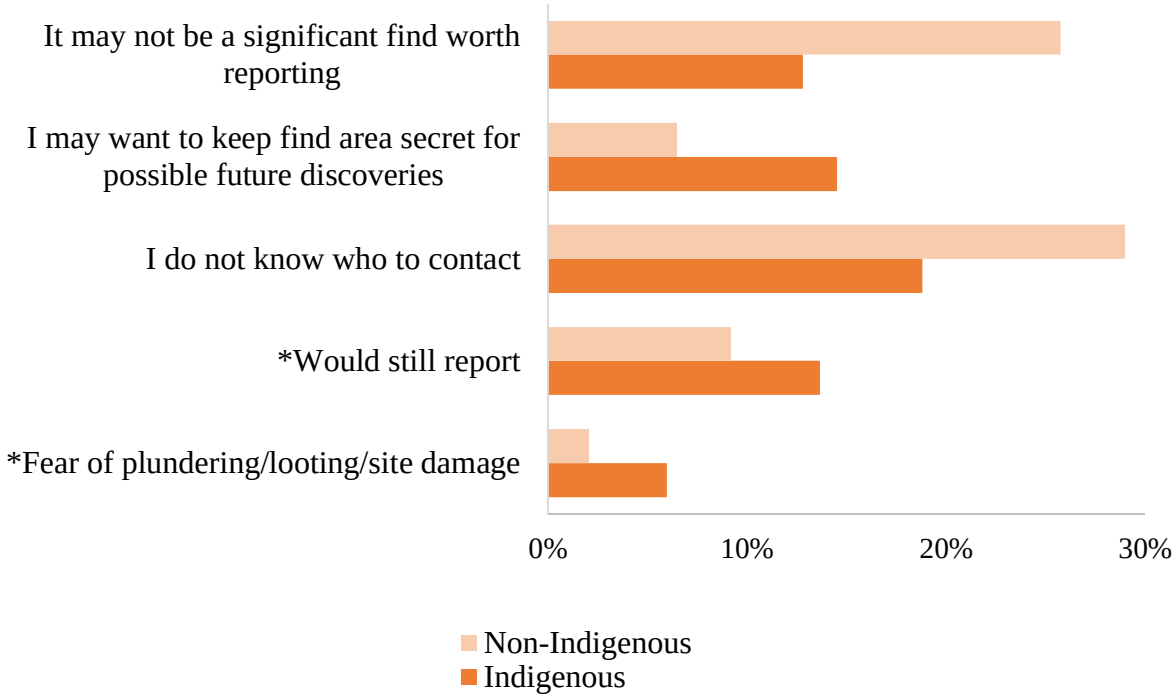

Fig. 15 – Comparison of Indigenous survey participants (n=117) and the rest of the survey participants (n=1202) concerning what would stop them from reporting an Indigenous artefact find. Categories of concern listed here include the topmost selected results, as well as those with the largest difference between Indigenous respondents and the rest of the population (i.e., fear of looting). Responses with an * were not listed options in the survey, but enough people wrote them in the 'Other' section that they have been added as a separate response.

6.1.1 Indigenous control of Indigenous heritage

The higher levels of reporting to local Indigenous communities by Indigenous respondents for both fossil and artefact finds may reflect the different cultural perspectives and protocols, relationship to Country, and connections to community compared to non-Indigenous respondents (Bawaka Country et al. 2016; Cooke et al. 2022). While it may not be surprising that Indigenous people would be more likely to contact their local Indigenous community, especially as they likely already have ties or are part of that community, it again reveals a preference for locally-controlled, rather than state-controlled heritage. Events such as the destruction of Juukan Gorge in 2020, and the perceived lack of consideration of Indigenous voices by government, have exacerbated the level of mistrust in government by Indigenous communities (among other stakeholders) (Wensing 2020). The aforementioned lack of community consultation (or consultation that is in name only, rather than action) and at times limited opportunities for Indigenous people to engage with and manage their own heritage and Country have been taken as evidence for the lack of political will to

prioritise Indigenous perspectives and control of their own heritage (Commonwealth of Australia 2021; Cole 2022; du Cros 2022; Estcourt 2022).

Government control of heritage has also led to the control and dissemination of nationalistic narratives, perpetuating destructive colonialist ideals (such as 'us versus them' [e.g., non-Indigenous people versus Indigenous people]), and maintaining disparate power dynamics between government bodies and Indigenous communities (Sakata & Prideaux 2013; Bennion & Kelly-Mundine 2021; Costello 2021; Raja et al. 2021). There is an obvious incentive to involve Indigenous peoples in heritage conversations, as they are the recognised owners of that heritage (UNDRIP 2007). Prioritising Indigenous perspectives, as well as Indigenous-led research, community programs, and other initiatives will not only positively contribute to heritage conservation, but has the great potential to initiate knowledge transfer between Indigenous and non-Indigenous peoples (Artelle et al. 2019). This can also contribute to reconciliation efforts, as truth-telling concerning past experiences, traumas, and discrimination can be shared and acknowledged, as dictated by Indigenous communities, rather than as state or federal colonial-based narratives (Menzies & Wilson 2020; Montero et al. 2022). While successful projects including Indigenous leadership, co-design, co-management, or integration of scientific, Western, and Indigenous knowledge and practices are underway (e.g., Cullun-Unsworth et al. 2012; McKemey et al. 2022; Deadly Science 2022), additional government support and action would be desirable to further elevate Indigenous voices, and to demonstrate the prioritisation of Indigenous voices concerning the control of Indigenous heritage.

The inclusion of Indigenous perspectives, management practices, and mindsets will likely be of vital importance for future conservation in Australia, with Indigenous views and practices of caring for Country being something that could be more widely adopted by the rest of the Australian population to preserve both cultural and natural heritage, and the wider environments these objects and sites reside in (McKemey et al. 2022). As Indigenous artefacts, sites, and by extension, some fossils/fossil sites are all part of the landscape and Country that still connects Indigenous people to their ancestors, Dreaming, identity, history, and future, the promotion of Indigenous voices and perspectives should be a priority to ensure future heritage protection initiatives are supported by the Indigenous and other communities they may impact (Kingsley et al. 2013; Tutchener et al. 2021; McConnell et al. 2022).

6.2 Farmers

The data presented here provides the first empirical data on fossil and Indigenous heritage perceptions in the agricultural sector of Australia. Farmers/agricultural workers made up 5.6% of the total survey participants, this option in the top 10 most selected occupations within the survey (placing 7th). Farmers said that they would report fossils and artifacts considerably less than the rest of the population, with farmers reporting around 20% less for fossils, and approximately 25% less for Indigenous artefacts (Fig. 16).

