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Found a fossil: improving awareness, engagement, and communication strategies for heritage discoveries

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Abstract

Fossils and Indigenous artefacts are often found by members of the general public. To gauge Australian awareness of heritage laws and willingness to report finds, the Found a Fossil project conducted a survey to understand barriers to reporting heritage material. Results showed enthusiasm to report but confusion over appropriate authorities to contact, lack of transparency by government, and poorly communicated legislation created barriers to heritage reporting. This project represents the first attempt to quantify reporting behaviours of Indigenous artefacts and fossils in Australia and recommends improvements for reporting, protection and communication of Australian heritage items and their historical narratives.

Keywords

Public engagement with science and technology; Public perception of science and technology; Science and policy-making

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Introduction

Imagine you're going on a bush walk, or maybe you're walking along the beach — and you find something…

Perhaps it is a fossil, the remains of a plant or animal from millions of years ago. Or maybe your discovery is an Indigenous artefact, a record of the oldest living culture in the world [Bennion & Kelly-Mundine, 2021]. What would you do with your find? Would you tell anyone about it? Do you know if you are *supposed* to tell anyone about it?

Natural and cultural heritage are the archives of our planet's history, helping to tell the stories of past landscapes, ecosystems, and people. These sites and objects assist in understanding our collective human experience - of how we got here, and where we may go in the future [Semeniuk, 2019]. Due to its importance, cultural and natural heritage is protected by international treaties as well as national and state laws in individual constituencies. 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].

Fossils, Indigenous artefacts, cultural objects, and sites are all part of this global history. While the connections to ancestors, landscapes and intangible elements of significance are acknowledged, it is the physical manifestations of heritage, the objects or sites we can see or touch that people often associate most directly with heritage — these physical objects, within a specific Australian context, are the focus of this project. While objects like fossils and Indigenous artefacts have different formation processes and significance, both are found across current Australian landscapes. Whilst scientists are likely to know how to report a heritage find, discoveries are often made by farmers, miners, bushwalkers or other curious "non-experts"— people who may not know the recommended or legislative protocols [Ebach & Smith, 2021].

To date, insufficient scholarly attention has been paid to public perceptions of both fossil and Indigenous heritage objects in Australia, or the likelihood that such discoveries are reported. Consequently, we have little idea if an average individual in Australia would report heritage items, who they would report to, or their awareness of heritage information and protective legislation. Thus, it is unclear if heritage material is being adequately protected due to a potential lack of awareness of heritage information and reporting requirements.

To address these knowledge gaps, the Found a Fossil project and website were created as educational resources to provide accessible and clear heritage information in Australia, and to explore the best means of communicating heritage-related information to the Australian community (Figure 1). Importantly, the website also included a structured online survey to collect empirical data on Australian reporting behaviours, legislation awareness, and the most effective modes of communication. This survey, its results, and the research presented here represent the first empirical data on Australian perceptions and reporting of both fossil and Indigenous heritage material, and the relationship between them.

Objectives

To address these knowledge gaps in Australian heritage studies, this research focused on four main questions:

1. How likely are Australians to report fossil or Indigenous artefact finds?
2. How aware are Australians of heritage regulations/laws?
3. What are the barriers to reporting finds?
4. What are the best communication modes to increase awareness of laws and improve the likelihood of Australians reporting heritage discoveries?

