RESEARCH ARTICLE

Social media conservation messaging mirrors age-old taxonomic biases in public domain

Caitlyn Y. Forster[1] | Dieter F. Hochuli[1] | Ryan J. Keith[1] | Tanya Latty[1] |
Thomas E. White[2] | Eliza J. T. Middleton[1,3]

[1]Heydon-Laurence Building, The University of Sydney, Camperdown, New South Wales, Australia

[2]Macleay Building, The University of Sydney, Camperdown, New South Wales, Australia

[3]Michael Spence Building, The University of Sydney, Camperdown, New South Wales, Australia

Correspondence
Eliza J.T. Middleton, Michael Spence Building, The University of Sydney, Corner of Eastern Avenue and City Road, Camperdown, NSW 2006, Australia.
Email: eliza.middleton@sydney.edu.au,

Abstract

In this global extinction crisis, we must act urgently to prevent the loss of species. The public plays a key role in ensuring the future of our biodiversity, by impacting funding decisions, creating behaviour change, and pushing change in corporations to prevent species loss. The Threatened Species Bake Off competition is a social media initiative created by the Australian Government in 2017 to raise awareness of nationally listed threatened species. In this study, we assessed the trends of the competition by collating entries via Instagram and Twitter in its first 5 years. Representations of 356 unique species were baked, 261 of which were listed as nationally threatened species. Birds and mammals were the most popular groups represented. Frogs, reptiles, fishes, and invertebrates were reasonably well represented; however, plants were drastically underrepresented in the competition. This is evidence of taxonomic bias towards the charismatic animals, and a problematic lack of representation of other threatened species that play essential roles in our ecosystems. Although the Bake Off is an innovative conservation messaging approach, it reinforces awareness of the same groups that traditional messaging techniques encouraged (i.e., charismatic megafauna). Public engagement in this competition reflects current conservation messaging, including media and education focus on charismatic animals, demonstrating engrained biases. Future competitions should address this by highlighting less popular but equally important threatened species, especially plants.

KEYWORDS
conservation messaging, Instagram, social media, threatened species, Twitter

INTRODUCTION

Amidst the sixth mass extinction, largely driven by human behaviour over the last 400 years (Ceballos et al., 2015; Lewis & Maslin, 2015), the need to protect and slow the loss of plant and animal species is of the utmost urgency. Around 1 million species are threatened with extinction under current global practices (Barnosky et al., 2011; Dirzo et al., 2022; IPBES, 2019), and several taxa, including arthropods, fungi, and fishes, are underassessed, risking extinction before a complete evaluation of their status (IUCN, 2021; Pimm et al., 2014). With a vast landmass encapsulating 8 of the 14 ecoregions across the globe, Australia contains unique flora and fauna such as monotremes (Department of Climate Change, 2022). Yet over the last 200 years Australia has experienced the greatest loss of biodiversity among high-income nations (Waldron et al., 2017).

Policy failures have exacerbated the Australian extinction crisis. In the last 10 years, 7.7 million hectares of threatened species habitat has been destroyed

---

Caitlyn Y. Forster and Eliza J.T. Middleton shared first authorship.

(Ward et al., 2019), at least three threatened species have gone extinct, the list of threatened species has grown, and many listed species have raised threat levels (Department of Climate Change, 2021a, 2021c). Legislation intended to slow extinction rates (e.g. Australia's Environmental Protection of Biological Conservation, EPBC Act, 1999) were developed rapidly but are ineffective (Cresswell et al., 2021). Legislation is not ecologically representative, nor optimized to protect biodiversity (Pimm et al., 2014; Walsh et al., 2013). Often biased towards charismatic species in terms of government conservation actions, public appeal, funding, and future planning (Colléony et al., 2017; Czech et al., 1998; Drijfhout et al., 2022), it engenders similar biases in conservation research (Bonnet et al., 2002; Martín-López et al., 2009; Wilson et al., 2007).

The question of how to effectively communicate with the public and initiate action on topics such as conservation and species loss has drawn significant debate (Kidd, Bekessy, & Garrard, 2019). Currently, "conservation optimism" is the dominant communication strategy, seeking to motivate individuals to act out of hope and frame negative outcomes as temporary setbacks (Balmford & Knowlton, 2017; Garnett & Lindenmayer, 2011; McAfee et al., 2019). Whilst optimistic messaging is effective in other disciplines, such as climate change (Ojala, 2012) and waste reduction (Peter & Honea, 2012), there is little evidence for the success of optimism in conservation, nor is there evidence for the success of the alternative, pessimism in conservation (Kidd, Bekessy, & Garrard, 2019). Messaging strategies have had mixed impacts dependent upon the characteristics and behaviours of the target audience and the lack of evidence to support pessimistic or optimistic approaches highlights the need for individualized strategies (Kidd, Garrard, et al., 2019; Kusmanoff et al., 2020; Rothman & Updegraff, 2010).

Social media can be used for conservation, with posts acting as tools for conservation messaging (Kroetz et al., 2021; Sullivan et al., 2019; Vins et al., 2022). For example, social media can spread news of species extinction events well outside the range of the extinct species (Fink et al., 2020), yet it is not a perfect messaging tool (see Bergman et al., 2022 for a conceptual model). One challenge is the inherent bias towards charismatic species, particularly mammals and birds (Kidd et al., 2018; Shaw et al., 2022).

The Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) has approached conservation messaging in an optimistic and novel way. Aiming engagement at social media users, DCCEEW invites the Australian public to bake a dessert representing a listed threatened species and post it on social media. Held annually since 2017, the aim of the Threatened Species Bake Off competition (hereon referred to as Bake Off) is to "build awareness in the community about Australia's remarkable and unique threatened wildlife" (Department of Climate Change, 2021d).