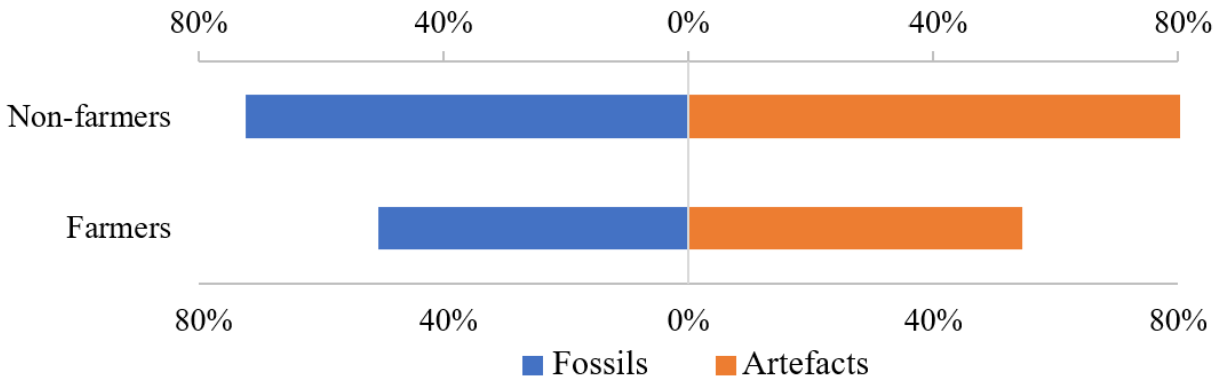

Fig. 16 – 'Yes, I would report a fossil/artefact' responses; comparison of Farmers/Agricultural workers' (n=77) responses with rest of survey participants (i.e., non-farmers) (n=1291). Pairwise proportion tests between occupations revealed that farmers were significantly less likely to report artefacts compared to those in Education and Training ($p<0.001$), Government and Public Administration ($p=0.003$), Heritage sector ($p<0.001$), Hospitality and Retail ($p=0.01$), and Students ($p<0.001$).

While for fossils, museums are still the number one choice of who to contact (approximately 25% of people, aligning with the rest of the Australian population), those farmers who selected they would report an artefact were more likely to do so to the local Indigenous community compared to the rest of the population (44% versus 29%). While museums were the next most popular option chosen by the non-farmer participants for artefacts, for farmers, museums were rated below state heritage bodies (15%), a university (12%), and equal to the response 'I don't know' (7%). The reasons for not reporting heritage finds also revealed that farmers are considerably more concerned by potential land reclamation/restrictions, trespassing, or impacts on activities such as ploughing, digging, etc. than the rest of the population (Fig. 17).

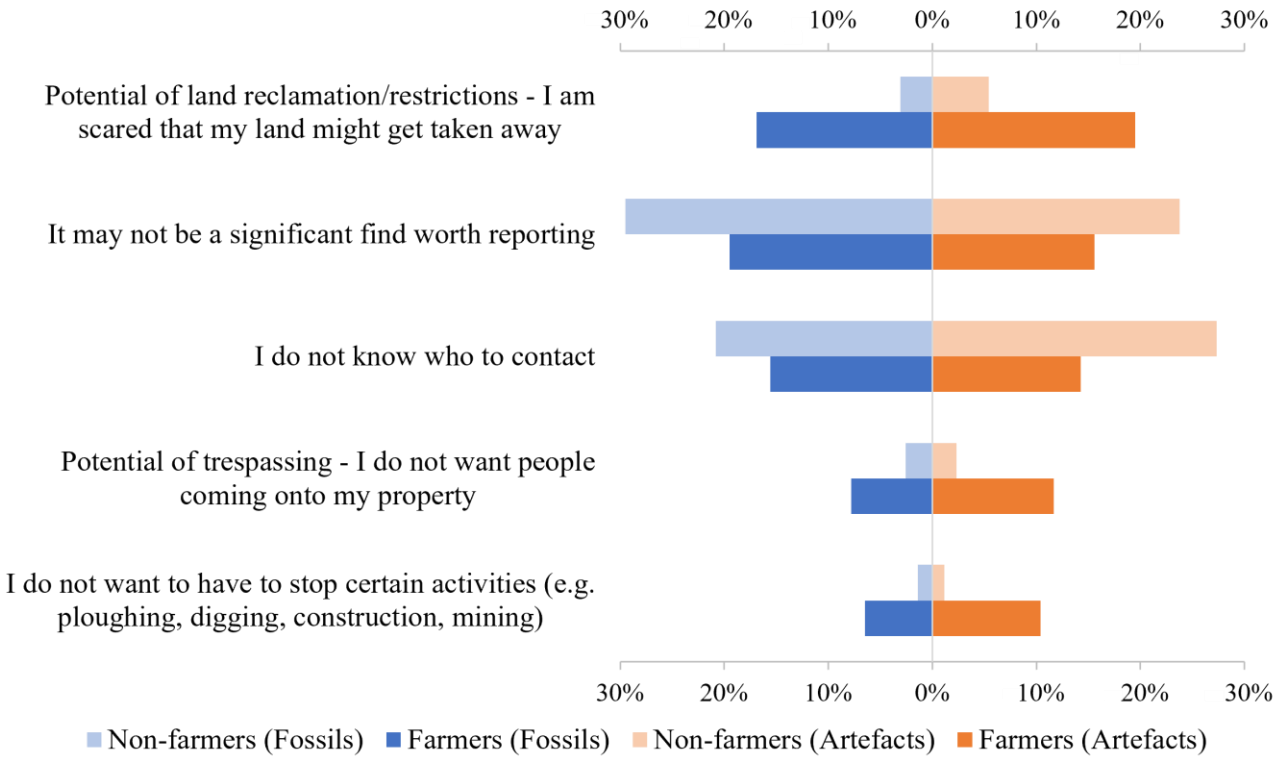

Fig. 17 – Comparison of farmers (n=77) and the rest of the survey participants (i.e., non-farmers) (n=1302) concerning what may stop them from reporting a heritage find. Potential land reclamation was the biggest concern for farmers for artefact finds (3.6 times more than the rest of the population) and for fossils (5.6 times more than the rest of the population). Another large difference was that farmers were considerably less likely (at a rate of >4 times the rest of the population) to report artefacts if they were asked not to (e.g., by a landowner or traditional owner).

6.2.1 Why farmers? A history of misinformation

Australia's landmass is approximately 7.6 million square kilometres, almost half of which is dedicated to recent agricultural use (approx. 3.8 million square kilometres) (National Farmers Federation 2017; ABS 2018). This means that farmers and others employed in agricultural industries are a key group of people likely to discover heritage objects or sites at their residence or during their work in the Australian landscape.