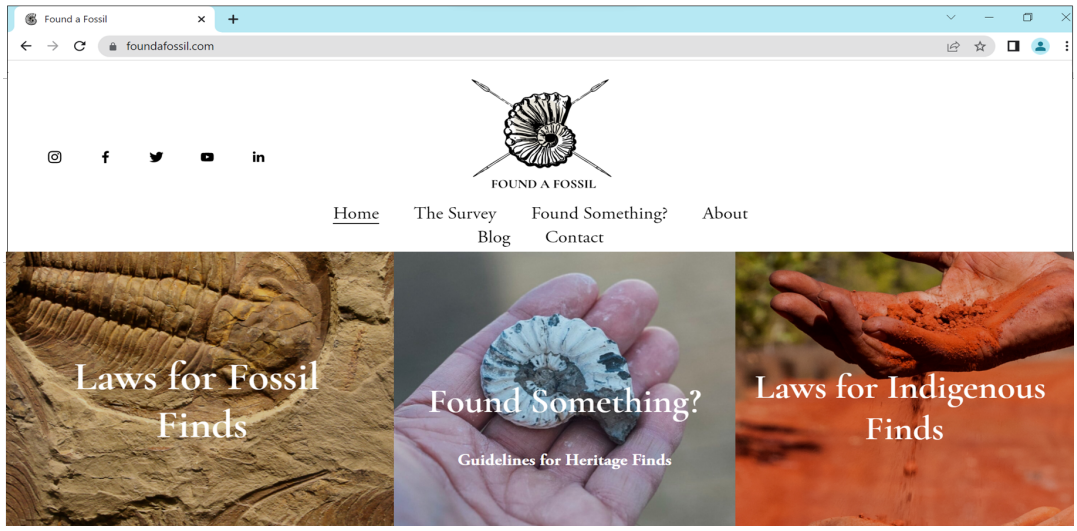

Figure 1. The Found a Fossil website [2023], a central educational portal created for this project to address the lack of accessible and clear heritage information in Australia [www.foundafossil.com].

Context

While the importance of heritage material is recognised at various governmental levels in Australia, as demonstrated by the existence of national, state, and local heritage registers, the legislation to protect heritage material and landscapes does not always reflect this significance [Heritage Council of NSW, 2008; Veale, 2014]. Both state and federal legislation is often weak in its coverage, vague in its practical application, and provides limited detail about 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, Jones & Phau, 2016; Rappoport, 2019; Hobbs & Spennemann, 2020]. Thus, heritage discoveries in Australia may not be properly reported and therefore not adequately protected and conserved, simply because the legislative framework is not designed, written, or communicated in an accessible way.

Key findings in the 2021 Australian State of the Environment Report identified that Indigenous heritage and geoheritage (including fossils, palaeontological and geoheritage sites) required particular attention for their protection and conservation into the future [McConnell, Janke, Cumpston & Cresswell, 2022]. Thus, an important discussion on how to improve the protection of these heritage materials is imperative.

Previous work

There is clear evidence that the legislation protecting Indigenous heritage in Australia is inadequate, with little detail concerning how compliance to these laws is tracked [Brown, 2016; Bennion & Kelly-Mundine, 2021]. It has also been frequently noted that the poor translation and circulation of information has impacted meaningful change and action [Beckett & McDermott, 2016; McConnell, 2021]. While many academic publications agree on these issues [e.g., Nicholas, 2021; Storey, 2023], there seems to have been inadequate communication of heritage information/issues to the public in general.

There are very few sources of information evaluating protective legislation for fossil heritage. 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 [2014] and several subsequent authors [i.e., Henriques & dos Reis, 2015; Delvene, Vegas, Jiménez, Rábano & Menéndez, 2018; Cresswell, 2018] is that fossils are rarely specifically mentioned in legislation but are sporadically included under a broader array of protected materials, thus issues of fossil reporting, ownership, conservation, and the legality of collecting can be frustratingly ambiguous.

Barriers to reporting heritage finds

Academic

Within the broader discipline of heritage conservation, academic discourse is dominated by journal publications written by specialists within the field, with other academics as the intended audience [Kristensen, Henry, Brownlee, Praetzellis & Sitchon, 2020]. Such information is disseminated primarily through traditional peer reviewed publications. While this literature helps to foster good research practices, and can engender trust, integrity, and authenticity in research processes and results, such publications are largely inaccessible for non-academic audiences, with access often hampered by expensive journal subscriptions or paywalls [da Silva & Dobránszki, 2014; Tennant & Lomax, 2019]. These problems also assume that the general public even knows about such academic publications, as well as how to access them. However, if an individual has not been exposed to these types of resources previously (e.g., through tertiary education), then the academic discourse is easily missed [Buhrich, McIntyre-Tamwoy & Greer, 2019; Kristensen et al., 2020]. Even if a person does gain access, technical jargon and 'linguistic walls' may be another obstacle [Crofts, Tormey & Gordon, 2021; Freeling, Doubleday, Dry, Semmler & Connell, 2021]. Additionally, traditional peer review publications rarely allow for any two-way communication and generally exclude non-academic participants from discussion, thus failing to be inclusive or accounting for the heterogeneous worldviews and diverse communities they are discussing [Hughes et al., 2016; Cvitanovic et al., 2018].

Legislative

In Australia, both fossils and Indigenous artefacts are protected under the *Protection of Movable Cultural Heritage Act 1986*. While this Commonwealth Act protects heritage materials from international export, it provides no course of action for handling heritage objects upon their initial discovery [Office for the Arts, 2020]. Each Australian state and territory has different legislation protecting heritage material (Table S1). Yet, the legislation that details these protections and reporting requirements is often lengthy, uses technical jargon and, unless a reader is aware of the specific act relevant to the location of their discovery, it can be a challenge to find [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 difficult to find information about the correct avenues and personnel to contact.