The Bake Off can provide insights into public awareness, with the species of most concern to the entrants reflected in their competition entries. This allows us to determine the impact of public engagement with social media conservation messaging, any trends in species dominance or bias towards certain groups or species, and if previous campaigns and legislation are reflective of public understanding and concern.

METHODS

We compiled the tweets and posts that used the hashtag #TSBakeOff from 2017 to 2021. The entries on the platforms must be public and tagged, or submitted via email to the Threatened Species Commissioner, who reposts them through their Facebook profile. We did not include entries

from Facebook to avoid conflation of audience and species representation. The entries should also be of a species listed in the Threatened Species List (EPBC Act, 1999) (TS List).

For each bake, we recorded the species represented, common name, and animal group (fish, bird, mammal, other animals, frog, reptile, plant, habitat, non-applicable, or political). The taxa used in the animal groups was based on the categories used by the Environment Protection and Biodiversity Conservation Act. Invertebrates are pooled in the "Other Animals" category (hereon referred to as other), and "Political" entries referred to posts that promoted alternative conservation themes, such as threatening processes (e.g., mining, deforestation), government policy and perceived inaction, or posts in opposition to the Bake Off. We recorded the threat level of each species as listed under the TS List (not listed, vulnerable, endangered, critically endangered, or conservation dependent) (Department of Climate Change, 2021b, 2021c). We also examined temporal trends, including the diversity of taxa, differences in species represented between each platform, number of independent submissions, and total entries overall. We further determined entrant retention across multiple years, and the growth in submissions to the competition over time, assuming usernames did not change.

Ethics approval for this study and the inclusion of entrants' public data for the entries collected and analysed from Twitter and Instagram were obtained from the University of Sydney Human Research Ethics Committee (2021/889).

RESULTS

Species richness

Since the inception of the Bake Off, there have been 1143 entries, with 236 birds, 377 mammals, 53 fish, 62 frogs, 113 reptiles, 163 other, 100 plant entries, and 39 entries that did not fit into the listed taxa (Figure 1). These numbers are inclusive of duplicate entries of the same species across the years, and when examining species richness, we find far fewer species have been represented.

Overall, 261 unique species from the TS list were represented as bakes, with examples from each of the taxa (fishes = 17, reptiles = 24, birds = 50, mammals = 58, frogs = 14, other = 34, and plants = 42) and each of the listed threat levels (not listed, vulnerable, endangered, critically endangered, conservation dependent, and extinct; Figure 2). Ninety-five species were not listed, and when included, the species richness increases to 356 unique species (fishes = 25, reptiles = 35, birds = 70, mammals = 79, frogs = 15, other = 66, and plants = 66). Animal taxa have had between 27% and 50% of the threatened species listed represented across the course of the Bake Off (50 of 165 listed birds equalling 30%, 58 of 146 mammals equalling 40%, 17 of 62 fishes equalling 27%, 14 of 43 frogs equalling 33%, 24 of 61 reptiles equalling 39%, and 34 of 68 other equalling 50%), yet plants only had 3% of the listed species represented (42 of 1399 listed species).

The five most popular species were the koala (*Phascolarctos cinereus*; $n = 33$), kangaroo island echidna (*Tachyglossus aculeatus*; $n = 29$), greater bilby (*Macrotis lagotis*; $n = 22$), numbat (*Myrmecobius fasciatus*; $n = 19$), and orange-bellied parrot (*Neophema chrysogaster*; $n = 17$; see Figure 3). These species may not top the most popular species represented in a single year, yet cumulative entries across the competition's history resulted in their overall popularity. For example, the kangaroo island echidna was not baked in 2018 for the competition, but 22 were represented in the bake off in 2021; enough to push this species to the top 5 overall.
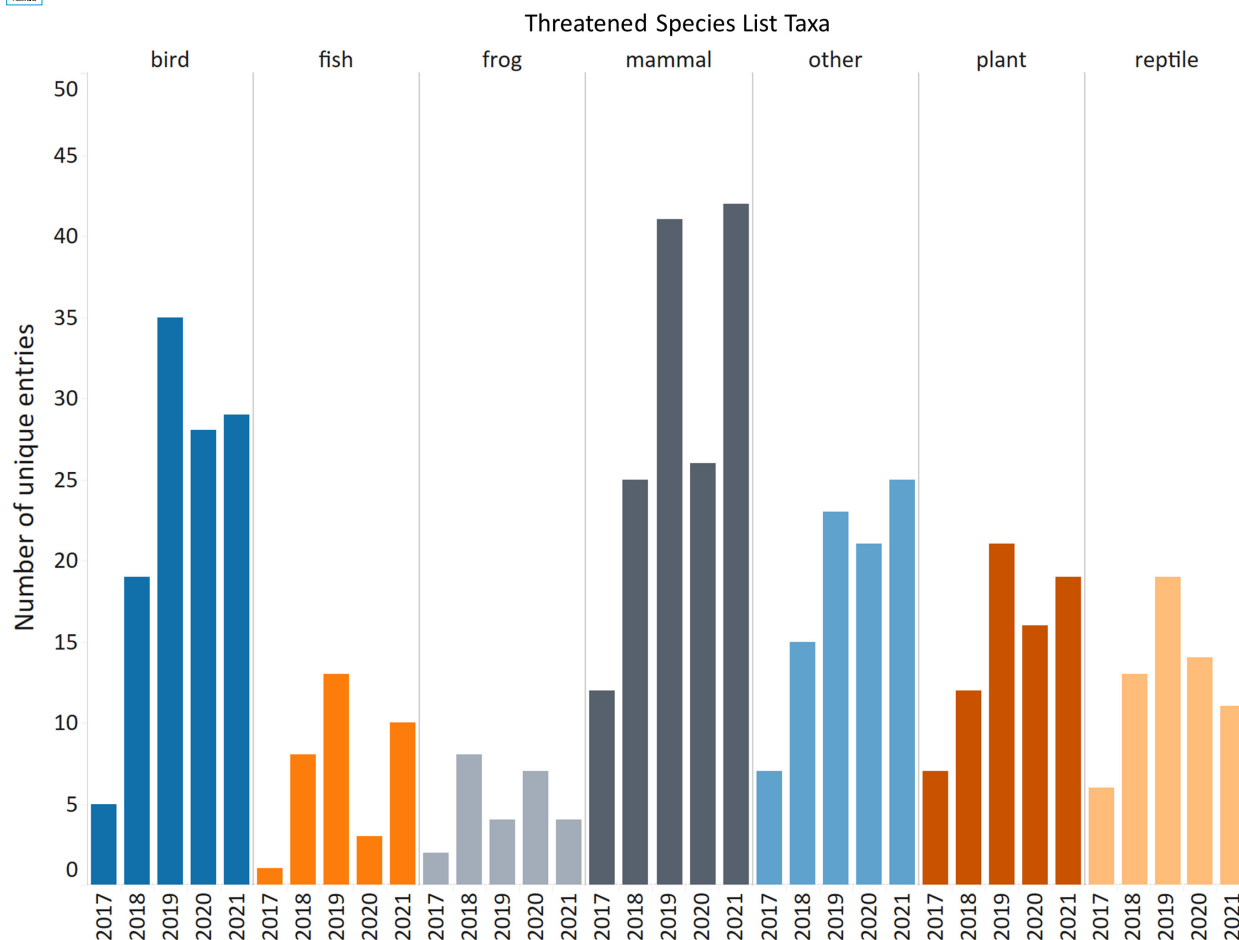
FIGURE 1 Total number of unique entries represented as bakes within each taxon (bird, fish, frog, mammal, other, plant and reptile) in each year of the competition regardless of listing in the Threatened Species List. Most taxa are seeing an increase in richness of entries each year, suggesting that with more participants, more unique species are represented.