In many cases, a fossil find may be seen as exciting, a discovery to be shared with the community and wider public. For example, earlier this year a farmer worked with the Australian Museum to explore a brand-new fossil site called McGrath's Flat on their property near Gulgong, NSW, that has been touted as one of the best-preserved fossil sites in the entire country (McCurry et al. 2022; ABC News 2022). Other examples are the farmers who have made discoveries of new dinosaur species and have not only been involved in subsequent research, but have even had the

new species named after them (e.g., *Muttaburrasaurus langdoni*, *Rhoetosaurus brownie*) (Quinlivan 2013; Gamillo 2021; Australian Age of Dinosaurs 2022).

There have certainly been similar instances of farmers discovering Indigenous material on their land, however, the recurring concern about Indigenous finds and notions of land reclamation is a barrier for the involvement of farmers in heritage conservation (McKenzie 2018). This sentiment was expressed by one survey participant stating '*I would however be extremely adverse to just anyone coming onto my land to search for more finds, especially if it's Indigenous finds they're looking for… but if I found a dinosaur, once confirmed, send me a team of archaeologists* [sic]*! I'll bake cookies!'* (Survey ID: 513).

For decades, many farmers have feared that the discovery of Indigenous material on their land may be grounds for that land being taken away, or at the very least, restrict their activities and access (First Peoples – State Relations 2021). Confusion between artefacts and fossils may have also led to this fear extending to this kind of heritage find as well. This fear appears to have been of major concern since the introduction of the *Native Title Act 1993*, where inadequate communication of this legislation led to the public belief that private land could be claimed back by Aboriginal or Torres Strait Islander communities (Hobbs & Spennemann 2021). This is not true, with only vacant Crown land and some limited other land types available for claim (NSW Aboriginal Land Council 2017). While the 1998 Amendment of the *Native Title Act* helped to clarify this issue, the deep-seated mistrust in the federal and state governments and their perceived ability to change laws on a whim for their own benefits and agendas remains to this day. Many farmers still believe that their land could be taken, and this likely accounts for the different levels of reporting between farmers and the rest of the population (Toone 2016; Bennett 2016; Liebelt 2020; Simmons et al. 2020). The failure of the Australian and state governments to work towards correcting this misinformation further demonstrates their continuing poor communication of legislation to the public, and farmers, fossils, Indigenous communities, and their heritage, are suffering because of it.

Independent surveys by Liebelt (2016) and Toone (2016) revealed that a range of emotions were felt by farmers upon discovering Aboriginal artefacts on their land, including fear, indifference, guilt, or aversion. However, this was also at times paired with curiosity, joy, pride, or responsibility. The lack of incentives for farmers to report heritage material paired with this fear of loss of control of their land, again means that many finds are likely not being reported (Found a Fossil 2021).

The guilt felt by farmers may stem from the fact that many (and indeed many members of the non-Indigenous community, myself included) realise that they are directly benefitting from the past displacement of Indigenous peoples from the land they now call their home (Allpress et al.

2010; Maddison 2011). This can then lead to a sense of shame from finding evidence on their property of this Indigenous habitation (and subsequent forced removal), and thus results in an unwillingness to report heritage objects/sites, and a further lack of engagement in heritage conversations (Liebelt 2020).

How can this perception be changed to demonstrate that finding Indigenous material is just as exciting as finding a fossil? And further, that farmers are welcome to learn more about the object and its history without judgement or repercussions, and that many in their local Indigenous community would appreciate their reporting and safeguarding of finds? The survey sample revealed that there was no crossover between farmers and Indigenous respondents (i.e., there was not a single Indigenous farmer), so providing a platform for both of these stakeholders to provide their different perspectives, experiences, and knowledge, and be a part of heritage conversations may be an answer (see Recommendations below) (Root-Bernstein et al. 2020; Westaway et al. 2021).

The inclusion of farmers in conversations about Indigenous heritage material can help to change outdated notions about heritage laws and land reclamation, and may therefore encourage the reporting and protection of Indigenous material on their property. Community-based conversations where all stakeholders are included could also provide a non-judgmental platform to discuss potential finds, where individuals could feel comfortable about discussing the repatriation of objects, co-management negotiations, object/site safekeeping (with appropriate permissions), or other negotiated management practices (Roberts et al. 2005; Schultz et al. 2011; Birnbaum 2015). The Found a Fossil survey has provided a template and platform for sharing these perspectives, generating interest and awareness, demonstrating that future, locally adapted surveys may also be an effective way to start these conversations.

RECOMMENDATIONS

Communication & community engagement

As stated in the 2021 State of the Environment report, "*the strongly regulatory approach of Australia's heritage legislation discourages a more positive, educational and shared experiential approach to heritage*" (McConnell et al. 2022, p. 174). Thus, finding effective, engaging, and sustainable ways to communicate with the community will be a priority for the future preservation of heritage materials. Enhanced transparency, interest, and care about heritage, whether it be fossils or Indigenous culture and history, may assist in increasing awareness of, and compliance with, heritage laws. Community members would better understand the value of this heritage material, why it should be protected, and how they can contribute to this protection (McDonald et al. 2014;

Santucci et al. 2016; Crofts et al. 2020). These individual stewardship behaviours of the community can also raise further awareness to others who may not have typically engaged in conversations about heritage, helping to educate others, dismantle stereotypes, and clarify misinformation (Cvitanovic et al. 2018; Pollard et al. 2020). Promoting bottom-up, community-led heritage processes would allow for the public to get involved in safeguarding their local heritage and telling local heritage stories. The closer proximity, intimate local knowledge, and personal connection to places, objects, and histories in one's local area is likely to result in a much higher level of care in the protection and celebration of local heritage, and thus allow for greater levels of community trust, control, and leadership in heritage management (Sakata & Prideaux 2013).

Providing opportunities for two-way dialogue can make content more engaging by involving the community in scientific discussions, research, fieldwork, and outreach. Community engagement can foster open and meaningful relationships and conversations between scientists and local communities around Australia (Turner et al. 2016; Pollard et al. 2020;). The willingness of scientists to listen and respond to the questions, concerns, and perspectives of different communities can lead to empowered individuals, social cohesion, and positive behaviour changes (Weerts & Sandmann 2010; Andrade & Rhodes 2012; Dickinson et al. 2012). Community engagement also has the power to involve minorities, and provide fun, hands-on opportunities to engage in science, which can lead to better learning and behavioural outcomes (Fig. 18) (Perkin 2010; Keddie 2014; MacFadden et al. 2016; Klar et al. 2020).