This confusing patchwork of legislation and its communication was raised in the Australian Heritage Strategy (the Strategy) [2015], which aimed to provide national direction for heritage management, conservation, and communication across all levels of the Australian government. The Strategy notes the inconsistencies across state and federal policy, the lack of funding dedicated to heritage, and the absence of community input, understanding, and appreciation of heritage and its protection. Yet, the Strategy puts much of the responsibility for addressing these issues onto local government, community groups, and stakeholders. While it does suggest 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 nine years on little, if any, progress has been made [Cresswell, 2018; McConnell & Fletcher, 2020].

While there has been significant academic debate on the effectiveness of heritage legislation in Australia [e.g., Huntley & Wallis, 2023; Wensing, 2023], less attention has been paid to non-academic audiences and their awareness of heritage laws/information, with little opportunity for the wider community to express their concerns or participate in heritage conversations. The exclusion of non-specialist groups has meant that we have limited detail on reporting behaviours, or information about the perspectives and attitudes of the public concerning these heritage finds and processes [Amar & Armitage, 2019]. This lack of research and inclusion means that there is also insufficient information regarding how different demographic factors may impact conservation behaviours, how best to include the community in heritage conservation, and effective strategies for communicating heritage content to non-academic audiences.

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

Perceptions are formed through past experiences, beliefs, knowledge, cultural, political, socioeconomic backgrounds, and other personal factors, and these perceptions will often go on to influence behaviour [Jefferson et al., 2015; Bennett, 2016]. While all these aspects mean that each person has unique perceptions, attitudes, and behaviours, including these insights in research can help to identify the common goals, desires, and concerns of the community in relation to heritage conservation. This inclusion can 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].

The inclusion of community perceptions may be fraught with clashing beliefs and opinions, yet an inclusive approach to heritage management and conservation that involves entire communities and all stakeholders in decision-making has many potential benefits [Singer, Bennett-Levy & Rotumah, 2015; Viduka, 2020]. An appreciation of the knowledge, lived experiences, histories, and stories of the entire community can help to protect the physical heritage material but also empowers communities and aids in local reconciliation efforts [Strickland-Munro & Moore, 2013; Gaymer et al., 2014; McGinnis, Harvey & Young, 2020]. Such a local approach to heritage and protections can create a greater sense of trust between involved community members/groups as they find common ground and acceptance of different world views [Isidiho & Sabran, 2016]. Whilst the questions in the survey

used herein are hypothetical, and the answers may not reflect actual behaviours, a survey of this type is likely to produce a valuable baseline about the heritage perceptions and reporting behaviours of the broader Australian community.

Methods

Survey Design and Structure

The Found a Fossil survey was created using LimeSurvey (version 3.28.0) and included ≤40 multiple choice questions and ≤10 open-ended questions (Table S2a) (25 compulsory questions were included, with additional questions asked depending on answers given) [LimeSurvey Development Team, 2022]. The online survey was open to anyone living in Australia over the age of 10. 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, Oliver, McConney, Maor & Schibeci, 2011; Australian Bureau of Statistics, 2022b]. The survey was also designed to ensure that all participants were anonymous, with the aim of encouraging honest and forthright responses, and hence be more likely to capture accurate results [Busetto, Wick & Gumbinger, 2020].

Participants were asked questions covering five broad categories: (1) generic information about themselves and their demographic background (e.g., age bracket, gender, occupation sector); (2) Indigenous artefact (henceforth shortened to artefact/s) reporting; (3) fossil reporting; (4) heritage laws; and (5) preferred media/communication formats. The fifth section was optional and asked participants to choose from five different communication formats (social media post, blog, brochure, video, or webpage [Table S2b]) that provided information about fossil and artefact discoveries and appropriate contacts for reporting; respondents were then prompted to answer questions about how effective the different formats were at changing their perceptions of fossil/artefact reporting and protection.

Survey Advertising

The survey was hosted on the Found a Fossil website for five months and was advertised through a 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]. Advertising posts were spread across social media platforms (Twitter, Facebook, LinkedIn, Instagram), and sent to a wide range of relevant interest groups (e.g., local Aboriginal land councils, geological societies, farming community groups, etc.), with radio interviews, conference/public talks, magazine and newsletter inclusions also sought to reach varied audiences (See Table S2c for list of advertising).