Conservation status

Each of the threatened species' levels has been represented throughout the competition, with the largest growth and most common species baked coming from endangered ($n = 278$) and vulnerable ($n = 291$) listings (Figure 4). Nationally unlisted Australian species are the third most represented category in the bake off with 254 entries.

Participant patterns

The number of unique participants using identifiable profiles has increased each year, but entries are dominated by first-time participants. In 2017, there were 21 unique participants, which grew by 605% to 148 in 2021, with a small percentage (11%–18%) of return entrants. Despite the competition running for 5 years, no participants have entered the competition in more than two rounds. Without further identifiable data some participants may have entered every year since 2017 but changed their entry method. That is, they may have entered on Twitter 1 year, Instagram another, or changed usernames between years and entries, which we were unable to track.

There were 613 entrants on Instagram and 530 on Twitter. Initially, more participants entered from Twitter accounts until 2020, when a drop
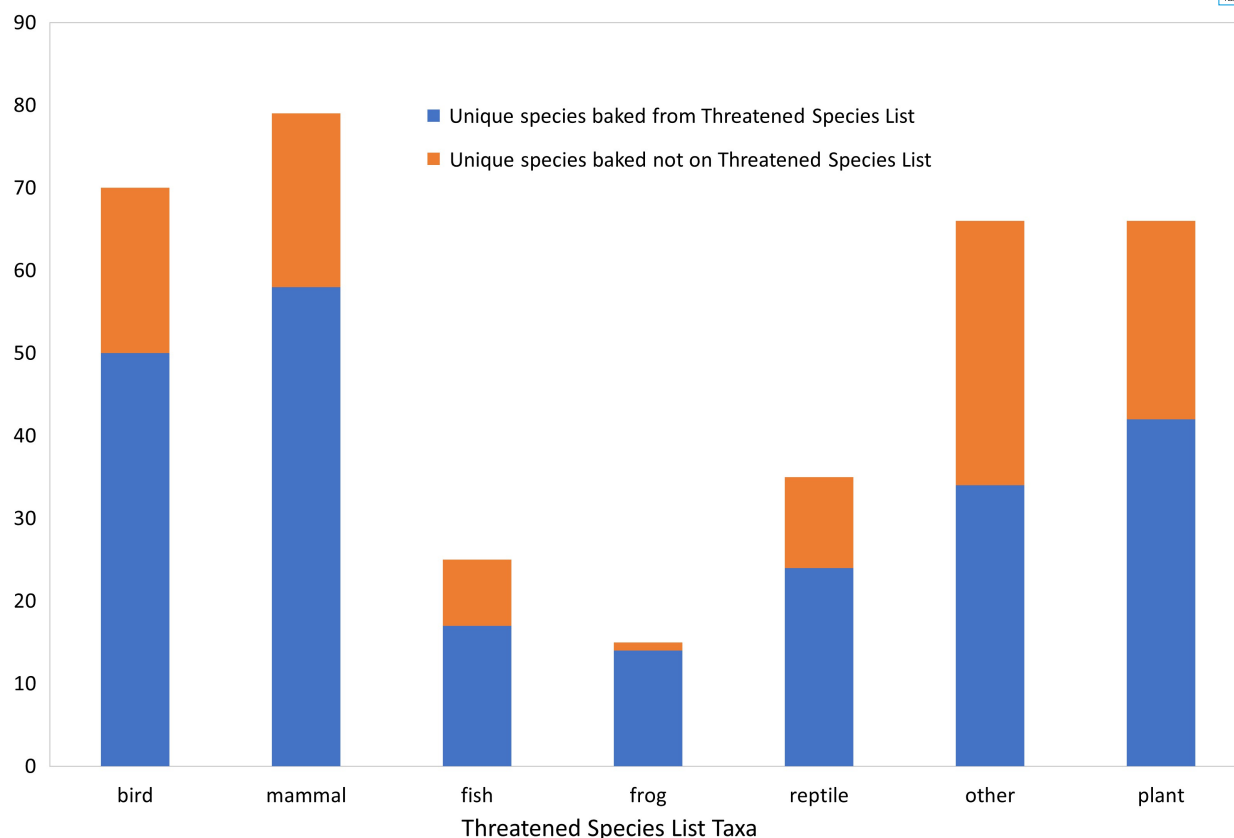
FIGURE 2 Number of unique species represented as bakes within each taxon (bird, fish, frog, mammal, other, plant and reptile) of those listed in the Threatened Species List (blue) and those not listed (orange). Most of the species baked for the competition are from the Threatened Species List.