Surveys have been an effective tool for community engagement and awareness of conservation topics. For example, Cvitanovic et al. (2018) surveyed stakeholders from the Ningaloo Marine Park in Western Australia; this outreach to the community and the inclusion of local, traditional, and experiential knowledge of participants helped to create trust in scientific research and led to increased support for the conservation project (Cvitanovic et al. 2018). Hopefully, the Found a Fossil survey can also foster participation and engagement with heritage conservation. Community stakeholder participation can lead to greater interest in heritage, and thus a higher chance of compliance or investment, especially when groups feel included in the decision-making process (McKenzie 2018).

Fig. 18 – Community members conducting fieldwork with the Australian Age of Dinosaurs Museum in Queensland. This museum invites community members from all over Australia to help them 'Dig a Dino' – helping to excavate, prepare, and protect dinosaur fossils. Fieldwork/fieldtrips are an engaging and fun initiative that enables participants to be included in the scientific process, in turn, fostering greater care for palaeontological heritage. Image courtesy of Australian Age of Dinosaurs Museum.

Ideas for effective engagement: the strength of stories

Both the video and the blog attached to the survey (Fig. 12) utilised storytelling, using visual and narrative elements to engage the viewer, make the content personally relevant to them, and provide a non-traditional alternative to the more structured and formal formats, such as the website. Narratives and stories have been used for thousands of years by humans across the globe to communicate (Chronis 2012; Finkler & León 2018). Their ability to elicit emotion in an audience, or transport the viewer to a different time, place, or situation means that they are especially applicable to the protection of natural and cultural heritage, and may be a powerful way to connect with stakeholder groups where traditional and formal communication (e.g., government websites, lectures, scientific or peer-reviewed articles) have not been successful (Davies et al. 2019). Additionally, a study by McCormack et al. (2021) showed that viewing, reading or listening to a story engages a considerable number of cognitive faculties and resources, and thus reduces the viewers' capacity to argue against or intercept underlying messages or information – something that is considerably more likely to occur when engaging with non-narrative (and arguably much drier) content. By telling stories, from the movements of dinosaurs across the landscape, or the habits of

Cretaceous crocodiles, to the ingenuity and immense technical skill required to produce stone tools and other cultural objects, people are more likely to remember, and more likely to care for something that made them feel interested, inspired, or included (Jefferson et al. 2015; Cvitanovic et al. 2018). Additionally, oral storytelling has been the traditional mode of knowledge transfer by Australian Indigenous communities for tens of thousands of years. Incorporating this potentially preferred mode of communication into wider heritage practices will likely not only be more enjoyable for non-Indigenous audiences, but may allow for the improved inclusion and knowledge exchange of Indigenous cultural practices, ways of seeing, and ways of being (Wright et al. 2012; Buxton 2018; Daniels et al. 2022). These stories can help to make seemingly distant scientific topics relevant to people's lives, therefore making science, or in this case, Australian heritage, more inclusive, understandable, and fun (ICOMOS 2008). Storytelling can encourage human appreciation and concern, and therefore, ultimately promote stewardship and protection of Australia's heritage material (Azman et al. 2010; Santucci et al. 2016).

Increasing heritage accessibility: The Found a Fossil website

To address the lack of accessible and clear heritage information, and to take an initial step towards improving communication of heritage information, I created the Found a Fossil website. Whilst housing the survey for this research was a primary function of the website, providing clear, plain English information to participants after survey completion and to others interested in heritage issues or seeking extra information, was a central goal of the website and this project. The Found a Fossil website provides an example of how heritage information can be communicated in a clear and accessible way, perhaps representing a model for how disparate state information can be displayed on a central platform (the website provides state-by-state breakdowns of reporting requirements, relevant legislation, contacts, and resources) (Table S1[f]). As previously mentioned, editing a government website to have greater accessibility, transparency of information and legislations is easily achieved, and could go a long way to improving heritage protections where the legislations itself may not be able to change easily.

The communication formats designed for this survey are permanently available on the Found a Fossil website to provide alternative and engaging content about heritage discoveries, and to be inclusive of audience communication preferences. These formats were created using simple graphics programs (e.g., Canva [2022] for the social media post and brochure), hired animators (for the video), and website/blog features built into the Found a Fossil website platform, SquareSpace (2022). With a budget of <$1000, and five weeks to create all five formats, this demonstrates that making this content accessible to the public is possible, even with the potentially limited funding

and time that may constrain current state heritage departments. The importance of the accessibility of content was again highlighted through another survey question [Q25] where the accessibility and ease of understanding the content was the highest rated reason for why people chose every single format.

Before the Found a Fossil website was created, there was no single resource that contained all this information together. Alongside the online presence of Found a Fossil, funding has recently been provided to the author by the Australian Geographic Society to support the creation of an outreach program to provide communities across Australia with hands-on experiences with fossils and Indigenous artefacts, with the aim of inspiring audiences to become protectors of their local heritage and the stories associated with them.

As discussed previously, traditional scientific publishing (including this lengthy thesis) is likely not the most effective way of communicating with non-academic audiences. Thus, the results of this thesis are planned to be shared via social media posts, and written up as a series of short (maximum 2 pages) executive summaries pitched to relevant stakeholders, including state governments, museums, Indigenous communities, farming groups, local councils, etc. that will allow dissemination of the results in a more engaging way, as dictated by the communication preferences examined in this study. By distributing these results in an accessible way to not only the people who participated in this research, but to the wider Australian population, hopefully the recommendations and information here can be adopted more widely, and Australia's heritage can be better protected. The Found a Fossil website will be the host to these open-access documents when they are written.

Keeping places on farms

Despite the apprehension expressed by many farmers in the Found a Fossil survey of engaging with Indigenous heritage, others voiced their interest in having conversations about Indigenous heritage and conservation, with one farmer stating '*I suspect I'm not the only closet Indigenous history fan!*' (Survey ID: 1100). Providing visible, voluntary, and incentivised opportunities for farmers to get involved in becoming caretakers for local heritage material may be one idea. 'Talking about Stones', a project that connected farmers with local Aboriginal communities, revealed that many farmers had collections of artefacts found on their properties stored in cupboards, sheds, or crates, and whilst recognizing their potential cultural significance, often did not know what to do with them (McKenzie 2018). Despite the lack of transparency, misinformation and fear of potential land reclamation, some farmers have embraced their roles as temporary guardians of the heritage objects/sites they find on their properties, forming relationships

or co-management agreements with their local Indigenous communities, and some even going so far as to transform sheds on their properties into collection spaces to preserve their finds (Bryant 2016; Kelso 2022; Breen 2022).