Statistical Analysis

Statistical analysis was conducted using R Studio [v. 4.3, R Studio, 2021]. 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).

Results & Discussion

The Found a Fossil survey was open from the 17th of January to the 30th of June 2022. A total of 1379 people completed the survey, with participants from every state of Australia (Table 1).

Representativeness of sample: Survey respondents vs Australian population

Population proportions from the survey were compared with the wider Australian population using data from the 2021 Census [Australian Bureau of Statistics, 2022a] (Table 2). These comparisons revealed that state of residence, age, and gender tended to be similar to the Australian population, whereas Indigenous ancestry, education (Table S3), and occupation are less representative. While this variation is not an unexpected outcome from an online-only survey, it does mean that caution must be used in regard to generalising for the entire Australian population from the results presented.

Demographic Predictors of Reporting Fossils and Artefacts

Most participants answered 'yes', to the question '*If you found an object that you knew was an [Indigenous artefact] or a [fossil], would you inform anyone (other than friends or family)?*'. For Indigenous artefacts, over 78.2% of people said 'yes', versus 21.8% of people saying 'no', they would not report an artefact find. Results were similar for fossils, with 70.6% of people saying they would report, versus 29.4% of people saying 'no'.

Gender was a significant predictor reporting artefacts (Fischer exact test, $p<0.001$), with females 1.5 times more likely to report artefacts than males. A similar result was also found with fossil discoveries, with females 1.7 times more likely to report a fossil compared to males (Fischer exact test, $p = 0.009$).

The higher proportion of reporting by females (for both fossils and Indigenous artefacts) is consistent with a study of attitudes to marine park management in Ningaloo Marine Park, Western Australia, where women were found to be more trusting of scientific and natural management processes than men [Cvitanovic et al., 2018]. Female visitors to the 'Jurassic Coast' fossil region in England were also much more likely than male visitors to think that fossils were important to protect for future generations and were more aware of potential negative outcomes of fossil collecting [Kim & Weiler, 2013].

Table 1. Breakdown of survey participant demographic characteristics, compared to data from the 2021 Australian Census [Australian Bureau of Statistics, 2022a, 2022c].

Demographic	Survey percentage [%]	ABS Proportion of population [%]
Country of Residence		
Australia	99.3	-
Other	0.7	-
State of Residence		
ACT	5.2	1.8
NSW	37.9	31.8
NT	2	0.9
QLD	12.3	20.3
SA	10.3	7
TAS	4.1	2.2
Vic	14.6	25.6
WA	6.9	10.5
Not stated/Other	6.4	<0.1
Age		
10–19 years old	4.4	13.6
20–29 years old	14.9	15
30–39 years old	13.2	16.5
40–49 years old	14.9	14.7
50–59 years old	22	14.1
60–69 years old	21.9	12.4
70+ years old	8.9	13.8
Gender		
Female	54.6	50.7
Male	42.5	49.3
Other	2.9	-
Indigenous Ancestry		
Indigenous	8.5	3.2
Non-Indigenous	91.5	96.8

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 than people over the age of 40. Higher rates of reporting for younger people may be due to a higher awareness and understanding of Indigenous social concerns, with the role of social media, increased exposure to politics and social issues, and recent inclusion of these topics in the school and university curricula likely playing a part [Yellow, 2020; Australian Curriculum, Assessment and Reporting Authority (ACARA), 2023]. Older people (i.e., 40+-year-olds) may also have more familiarity and memory of the introduction of the *Native Title Act* in 1993, and the resulting discussion and concerns about land reclamation and restrictions [Toone, 2016; Hobbs & Spennemann, 2020].

Pairwise comparisons of proportions did reveal a significant difference (p=0.037) in the likely fossil reporting behaviours of students and farmers (with farmers less likely to report). In another comparison, farmers were also 20% less likely to report a fossil and 25.7% less likely to report Indigenous artefacts than the non-farmers surveyed. This result is likely due to the misguided fear of land reclamation due to finding heritage material on one's property [Toone, 2016].