in Twitter participants occurred. Entries via Instagram have increased each year, from 30 in 2017 to 273 in 2021.

DISCUSSION

The Threatened Species Bake Off provides a novel way of promoting threatened species to a broad audience through the creation of a fun, and highly visual social media competition. The innovative approach of the competition has highlighted key issues in conservation messaging in Australia; a taxonomic bias with overrepresentation of charismatic megafauna, a gap in protection of locally important species, and the need for broader incorporation of other conservation topics such as threatening processes. The competition has grown, inspiring similar competitions across Australasia and gained international media attention (Cherney, 2021), attracting professional and amateur bakers alike (Figure 5).

Taxonomic trends

Our results revealed a bias in the taxa represented in entries, echoing common conservation preferences (Martín-López et al., 2007). Mammals were the most frequently baked group and are the most popular group for conservation efforts (Fančovičová et al., 2021; Shaw et al., 2022). Popular species including koalas, echidnas, and bilbies are poster child examples of Australian conservation, their uniqueness, and charismatic appeal
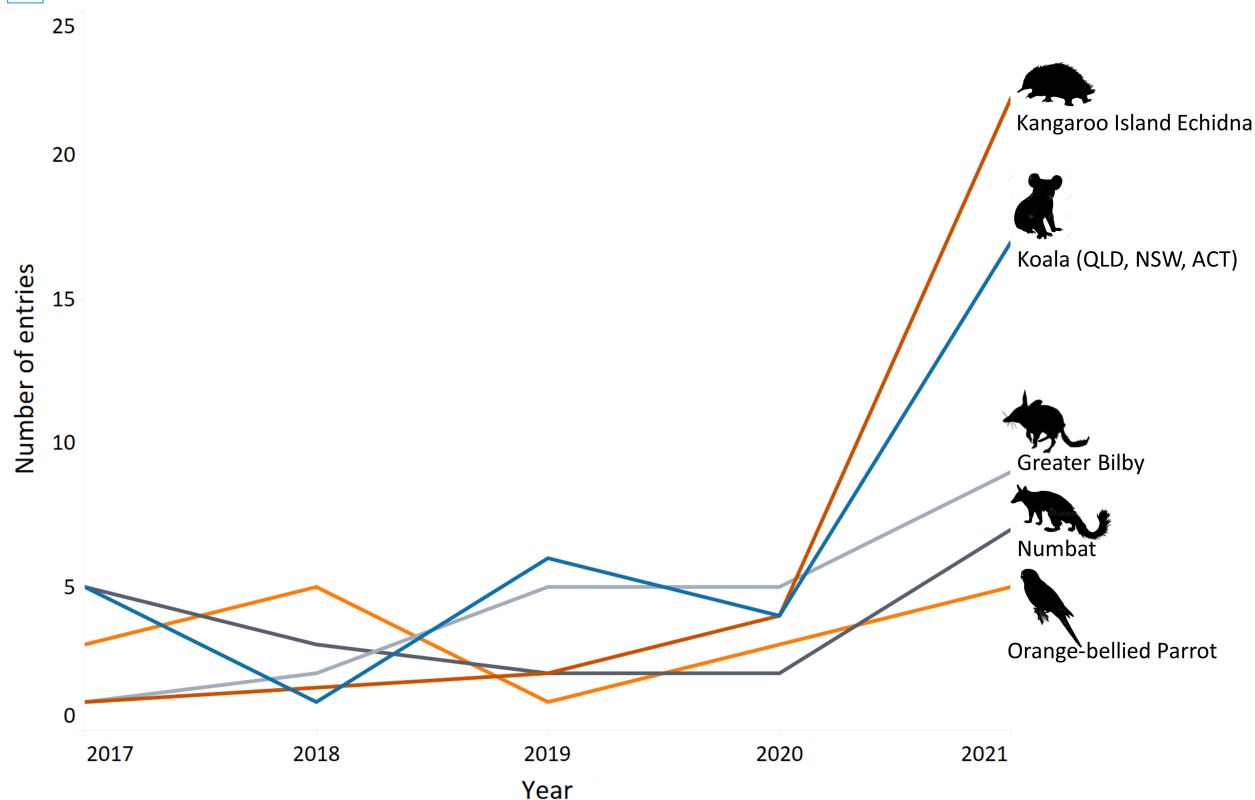
FIGURE 3   Number of entries over time for the top five species represented as bakes, the combined Koala populations of QLD, NSW and the ACT, Kangaroo Island Echidna, Greater Bilby, Numbat, and Orange-bellied Parrot. Mammals dominate the top baked species with 4 out of 5 top species being mammals.

contributing to their prevalence in advertising and media and such exposure biasing public perception (Shaw et al., 2022). Some species were also likely overrepresented due to significant media interest. For example, the koala and Kangaroo Island echidna likely saw an increase in representation after the 2019/2020 Australian bushfires where they received increased media attention. The focus of Bake Off entrants on mammals and birds contributes to the difficulty in raising awareness of traditionally less 'charismatic' species (Albert et al., 2018; Macdonald et al., 2015).