Farmers may have storage space on their properties that can be transformed into keeping places. Keeping places are designated spaces for the safekeeping of Indigenous heritage material, managed by local Indigenous communities, and can be anything from a storage container to a lockable shed (Museums & Galleries of NSW 2011; Pickering 2020). The need for more local keeping places was identified in the State of the Environment Report 2021 (McConnell et al. 2022). Unfortunately, many Indigenous communities may lack resources or storage space to house collections or artefact finds, a similar problem faced by many local and state museums that additionally may not have the time, funding, or resources to adequately document and store collections (Fforde 2014; Costello 2021). While it is encouraged to leave artefacts where they were found within the landscape, this may not be possible due to potentially destructive development, farming, or other practices present in Australia's modern landscapes. The potential of having keeping places on local farms may be a way to create sustainable relationships and partnerships between Indigenous communities and farmers, encourage meaningful knowledge exchange, myth-bust outdated notions of land reclamation, and ensure the future survival and care of Indigenous artefacts in Australia (Greer 2010; Pollard et al. 2020). This initiative may also be beneficial because instead of having artefacts sent to a faraway museum that many local community members may never visit, artefacts (and potentially fossils or other historical objects) can be kept on Country, and their connection to the land, its history, and people, can be maintained. Combining these efforts with digital methods of recording finds, for example, using software like The Keeping Place (2022), which allows geospatial recording and storage of cultural knowledge, and security permissions that can cater to cultural protocols, would be an effective way of maintaining the privacy and trust of both the farmer, and the Indigenous community they are working with. While negotiation over access to these items by other local people may be difficult and would vary case by case, evidence of farmers already taking part in these stewardship behaviours provides hope for similar initiatives in the future (Breen 2022).

Encouraging engagement using smartphones

As some fossils or artefacts can be abundant and common in some localities, many people in the survey (over 25% for both fossils and artefacts) reflected that the potential low significance of finds may prevent them from informing anyone about their discovery. To address this, a mobile

phone application offers a useful and effective way of helping people identify their find and its significance, and communicate required or desired reporting/collecting actions. The ubiquity of smartphones across the country has led to the proliferation of apps, such as iNaturalist, FrogID, and Merlin BirdID, that can perform identification and reporting of different finds within the landscape (Rowley et al. 2019; Unger et al. 2021; Merlin BirdID 2022; iNaturalist 2022). While many of these apps generally focus on living creatures, several others already exist for the identification of geological specimens (e.g., Rock Identifier: Stone ID [2022]). A similar app could be set up to identify fossils and artefacts, record their location and condition, upload photographs, and have them sent to a community of amateurs and scientists who may help with identification and reporting (Wäldchen & Mäder 2018). Overlaying geological and/or heritage maps with data of finds also has the potential for initiating citizen science projects based on the collected data. While the privacy of landowners, and issues of potential looting would need to be carefully managed, these citizen science projects have shown to empower communities and may lead to a greater awareness and appreciation of local environments, or in this case, heritage (Lee & Nel 2020; Mesaglio et al. 2021).

The development of such an app would be beneficial as it recognises that not all finds may carry the same level of scientific or cultural significance, and that it is not viable to report every fossil or artefact – with the time/money/energy cost required being overbearing for both the collector and the institution they go to for identification (Wood et al. 2022). While the initial and ongoing app development costs, navigating privacy and anonymity of participants, and sustainability of the app are all concerns that would need addressing, the self-sufficient mode of identification provided by an app may encourage people to be curious about their finds and local heritage, provide a central and accessible platform to communicate handling/collecting guidelines, legislation, and contacts for identification or repatriation, and overall, lead to the improved awareness and protection of heritage finds by the Australian community.

CONCLUSIONS & OUTCOMES

Aim 1: *to determine the perceptions and awareness of Australians concerning heritage discoveries, heritage laws, and explore their communication preferences.*

The Found a Fossil Survey was successful in beginning a process of finding out what the Australian population thinks about fossils, Indigenous artefacts, their discovery, and their conservation (Fig. 19). Survey data about perceptions and attitudes, like that presented here, provide a valuable dataset of the opinions, demographics, and preferences of the Australian community concerning heritage. Moreover, they can be used to illustrate potential solutions that cater to the

local communities whose heritage is affected, and to guide targeted future communications to relevant stakeholders (Kidd et al. 2019; Yuriev et al. 2020). This data may also be used to hold government departments accountable for their poor communication of research and other information, and can be used as a guide for how to improve, as mediated by the preferences of the Australian community who participated in the survey (Cvitanovic 2018; Haering et al. 2020).

Aim 2: *to use this data to understand community concerns and problems related to heritage protection, including the poor communication of heritage information.*

The survey revealed a diversity of community concerns – from lack of transparency regarding heritage and reporting information, to mistrust in governments, to a fear of land reclamation/restrictions. It also revealed wider systemic issues present in the state-controlled processes within Australian heritage conservation, with a lack of funding, resources, and local inclusion, and a need for improved accessibility of content and meaningful engagement with community being at the forefront of issues discussed here. While the 50-page limit of this thesis has prevented in-depth analysis of every survey question, this data provides a valuable avenue for future work.

Aim 3: *to provide recommendations for better conservation practices and communication methods for conveying modes of heritage information to the Australian community*.

Despite concerns expressed by the survey participants, the survey responses have also provided a wealth of ideas and methods for better connecting with stakeholders, and for possible future initiatives to improve the protection and appreciation of heritage in Australia. From which communication formats may best target different demographics, to the proposal of a smartphone application, the analysis of perceptions, and the inclusion of diverse voices has shown how the Australian community can meaningfully contribute to the development of new solutions and ideas that are innovative, sustainable, and more closely reflect the values of the Australian community (Clary & Wandersee 2014; Bonney et al. 2015). These inclusive conversations can help to increase the transparency of information and assist in generating interest about heritage, and ultimately lead to the better protection of heritage in Australia (Andrade & Rhodes 2012; Lepore 2019; Hobbs & Spennemann 2021).