Improving reporting behaviour

The survey reveals that a major barrier to reporting was that people did not know who to contact about a heritage find. This was the top answer to the question '*What would stop you from reporting a heritage find?*' for artefacts (28%), and the second most selected answer for fossils (22%) (after not knowing if the find was significant). While most state laws mandate reporting of Indigenous artefacts to a State Heritage department, only 8% of respondents indicated that they would contact the State Heritage body if they found an artefact (Table S1) [Wensing, 2023]. Another question asked respondents to agree or disagree with the statements '*I feel confident that any existing laws in my state adequately protect* [*fossils and fossil sites*] *or* [*Indigenous artefacts and sites*]'. Respondents were also able to select 'I don't know'. Results revealed that over 37% (for artefacts) and 47% (for fossils) of people selected the 'I don't know' option, indicating that they did not have sufficient knowledge of the relevant legislation to agree or disagree about the adequacy of its protection.

When asked '*Who would you report your find to?*' museums were the clear choice for fossils (34.8%), whereas the local Indigenous community was the top choice for artefacts (37.5%), followed by museums (20.3%), then Parks and Wildlife (9.5%), and the relevant State Heritage Body (9.1%) (Figure 2). This data provides ample evidence that heritage information has not been clearly and adequately communicated to the public, but it also reveals a well-defined pathway forward for improvement.

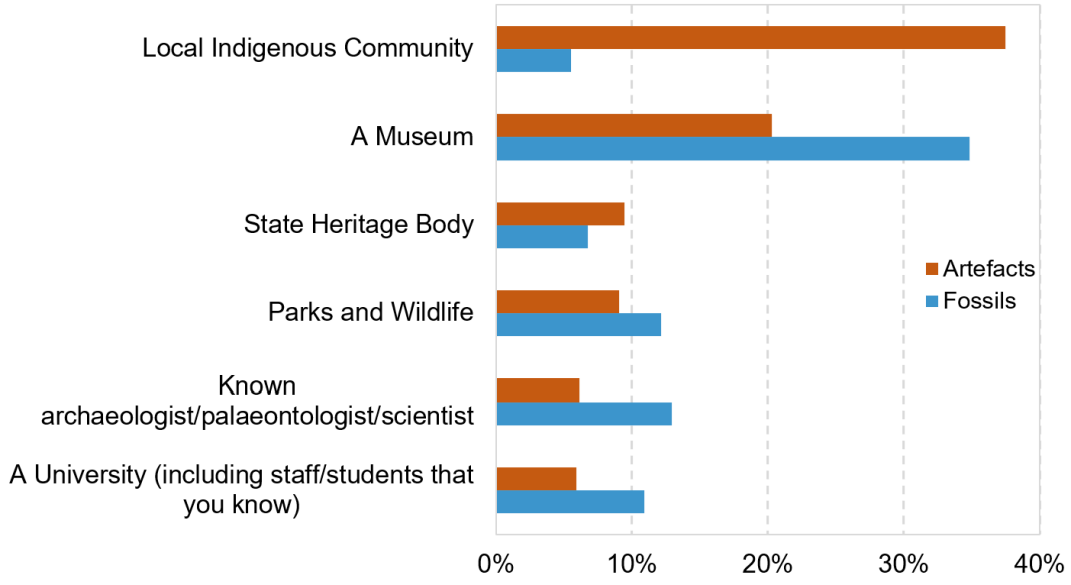

Figure 2. Top 6 responses to the question '*Who would you report a [fossil] or [Indigenous artefact] to?*'. This question was only asked to participants who said 'yes, I would tell someone…' about an Indigenous artefact find (n=1078) or fossil find (n=973).

Communication Formats in Survey

In this section, participants were able to opt in to watch/read one of five different communication formats; 47.5% of the survey respondents subsequently chose to participate (n = 655). Available formats included a social media post, a webpage, a

video, a brochure, and a blog (Figure 3). Each of these formats had the estimated reading/watching time listed in the survey, with the social media post being the shortest (~ 1 minute) and the webpage being the longest (~7–8 minutes). These formats were created with a budget of <$1000 using simple graphics programs (e.g., Canva for the social media post and brochure), a hired animator (for the video), and website/blog features built into the Found a Fossil website platform, SquareSpace.