Species biases may not reflect public willingness to contribute to or apply pressure to prioritize high-profile species for conservation. When surveyed, Australians were more invested in the conservation of the northern hairy-nosed wombat (*Lasiorhinus krefftii*), despite koalas receiving more funding (Tisdell & Nantha, 2007). The perception of a species' endangered status is what drives the willingness to protect it, and with the wombat at more risk than the koala, respondents were more willing to fund it. This willingness has been observed in the conservation perception of other species (Bandara & Tisdell, 2005; Tkac, 1998), and the Bake Off could raise the profile of less charismatic, but more threatened species through advertising in the lead up to each competition. Whilst competitions like the Bake Off are unlikely to lead directly to the reversal of species decline in Australia, they highlight the urgent need to explore creative and novel ways to engage with diverse audiences.

The absence of common names may contribute to species biases and a lack of accompanying visuals. Of the species represented as bakes in the competition, all had a recognized common name. Whilst scientific species names are informative, they are often obscure and difficult to pronounce
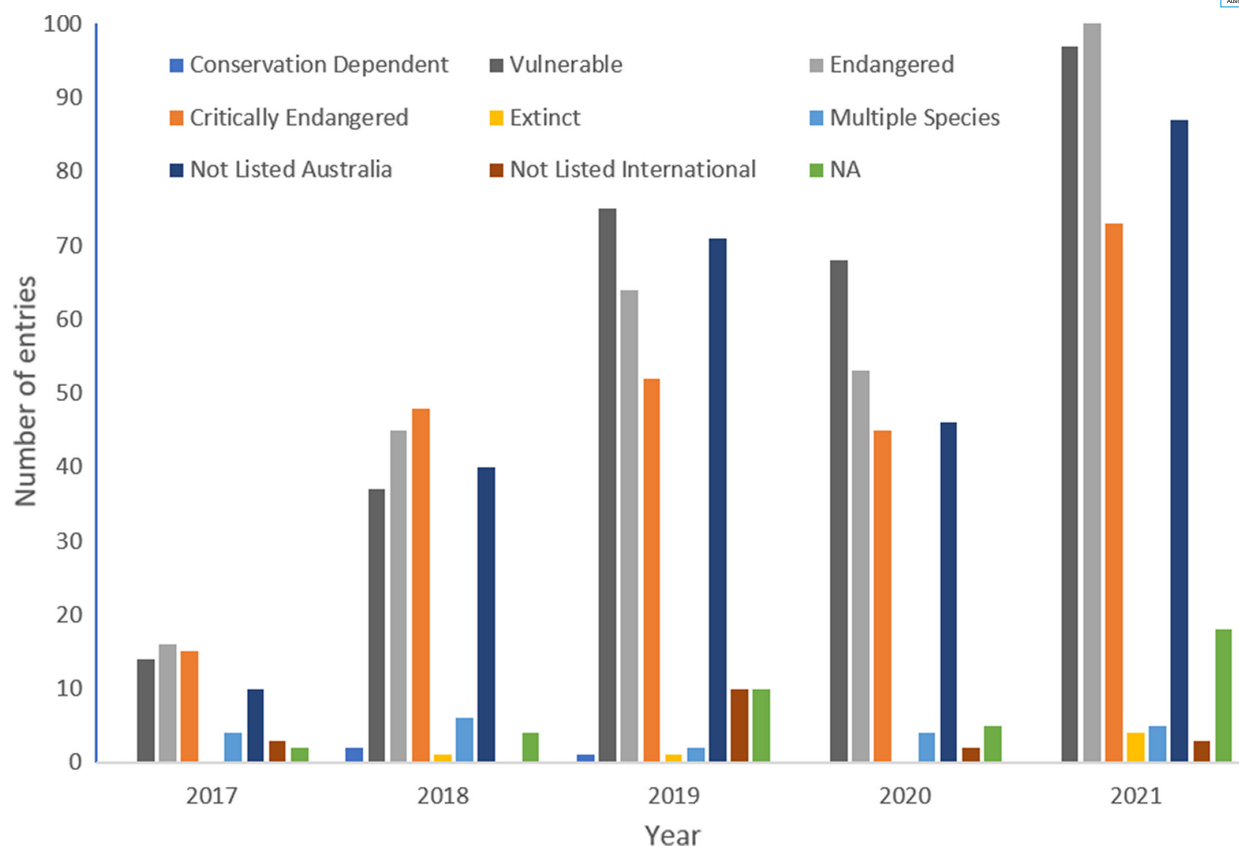
FIGURE 4 Number of entries per year for each conservation status; endangered and vulnerable listed species were overall the most baked status, followed by Australian species that are not currently listed. Conservation dependent species were poorly represented, which may highlight an opportunity to increase awareness and understanding of this status.

or remember for the nonspecialist. However, common names can be approachable; they are often descriptive, easier to remember and pronounce (Braby et al., 1997) and more engaging for the public (New, 2008). Similarly, many non-mammal and bird species have no photos associated with their listing, making recreation difficult.