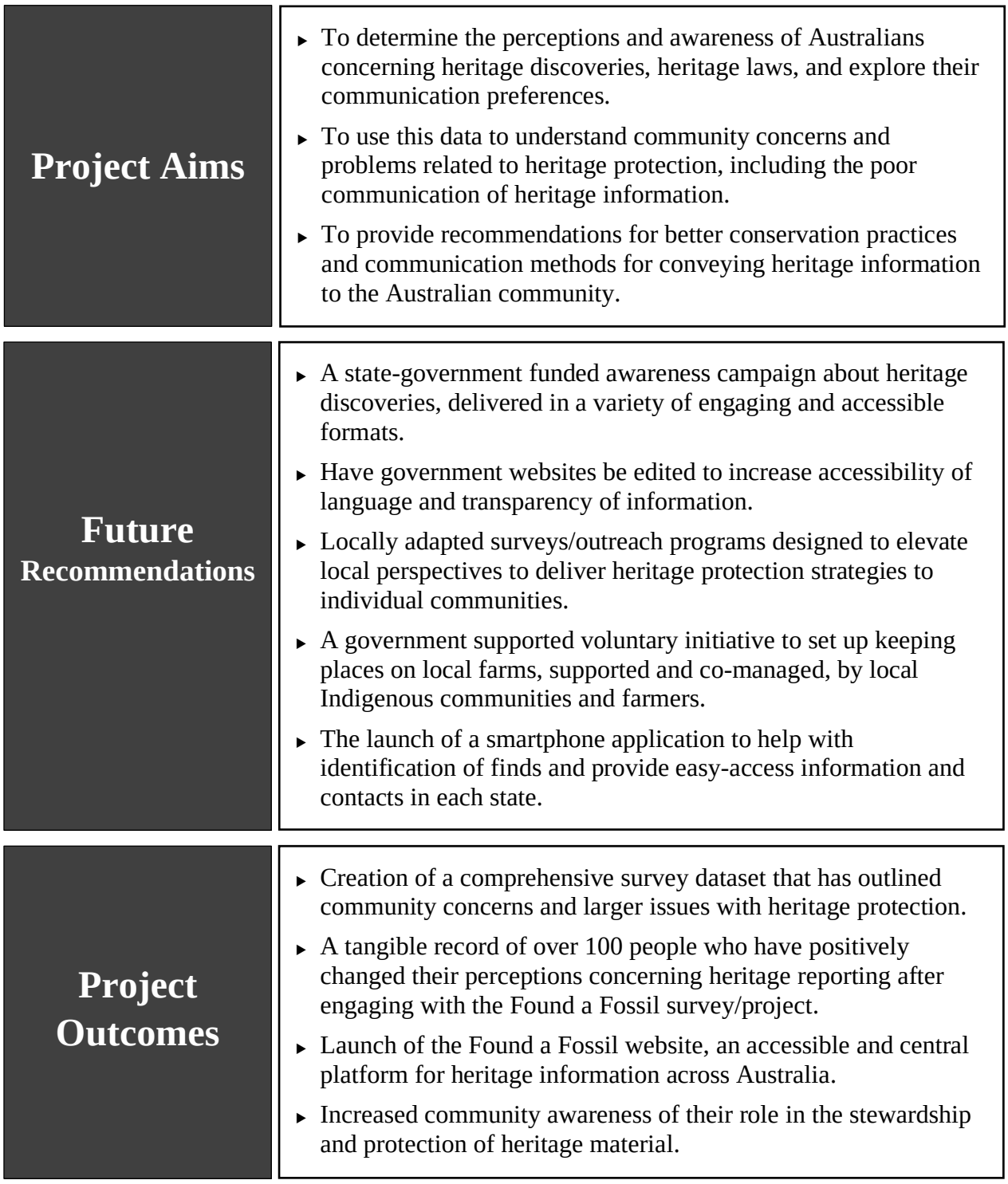

Fig. 19 – Aims, recommendations, and outcomes of the Found a Fossil project to date. These future recommendations would help to foster care and appreciation, encourage celebration, and promote the protection of heritage, with each Australian playing their part of steward for the country's heritage material and the vibrant narratives and knowledge that go along with them.

FUTURE DIRECTIONS

The Found a Fossil project, including the survey, its results, and this thesis, has outlined the perceptions of a subsample of the Australian community concerning both fossil and Indigenous heritage material, and has explored how demographics, poor communication of heritage information, and lack of transparency may have impacted heritage conservation behaviours. The intersection between palaeontology, archaeology, social science, and public communication within this research has helped to address a significant gap in the academic literature, and represent the first baseline, empirical data that has explored perceptions and conservation of both fossil and Indigenous heritage, and the relationship between them, and the Australian community. Already these results have shown the public's interest in heritage, their ability to come up with creative solutions, and their desire to be involved.

Everyone – from academic to non-academic, scientists to farmers, Indigenous to non-Indigenous communities – is needed to enhance the protection of heritage material, and to formulate and deliver creative and sustainable solutions for protecting and celebrating heritage in ways that elicit the same sense of curiosity and excitement as any new discovery.

Fossils and Indigenous archaeological material are finite resources, and without the support of the Australian community, significant objects and new discoveries could be lost. It would be a sad world without fossils, without megafauna, or petrified forests, or dinosaurs that capture the imagination. We are privileged to experience the stories, places, and objects of the oldest living culture in the world; it would be an unspeakable tragedy to lose these, especially when we are capable of protecting them. This project has already shown how participation in an 8-minute survey can change the minds of over 100 people. If improved communication and community engagement of the public can better protect this material for future generations, then it will be a valuable pursuit. Indigenous artefacts and fossils help to tell us the story of life on earth, a story and history over 4.5 billion years in the making. That certainly seems like a history worth protecting.

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SUPPLEMENTARY

Table S1 – Links to relevant documentation and resources (if hyperlinks unavailable, head to www.foundafossil.com/thesis-supplementary)

Links to additional documentation/resources	Details
[a] Approved Human Ethics Application	Ethics application approved by the Macquarie University Human Research Ethics Committee [see letter of ethics approval below – Appendix 1
[b] Survey Questions	Copy of the survey (including consent forms) that was released to the public for this research
[c] Survey Advertising List	List of radio interviews, Facebook groups, presentations, social media posts, etc. where the survey was advertised
[d] Macquarie University Data Repository	Found a Fossil survey responses dataset will be uploaded here
[e] Communication Formats: ➢ Blog ➢ Social media post ➢ Webpage ➢ Video ➢ Brochure	Individual links to the communication formats designed for the Found a Fossil survey (now publicly available on Found a Fossil website)
[f] Guidelines to Heritage Finds – Found a Fossil website	State-by-state breakdowns of legislation, reporting requirements, contacts, and other resources

Table S2 – Breakdown of survey participant demographic characteristics, compared to data from the 2021 Australian Census (Australian Bureau of Statistics 2022c,d).