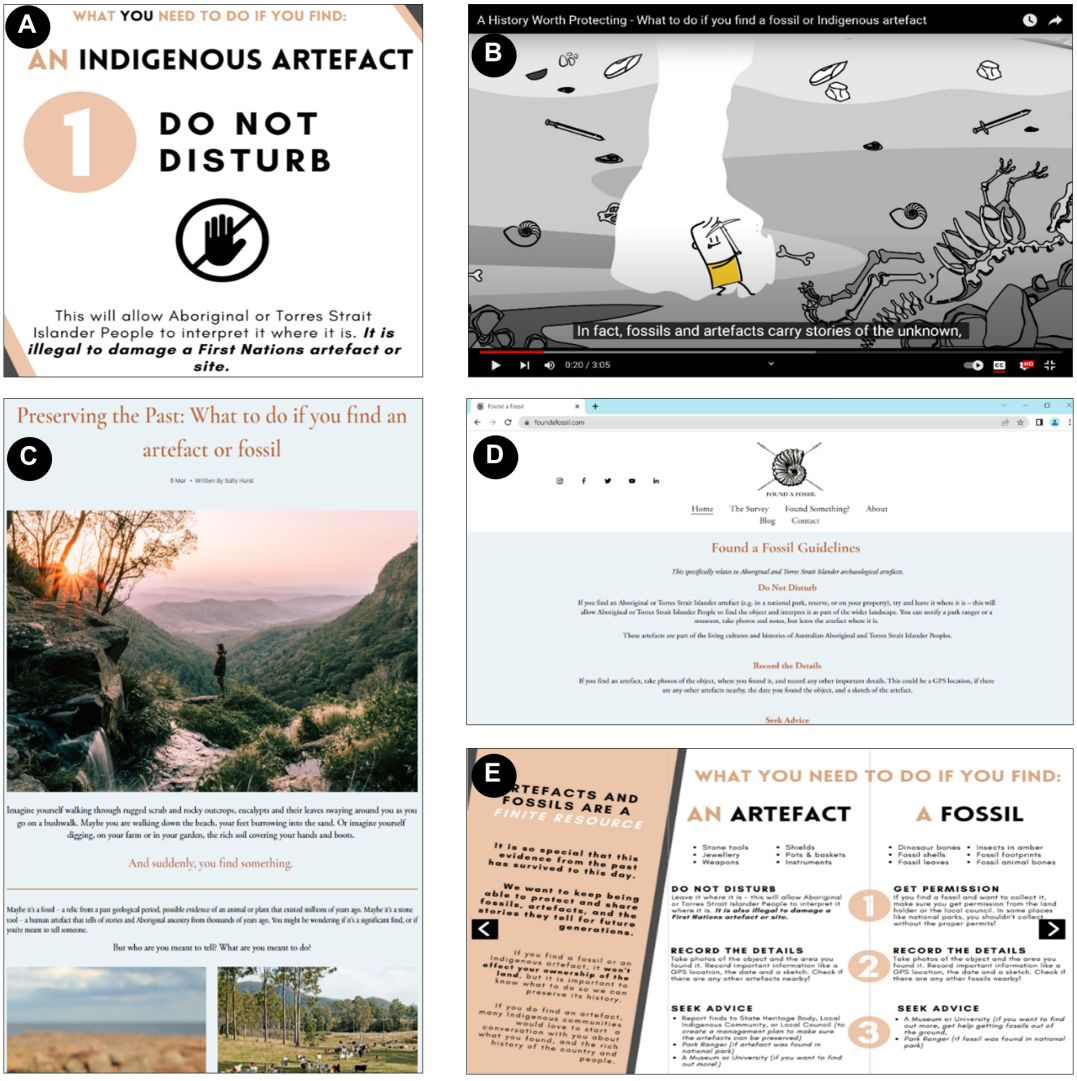

Figure 3. Examples of communication formats created for the Found a Fossil survey, and now permanently available on the Found a Fossil website. Formats included a social media style post (A), a video (B), blog (C), a webpage (D), and a brochure (E).

After watching/reading the selected format, participants were asked why they chose it (Figure 4), and how informative and engaging it was. The social media post was the most popular option (32%) and was considered the quickest to view, and one of the most accessible formats. Videos (30%) were also considered similarly accessible and easy to understand, and visually engaging and interactive. When participants were asked if they found their chosen format engaging and/or informative, over 45% responded that they found it 'Very Engaging', and over 55% said it was 'Very Informative'.