Plants were underrepresented in the Bake Off. Compared to the number of plants listed (1399), only 42(3%) were baked. In Australia, plants have the highest number of listed threatened species. All other taxa had more threatened species represented in bakes, with between 27% (fishes) and 50% (other) of their listed species represented. 'Plant blindness', that is the human tendency to ignore plant species (Balding & Williams, 2016), may have played a role in plant underrepresentation, as well as inconsistencies in conservation messaging and the value placed on various species (Balding & Williams, 2016; Havens et al., 2014).

Whilst most species represented were listed as endangered, vulnerable, or critically endangered, the third most popular group of species baked were native Australian species that are unlisted. Participants, and the public in general, may not be receiving the correct message about which species need protection, and which are less threatened. This highlights a need for the DCCEEW to champion relevant threatened species prior to the competition. Species chosen that were not listed on the national TS List may have been baked because they attracted local community interest. For example, in 2020 the Wollongong City Council entered a pied oyster-catcher, *Haematopus longirostris* (Figure 5c), which is listed as endangered in New South Wales but is not listed nationally (Office of Environment and Heritage, 2021).

FIGURE 5   Example entries from the Threatened Species Bake Off; (a) Overall winner of the 2018 competition, a Growling Grass Frog (*Litoria raniformis*) by EnviroDNA; (b) Example of a Koala (*Phascolarctos cinereus*) cake reminiscent of the popular Women's Weekly magazine Koala cakes by Mittagong Preschool; (c) A locally threatened but not nationally listed Pied Oystercatcher (*Haematopus longirostris*) by Wollongong City Council; (d) Example of a threatening process, fossil fuel mining and the threat to the Boodie, or Burrowing Bettong (*Bettongia lesueur graii*) by Nathan Beerkens. Image sources – A Cesar Australia; B Mittagong Preschool; C Wollongong City Council; D Nathan Beerkens.

Some entrants chose to represent threatened ecological communities or key threatening processes. Examples included mining and deforestation; processes addressed in the TS List but not considered in the competition (Figure 5d). The use of bakes representing key threatening processes presents an opportunity to understand public concern about ecological issues and may provide an avenue for future targeted messaging strategies.

Lastly, the prevalence of unlisted species, and the bias in species baked, may reflect the nature of this competition; entrants may have selected animals that lend themselves to be being represented by cakes. It may simply be easier to prepare an appealing koala cake than it is to prepare an appealing critically endangered Glenelg freshwater mussel cake (*Hyridella glenelgensis*; Figure 5b).

Species bias is an important issue within the Threatened Species Bake Off, though there are multiple opportunities moving forward to reduce the bias in species chosen. Increasing the visibility of species by providing common names and photos of listed species is of high priority. Prior Bake Off competitions have incorporated themes, such as "Ecosystem Engineers" in 2021, which again saw many charismatic mammals and birds represented despite the opportunity for soil invertebrates or plants to have a greater focus. Future competitions should

consider themes that encourage lesser known species, including examples such as 'species I've never seen' or 'species I didn't know were threatened', and a more directed advertising campaign to highlight the underrepresented species. Moving away from a single species focus, rather incorporating habitats and threatening processes could be a beneficial approach, demonstrating the importance of an ecosystem as a whole for saving threatened species.

Conservation messaging and social media platforms

Social media offers a unique form of public engagement for conservation messaging. Determining your target audience and how they interact with social media platforms would inform and influence the best way to garner audience involvement. The use of Twitter, Instagram, and Facebook for the Bake Off is beneficial, as these platforms have been identified in conservation research as potential tools for conservation messaging and data collection (Sullivan et al., 2019, for example; Kidd et al., 2018, Kroetz et al., 2021). However, if the target audience is the general public, their engagement should be assessed to understand this competition's effectiveness as a conservation awareness tool.

Unsurprisingly, the competition has drawn several "protest" entries. Issues raised include the waste of funding on a competition that seemingly does not contribute to the protection of threatened species, or change legislation relating to threatening processes (e.g., climate change and land use). Whilst uncommon, these entries are increasing each year. This highlights a potential approach for the DCCEEW to increase conservation awareness and public engagement, which is to highlight key threatening processes, and allow entrants to represent what they understand are species at risk due to particular activities.

The Threatened Species Bake Off is a novel approach to community engagement with conservation messaging in Australia, providing insights into public interpretation of conservation. The competition has highlighted historic damaging trends of charismatic vertebrates dominating entries, limited representation from other taxa and most strikingly, the lack of representation of threatened plants. Further, our results show the public is interested and engaged in locally threatened species and threatening processes that place a multitude of species at risk. With an increase in entries on Instagram as opposed to Twitter, there is potential to direct messaging efforts to suit each platform. Despite the increasing popularity of the competition without clear measures of success from the DCCEEW, it is unknown if they are reaching their stated goal of increasing awareness of threatened species.

investigation (equal); methodology (equal); project administration (lead); writing – original draft (lead); writing – review and editing (equal).

CONFLICT OF INTEREST STATEMENT

There is no conflict of interest from the authors involved in this study.

DATA AVAILABILITY STATEMENT

Deidentified data will be kept and available on the Github repository of the authors EJM and CYF for public scrutiny. Identifiable data will be kept as per the University of Sydney ethics committee directions on secure university servers and unavailable for general viewing.

PERMISSIONS

Each image in Figure 5 has the explicit written permissions of the owner of the figures for reproduction in a scientific journal.