Demographic	Survey percentage (%)	ABS Proportion of population (%)
Country of Residence		
Australia	99.3	-
Other	0.7	-
State of Residence[1]		
ACT	5.2	1.8
NSW	37.9	31.75
NT	2	0.91
QLD	12.3	20.28
SA	10.3	7.01
TAS	4.1	2.2
Vic	14.6	25.58
WA	6.9	10.46
Not stated/Other	6.4	0.019
Age		
10-19 years old	4.35	13.6
20-29 years old	14.87	15
30-39 years old	13.2	16.5
40-49 years old	14.94	14.7
50-59 years old	21.97	14.1
60-69 years old	21.93	12.4
70+ years old	8.85	13.8
Gender		
Female	54.6	50.7
Male	42.5	49.3
Other[2]	2.9	-
Indigenous Ancestry		
Indigenous	8.5	3.2
Non-Indigenous	91.5	96.8

[1]Please note that these population ABS figures for the State of Residence, Gender, and Indigenous Ancestry categories include under 10-year-olds.

[2']Data output from the sex question will be reported in 2021 Census products as male and female only (Australian Bureau of Statistics 2022e).

Table S3 – Differences between Survey participants (n=1379) and Australian population of level of highest educational achievement (ABS 2022f). The survey participants has a considerably higher percentage of people who have completed a bachelor's degree or higher, likely due to the personal networks of the author.

Level of Highest Educational Achievement	**Survey percentage (%)**	**ABS Proportion of population (%)**
Did not attend school/no educational attainment	0.3	0.8
Primary School[1]	0.4	7.2
Highschool	11.6	29.5
Technical College (e.g., TAFE) or other certificate/diploma	22.3	25.6
Bachelor's degree or higher	65.5	26.3
Inadequately described/not stated	NA	10.6

[1] The Census data does not have a specific section for only Primary School, with this question only being asked of people 15 years and older; instead, it has 'Year 9 or below' as the equivalent. This category has been used in place of Primary School.

Table S4 – Differences between states when survey participants (n=1279) were asked 'Would you report a fossil or Indigenous artefact?'. Canberrans (ACT) were the most likely to report artefacts, with Northern Territorians the least likely to report Indigenous artefacts, followed by Western Australians. Tasmanians were the least likely to report fossils, whereas Western Australians were the most likely to report fossils. Most states are more likely to report Indigenous artefacts compared to fossils, except for WA and NT.

State	Artefacts	Fossils
Australian Capital Territory		
No	11.10%	33.3%
Yes	88.90%	66.7%
New South Wales		
No	22.20%	31.4%
Yes	77.80%	68.6%
Northern Territory		
No	43.50%	30.4%
Yes	56.50%	69.6%
Queensland		
No	24.30%	27.2%
Yes	75.70%	72.8%
South Australia		
No	19.1%	25.5%
Yes	80.9%	74.5%
Tasmania		
No	30.40%	41.1%
Yes	69.60%	58.9%
Victoria		
No	21.00%	28.5%
Yes	79.00%	71.5%
Western Australia		
No	26.30%	24.2%
Yes	73.70%	75.8%

Table S5 – Differences between age groups when survey participants (n=1379) were asked 'Would you report a fossil or Indigenous artefact?'. Age was a significant predictor for reporting Indigenous artefacts, with younger age groups more likely to report than older age groups.

Age Group	Artefacts	Fossils
10-19 years old		
No	15.0%	26.70%
Yes	85.0%	73.30%
20-29 years old		
No	18.5%	27.30%
Yes	81.5%	72.70%
30-39 years old		
No	17.0%	26.40%
Yes	83.0%	73.60%
40-49 years old		
No	22.3%	31.10%
Yes	77.7%	68.90%
50-59 years old		
No	23.1%	32.70%
Yes	76.9%	67.30%
60-69 years old		
No	26.2%	31.60%
Yes	73.8%	68.40%
70+ years old		
No	23.0%	23.00%
Yes	77.0%	77.00%

Table S6 – Differences between genders when survey participants (n=1379) were asked 'Would you report a fossil or Indigenous artefact?'. Gender was a significant predictor for reporting both Indigenous artefacts and fossils, with women significantly more likely to report than men.

Gender	Artefacts	Fossils
Female		
No	17.0%	26.3%
Yes	83.0%	73.7%
Male		
No	27.8%	32.9%
Yes	72.2%	67.1%
Other		
No	16.7%	33.3%
Yes	83.3%	66.7%
Prefer not to say		
No	28.6%	39.3%
Yes	71.4%	60.7%

Table S7 – Difference between Indigenous and non-Indigenous survey participants when asked 'Would you report a fossil or Indigenous artefact?'. No significant differences were found between groups.

Ancestry	Artefacts	Fossils
Non-Indigenous		
No	22%	30%
Yes	77.8%	70.0%
Indigenous		
No	17.90%	23.90%
Yes	82.10%	76.10%

Table S8 – Principal heritage legislation in Australia relating to Indigenous and palaeontological heritage and its protection. The inaccessibility of information concerning Indigenous and fossil heritage is exacerbated by the multiple legislative acts in place across different levels of government. Much of this legislative information, including the Australian Government website, often have outdated legislation listed and dead links, increasing the difficulty of finding accurate and up to date heritage information. Information gathered from Percival 2014; Australian Government 2022b; state government legislative registers.

Jurisdiction	Indigenous Heritage	Fossil Heritage
Australia	*Protection of Moveable Cultural Heritage 1986; Environment Protection and Biodiversity Conservation Act 1999; Aboriginal and Torres Strait Islander Heritage Protection Act 1984; Native Title Act 1993*	*Protection of Moveable Cultural Heritage 1986; Environment Protection and Biodiversity Conservation Act 1999*
ACT	*Heritage Act 2004*	*Heritage Act 2004; Natural Conservation Act 2014*
NSW	*National Parks and Wildlife Act 1974 / NPW Amendment (Aboriginal Ownership) Act 1996; Heritage Act 1977; Aboriginal Cultural Heritage Act 2018* [yet to be finalised]	*National Parks and Wildlife Act 1974*
NT	*Heritage Act 2011; Aboriginal Sacred Sites Act 1989*	*Heritage Act 2011; Mineral Titles Act 2010*
Qld	*Aboriginal Cultural Heritage Act 2003; Torres Strait Islander Cultural Heritage Act 2003*	*Fossicking Act 1993; Forestry Act 1959*
SA	*Aboriginal Heritage Act 1988; Heritage Places Act 1993*	*Wilderness Protection Act 1992 / Wilderness Protection Regulations 2021; Forestry Act 1950 / Forestry Regulations 2013; Heritage Places Act 1993; National Parks and Wildlife Act 1972/ National Parks and Wildlife Regulations 2016*
Tas	*Aboriginal Heritage Act 1975*	*Mineral Resources Development Act 1995*
Vic	*Aboriginal Heritage Act 2006; Heritage Act 1994*	Not mentioned under any specific legislation
WA	*Aboriginal Cultural Heritage Act 2021*	*Conservation and Land Management Regulations 2002*