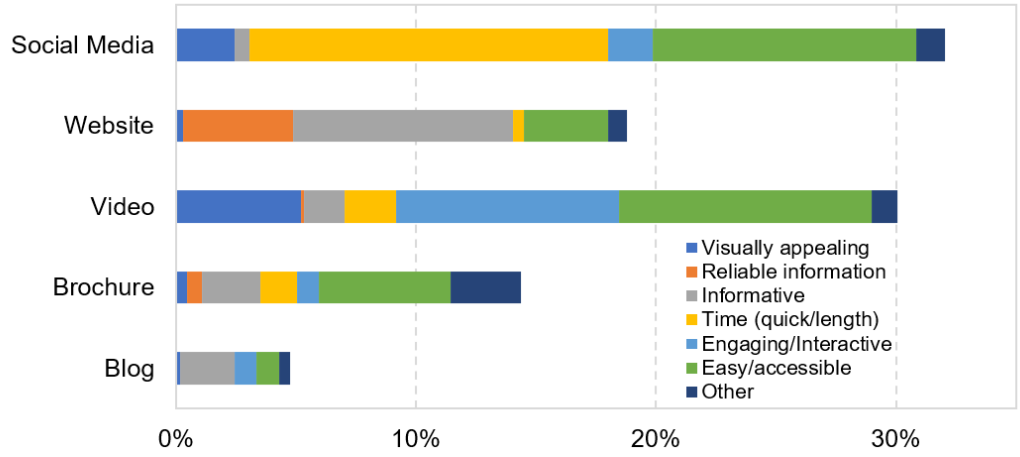

Figure 4. Reasons why participants chose different communication formats to read/or view within the survey (total n=655).

When breaking down communication preferences by demographic variables, such as age, there is some variation between age brackets, where 30+ year-olds preferred webpages but 20–29-year-olds favoured social media style posts (Figure S1). These results provide important insights that can assist with producing effective, targeted messaging to different demographics across Australia [Jakopak, Western & Monteith, 2021]. Tailored messaging to specific audiences is a foundation of strategic communication, and considers the different backgrounds, perspectives, experiences, and concerns of the diverse groups that are attempting 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 with and perceptions of heritage and reporting and will be key to the effective engagement and involvement of different communities and groups in the protection of heritage [Jefferson et al., 2015].

Changing Minds

This communication preferences section of the survey (Q21.31–44) (Table S2a) provides evidence for the value of making information transparent and accessible. This survey section asked those participants who had originally selected that they would not report a fossil and/or artefact (Q10 & Q14 in the survey) 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

While the rate of changing minds only hovers at around 40–50%, this 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 can obtain that result of change, then a state government funded or supported awareness campaign directed at a broader suite of the community would likely improve the protection, conservation, and appreciation of heritage material across Australia.

Thus, by making the current heritage information and legislation easier to understand, by doing something as simple as editing a website or providing a link to a video, greater accessibility and transparency of information could surely be achieved. The communication formats designed for this survey are now 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.

Ideas for effective engagement: the strength of stories

Both the video and the blog attached to the survey focused on storytelling, using visual and narrative elements to engage the viewer to make the content personally relevant, providing a non-traditional alternative to the more structured and formal formats, such as the website. Narratives, ancient texts, and stories have been used for thousands of years by humans across the globe to communicate [Chronis, 2012; Finkler & Leon, 2019]. 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 people where traditional and formal communication (e.g., government websites, lectures, scientific or peer reviewed articles) have not been successful [Davies, Halpern, Horst, Kirby & Lewenstein, 2019]. Additionally, a study by McCormack, Martin and Williams [2021] has shown 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 — whether it be describing the movement of dinosaurs across the landscape, or the life 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, become engaged and more likely to care for aspects of heritage that interest, inspire, or include them [Jefferson et al., 2015; Cvitanovic et al., 2018]. Oral storytelling has been the traditional mode of knowledge transfer by Australian Indigenous communities for tens of thousands of years [Cooper, Fricker, Sheffield & Tang, 2022]. Incorporating this mode of communication into wider heritage practices will likely not only be more enjoyable for non-Indigenous audiences, but may also 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, Ngukurr Yangbala rangers, Russell & Ens, 2022]. Such 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 encourages human appreciation and concern, and therefore, ultimately promotes stewardship and protection of Australia's heritage material and environment [Azman, Halim, Liu, Saidin & Komoo, 2010; Santucci, Newman & Taff, 2016].

The Found a Fossil website: Increasing accessibility and transparency

The 2021 State of the Environment reported: "*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, conservation and appreciation of heritage. Enhanced transparency, interest, and care about heritage, whether it be fossils or Indigenous culture and history, may also assist in increasing awareness of, and compliance with, heritage laws.