ORCID

Ryan J. Keith https://orcid.org/0000-0002-5603-3261
Eliza J. T. Middleton https://orcid.org/0000-0003-2500-3016

REFERENCES

Albert, C., Luque, G.M. & Courchamp, F. (2018) The twenty most charismatic species. *PLoS One*, 13, e0199149.

Balding, M. & Williams, K.J. (2016) Plant blindness and the implications for plant conservation. *Conservation Biology*, 30, 1192–1199.

Balmford, A. & Knowlton, N. (2017) Why earth optimism?: American Association for the Advancement of Science, Why Earth Optimism? .

Bandara, R. & Tisdell, C. (2005) Changing abundance of elephants and willingness to pay for their conservation. *Journal of Environmental Management*, 76, 47–59.

Barnosky, A., Matzke, N., Tomiya, S., Wogan, G., Swartz, B., Quental, T. et al. (2011) Has the Earth's sixth mass extinction already arrived? *Nature [Online]*, 471(7336), 51–57.

Bergman, J.N., Buxton, R.T., Lin, H.-Y., Lenda, M., Attinello, K., Hajdasz, A.C. et al. (2022) Evaluating the benefits and risks of social media for wildlife conservation. *Facets*, 7, 360–397.

Bonnet, X., Shine, R. & Lourdais, O. (2002) Taxonomic chauvinism. *Trends in Ecology & Evolution*, 17, 1–3.

Braby, M.F., Atkins, A.F., Dunn, K.L., Woodger, T.A. & Quick, W.N.B. (1997) A provisional list of common names for Australian butterflies. *Australian Journal of Entomology*, 36, 197–212.

Ceballos, G., Ehrlich, P.R., Barnosky, A.D., García, A., Pringle, R.M. & Palmer, T.M. (2015) Accelerated modern human−induced species losses: Entering the sixth mass extinction. *Science Advances*, 1, e1400253.

Cherney, M. (2021) The next lockdown baking challenge: wombat-shaped cakes, bagel frogs; Sourdough and banana bread are so 2020; Australians move on to wildlife patisserie. *The Wall Street Journal*, Eastern edition. https://www.wsj.com/articles/the-next-lockdown-baking-challenge-wombat-shaped-cakes-11630600258: Dow Jones & Company, Inc

Colléony, A., Clayton, S., Couvet, D., Saint Jalme, M. & Prévot, A.-C. (2017) Human preferences for species conservation: Animal charisma trumps endangered status. *Biological Conservation*, 206, 263–269.

Cresswell, I., Janke, T. & Johnston, E.L. (2021) Australia state of the environment 2021 [Online]. https://soe.dcceew.gov.au: Australian Government. [Accessed 12/08/2022 2022]

Czech, B., Krausman, P.R. & Borkhataria, R. (1998) Social construction, political power, and the allocation of benefits to endangered species. *Conservation Biology*, 12, 1103–1112.

Department of Climate Change, E., The Environment and Water. (2021a) EPBC Act List of Threatened Fauna [Online]. https://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl: Australian Government. [Accessed 13/10/2022 2022].

Department of Climate Change, E., The Environment and Water. (2021b) *EPBC Act List of Threatened Fauna* [Online]. https://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=fauna: Australian Government. Available: https://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=fauna [Accessed 3/3/2022 2022]

Department of Climate Change, E., The Environment and Water. (2021c) *EPBC Act List of Threatened Flora* [Online]. https://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora: Australian Government. Available: https://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora [Accessed 3/3/2022 2022]

Department of Climate Change, E., The Environment and Water. (2021d) *Threatened Species Bake Off* [Online]. https://www.awe.gov.au/environment/biodiversity/threatened/commissioner/tsbakeoff: Australian Government. Available: https://www.awe.gov.au/environment/biodiversity/threatened/commissioner/tsbakeoff [Accessed 3/3/2022 2022]

Department of Climate Change, E., The Environment and Water. (2022) *Australia's ecoregions* [Online]. https://www.dcceew.gov.au/environment/land/nrs/science/ibra/australias-ecoregions: Australian Government. Available: https://www.dcceew.gov.au/environment/land/nrs/science/ibra/australias-ecoregions [Accessed 9/8/2022 2022]

Dirzo, R., Ceballos, G. & Ehrlich, P.R. (2022) Circling the drain: the extinction crisis and the future of humanity. *Philosophical Transactions of the Royal Society B*, 377, 20210378.

Drijfhout, M., Kendal, D. & Green, P. (2022) Mind the gap: Comparing expert and public opinions on managing overabundant koalas. *Journal of Environmental Management*, 308, 114621.

EPBC Act. (1999) *The Environmental Protection and Biodiversity Conservation Act (1999)*. Canberra: Commonwealth Government of Australia.

Fančovičová, J., Prokop, P., Repáková, R. & Medina-Jerez, W. (2021) Factors influencing the sponsoring of animals in Slovak zoos. *Animals*, 12, 21.

Fink, C., Hausmann, A. & Di Minin, E. (2020) Online sentiment towards iconic species. *Biological Conservation*, 241, 108289.

Garnett, S. & Lindenmayer, D. (2011) Conservation science must engender hope to succeed. *Trends in Ecology & Evolution*, 26, 59–60.

Havens, K., Kramer, A.T. & Guerrant Jr, E.O. (2014) Getting plant conservation right (or not): The case of the United States. *International Journal of Plant Sciences*, 175, 3–10.