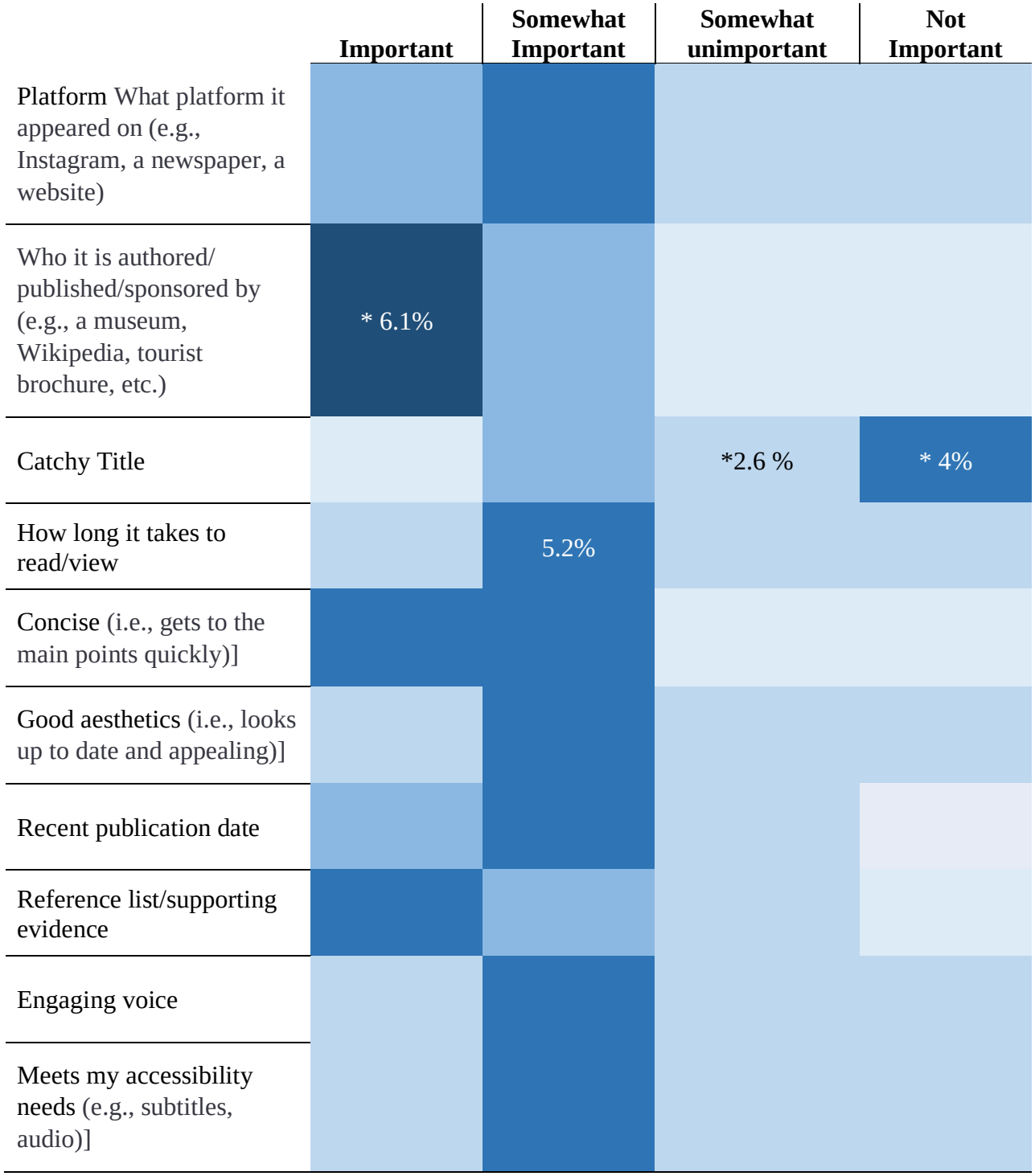

Fig. S1 – Survey results showing how the different communication features were rated(n=1379). '*' represents the highest proportion of responses for the agree/disagree column. Colour key: <1%; 1-2.9% 3-3.9%; 4-5.9%; >6%.

Additional References

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Appendix 1 – Final Ethics Approval letter

Office of the Deputy Vice-Chancellor (Research)

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MACQUARIE University
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10/09/2021

Dear Professor Glenn Brock,

Reference No:520211018132305

Title: 10181 'Who you gonna call?' Assessing knowledge and perspectives of palaeontological and archaeological material in Australia

Thank you for submitting the above application for ethical and scientific review. Macquarie University Human Research Ethics Committee HREC EXEC Humanities & Social Sciences Committee considered your application.

I am pleased to advise that ethical and scientific approval has been granted for this project to be conducted by Professor Glenn Brock and other personnel: Sally Hurst, Dr Matthew Kosnik, Dr Linda Evans**.**

Approval Date: 10/09/2021

This research meets the requirements set out in the *National Statement on Ethical Conduct in Human Research* (2007, updated July 2018) (the *National Statement*).

Standard Conditions of Approval:

1. Continuing compliance with the requirements of the *National Statement,* which is available at the following website: http://www.nhmrc.gov.au/book/national-statement-ethical-conduct-human-research
2. This approval is valid for five (5) years, subject to the submission of annual reports. Please submit your reports on the anniversary of the approval for this protocol.
3. All significant safety issues, that adversely affect the safety of participants or materially impact on the continued ethical and scientific acceptability of the project, must be reported to the HREC within 72 hours.
4. Proposed changes to the protocol and associated documents must be submitted to the Committee for approval before implementation.

It is the responsibility of the Chief investigator to retain a copy of all documentation related to this project and to forward a copy of this approval letter to all personnel listed on the project.

Should you have any queries regarding your project, please contact the Ethics Secretariat on 9850 4194 or by email ethics.secretariat@mq.edu.au

The HREC EXEC Humanities & Social Sciences Committee Terms of Reference and Standard Operating Procedures are available from the Research Office website at: https://www.mq.edu.au/research/ethics-integrity-and-policies/ethics/human-ethics

The HREC EXEC Humanities & Social Sciences Committee wishes you every success in your research.

Yours sincerely,

Dr Karolyn White
Chair, HREC EXEC Humanities & Social Sciences Committee

This HREC is constituted and operates in accordance with the National Health and *Medical Research Council's (NHMRC)National Statement on Ethical Conduct in Human Research (2007, updated July 2018)* and the *CPMP/ICH Note for Guidance on Good Clinical Practice*