The Found a Fossil website was created by SH with these reasons in mind. Whilst hosting the survey for this research was a primary function of the website, it also provides clear, plain English information to all visitors (not just survey participants) interested in heritage issues or seeking extra information. The Found a Fossil website provides a workable example of how heritage information can be communicated in clear and accessible ways, providing a potential model for centralising disparate state information on a single platform (the website currently provides state-by-state breakdowns of reporting requirements, relevant legislation, contacts, and resources) (Table S2d). Re-designing government websites to have greater accessibility and transparency of relevant information is low cost and relatively easy to achieve and would greatly improve the full scope of heritage protections where legislation itself may not be easily changed.

If heritage departments had an increased social media presence and content available, this could also contribute to increasing awareness of heritage and its protection. During the survey advertising period, sponsored media posts had an estimated reach (i.e., the number of people who saw the ad at least once) of over 150,000 people on Facebook alone. Within Australia, there are an estimated 20 million social media users — over 80% of the total population, making social media a powerful tool for information dissemination [Yellow, 2020]. 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 peer reviewed publications (which they may not be reading anyway), to the exciting behind-the-scenes of science and archaeology, and the fascinating stories associated with heritage places and objects [Riesch, Potter & Davies, 2016; Klar, Krupnikov, Ryan, Searles & Shmargad, 2020]. In the context of Australian heritage protection, social media platforms provide an excellent opportunity to connect with audiences of different demographics and interests around the country [Kelly, 2010; Liang, Lu & Martin, 2021].

Talking on radio shows, doing magazine interviews, performing at science comedy gigs, and especially visiting schools by SH has also increased the visibility and accessibility of the Found a Fossil project. These events, which tend to have a more general than academic audience, have assisted in the grass-roots support and awareness of heritage protections, and hundreds of people around the country are now better informed about what to do if they discover a heritage find, even if they did not participate in the survey itself. Going forward, these events will be a major focus for improving awareness of the Found a Fossil project, and will contribute to increasing community awareness of their role in the stewardship and protection of heritage material.

Conclusions

The Found a Fossil survey was successful in identifying a process for determining potential reporting behaviours for fossils and Indigenous artefacts by members of the Australian community. While we were able to determine that a majority of Australians sampled (over 70%) want to report fossil and Indigenous heritage finds, many of these people were not aware of specific heritage protections, or if existing legislation is adequate in its protection of this heritage material; these results addressing objectives 1 and 2 of this project. Our third objective was to outline existing barriers to reporting heritage finds, and results showed that not knowing who to contact upon discovering a heritage find was a major problem, likely caused by poor communication of heritage information, and a lack of transparency regarding who is responsible for heritage. Another barrier identified was that the exclusion of non-academic audiences from heritage conversations, paired with the lack of accessible information, greatly reduced the possibility of Australians engaging in heritage conservation processes, such as reporting.

Our final objective was to explore the best communication methods to increase awareness of heritage legislation and reporting guidelines. Results revealed that despite the existing challenges within heritage reporting, survey respondents' preferences and feedback on the included communication formats indicate a clear pathway to improvement for creating effective communication for the future. Social media and videos proved to be powerful and popular tools, making heritage content accessible and engaging. Increasing the inclusion of these media types, as well as storytelling elements in future communication strategies, alongside an improved understanding of Australian audiences and demographics, can help to tailor messaging, and hopefully provide effective guidance for connecting with and communicating to the public in the future [Kidd et al., 2019; Yuriev, Dahmen, Paillé, Boiral & Guillaumie, 2020].

This research and the survey results may also be used to hold government departments accountable for their poor communication of heritage legislation and associated 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 et al., 2018; Haering, Wilson, Zhuo & Stathis, 2020]. These inclusive conversations can help to increase the transparency of information and assist in generating interest, and ultimately lead to the better protection of heritage in Australia [Andrade & Rhodes, 2012; Lepore, 2019; Hobbs & Spennemann, 2020].

The intersection between palaeontology, archaeology, social science, and public communication in this research has helped to address a significant gap in the academic literature, and 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. The survey has led to the creation of a comprehensive dataset that has outlined community concerns and larger issues with heritage protection but can also be drawn upon for solutions to these challenges. These survey results are also a tangible record of over 100 people positively changing their perceptions and reporting behaviours after engaging with the Found a Fossil survey/project. If participation in an independent research survey can have that rate of change, a government funded/supported awareness campaign could go a long way to improving heritage protection and community involvement for future generations. The Found a Fossil website will continue to fill this gap in the meantime, providing understandable and centralized information for heritage finds across Australia.

Fossils and Indigenous archaeological material are finite resources, and without the support of the Australian government and 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. 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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