IPBES. (2019) Nature's dangerous decline 'unprecedented'; species extinction rates 'accelerating'. https://www.ipbes.net/news/Media-Release-Global-Assessment: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IUCN. (2021) *The IUCN Red List of Threatened Species* [Online]. https://www.iucnredlist.org/assessment/red-list-index. Available: https://www.iucnredlist.org/assessment/red-list-index [Accessed 03/07/2022 2022]

Kidd, L.R., Bekessy, S.A. & Garrard, G.E. (2019) Neither Hope nor fear: Empirical evidence should drive biodiversity conservation strategies. *Trends in Ecology & Evolution*, 34, 278–282.

Kidd, L.R., Garrard, G.E., Bekessy, S.A., Mills, M., Camilleri, A.R., Fidler, F. et al. (2019) Messaging matters: A systematic review of the conservation messaging literature. *Biological Conservation*, 236, 92–99.

Kidd, L.R., Gregg, E.A., Bekessy, S.A., Robinson, J.A. & Garrard, G.E. (2018) Tweeting for their lives: Visibility of threatened species on twitter. *Journal for Nature Conservation*, 46, 106–109.

Kroetz, A.M., Brame, A.B., Bernanke, M., Mcdavitt, M.T. & Wiley, T.R. (2021) Tracking public interest and perceptions about smalltooth sawfish conservation in the USA using Instagram. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 31, 2901–2909.

Kusmanoff, A.M., Fidler, F., Gordon, A., Garrard, G.E. & Bekessy, S.A. (2020) Five lessons to guide more effective biodiversity conservation message framing. *Conservation Biology*, 34, 1131–1141.

Lewis, S.L. & Maslin, M.A. (2015) Defining the anthropocene. *Nature*, 519, 171–180.

Macdonald, E., Burnham, D., Hinks, A., Dickman, A., Malhi, Y. & Macdonald, D. (2015) Conservation inequality and the charismatic cat: Felis felicis. *Global Ecology and Conservation*, 3, 851–866.

Martín-López, B., Montes, C. & Benayas, J. (2007) The non-economic motives behind the willingness to pay for biodiversity conservation. *Biological Conservation*, 139, 67–82.

Martín-López, B., Montes, C., Ramírez, L. & Benayas, J. (2009) What drives policy decision-making related to species conservation? *Biological Conservation*, 142, 1370–1380.

Mcafee, D., Doubleday, Z.A., Geiger, N. & Connell, S.D. (2019) Everyone loves a success story: Optimism inspires conservation engagement. *Bioscience*, 69, 274–281.

New, T.R. (2008) What's in common names: Are they really valuable in insect conservation? *Journal of Insect Conservation*, 12, 447–449.

Office of Environment and Heritage. (2021) *Pied Oystercatcher - profile* [Online]. https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10386: NSW Government. Available: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10386 [Accessed 15/6/2022 2022]

Ojala, M. (2012) Hope and climate change: the importance of hope for environmental engagement among young people. *Environmental Education Research*, 18, 625–642.

Peter, P.C. & Honea, H. (2012) Targeting social messages with emotions of change: the call for optimism. *Journal of Public Policy & Marketing*, 31, 269–283.

Pimm, S.L., Jenkins, C.N., Abell, R., Brooks, T.M., Gittleman, J.L., Joppa, L.N. et al. (2014) The biodiversity of species and their rates of extinction, distribution, and protection. *Science*, 344, 1246752.

Rothman, A.J. & Updegraff, J.A. (2010) Specifying when and how gain- and loss-framed messages motivate healthy behavior: an integrated approach. In: Keren, G. (Ed.) *Perspectives on framing*. New York: Psychology Press, pp. 269–290.

Shaw, M.N., Borrie, W.T., Mcleod, E.M. & Miller, K.K. (2022) Wildlife photos on social media: a quantitative content analysis of conservation Organisations' Instagram images. *Animals*, 12, 1787.

Sullivan, M., Robinson, S. & Littnan, C. (2019) Social media as a data resource for #monkseal conservation. *PLoS One*, 14, e0222627.

Tisdell, C. & Nantha, H.S. (2007) Comparison of funding and demand for the conservation of the charismatic koala with those for the critically endangered wombat Lasiorhinus kreftii. In: Hawksworth, D.L. & Bull, A.T. (Eds.) *Vertebrate conservation and biodiversity*. Netherlands: Springer, pp. 435–455.

Tkac, J. (1998) Award-winning undergraduate paper: the effects of information on willingness-to-pay values of endangered species. *American Journal of Agricultural Economics*, 80, 1214–1220.

Vins, M., Aldecoa, M. & Hines, H.N. (2022) Sharing wildlife conservation through 4 billion views on YouTube. *Global Ecology and Conservation*, 33, e01970.

Waldron, A., Miller, D.C., Redding, D., Mooers, A., Kuhn, T.S., Nibbelink, N. et al. (2017) Reductions in global biodiversity loss predicted from conservation spending. *Nature*, 551, 364–367.

Walsh, J.C., Watson, J.E.M., Bottrill, M.C., Joseph, L.N. & Possingham, H.P. (2013) Trends and biases in the listing and recovery planning for threatened species: an Australian case study. *Oryx*, 47, 134–143.

Ward, M.S., Simmonds, J.S., Reside, A.E., Watson, J.E., Rhodes, J.R., Possingham, H.P. et al. (2019) Lots of loss with little scrutiny: the attrition of habitat critical for threatened species in Australia. *Conservation Science and Practice*, 1, e117.

Wilson, J.R., Procheṣ, Ṣ., Braschler, B., Dixon, E.S. & Richardson, D.M. (2007) The (bio)diversity of science reflects the interests of society. *Frontiers in Ecology and the Environment*, 5, 409–414.