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RESEARCH ARTICLE

From cash to conservation: Which wildlife species appear on banknotes?

Beaudee Newbery[1] | Clare Morrison[2] | J. Guy Castley[2]

[1]Australian Rivers Institute and School of Environment and Science, Griffith University, Gold Coast, Queensland, Australia

[2]School of Environment and Science, Griffith University, Gold Coast, Queensland, Australia

Correspondence
Beaudee Newbery
Email: beaudee.newbery1@gmail.com

Funding information
School of Environment and Science, Griffith University

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Abstract

1. The use of wildlife imagery in society is highly varied and could contribute to reinforcing national identity. Standard depictions of wildlife include photographs, video, artwork and symbols or icons, including on currency.
2. We investigated the representation of native fauna on 4541 banknotes from 207 countries between 1980 and 2017, to identify geographic hotspots and taxonomic patterns and determine whether threatened and endemic species were more readily represented.
3. Native fauna was depicted on 15.2% of banknotes reviewed (352 unique species) with a strong bias towards terrestrial species (89%) and a dominance of bird and mammal species (83% combined). African banknotes had the highest mammal representation while birds were favoured in South America. Globally, threatened species were commonly depicted on banknotes with 30% of all imagery representing these species.
4. The fauna species depicted on banknotes generally perpetuate existing perceptions about these species (i.e., charismatic species). We recommend several avenues for further investigation to explore relationships between perceived value and wildlife representation. These include longitudinal studies of how representation changes over time, the inclusion of flora and/or coin imagery, identifying species-specific traits for selected wildlife and examining the decision-making processes governing wildlife imagery on banknotes.

KEYWORDS
banknote imagery, conservation, currency, Fauna, iconography, national identity

1 | INTRODUCTION

Since the rise of the 'Anthropocene', global biodiversity has declined dramatically due to pervasive pressures facing species and their natural environments (Finn et al., 2023; IPBES, 2019; Zalasiewicz et al., 2011). Among the myriad threats to biodiversity, including pollution, invasive alien species, agricultural activities and climate change, direct exploitation and habitat modifications stand out as key drivers of biodiversity loss and species extinction (Jaureguiberry et al., 2022), reinforcing discussions that the earth is experiencing a sixth 'mass extinction' (Ceballos & Ehrlich, 2023). Recent data from the IUCN (2023) indicates that 28% of all assessed species, some 42,100 extant species, are threatened with extinction. Among these, 27% of mammals, 13% of birds, 21% of reptiles and 41% of amphibians are at risk (Cox et al., 2022). Protected areas and broader wildlife conservation efforts serve as an effective

mechanisms to minimise extinction risk (Acreman et al., 2020). However, ongoing public support for such conservation efforts is often determined by the perceived need for action, as well as the value placed on these species by society (Barua et al., 2011; Pullin et al., 2013; Vannelli et al., 2019).

There are multiple values of nature that are highly context-dependent, and individuals, groups and sectors within society can place different values on the same component of nature, both within and between these stakeholders (Chan et al., 2018; Gomez et al., 2022). Pascual et al. (2017) highlight the importance of relational values of nature and nature's contributions to people and how these improve the quality of life. Examples of these values include the cultural identity that connects people with nature, the reciprocal nature of sense of place and identity (Locke, 2023), as well as the symbolic meaning of nature. In the context of wildlife values, some stakeholders (e.g., Indigenous communities, hunters and pharmaceutical companies) may place emphasis on the direct consumptive use value (e.g., food, recreation and medicine), while others (e.g., ecotourism operators and local communities) may place emphasis on the nonconsumptive use values (e.g., recreation). Wildlife also holds significant cultural and spiritual values where many communities associate wildlife with their beliefs and often carry out traditional practices (e.g., totemic protection) through select species (Alves et al., 2012; de Vasconcellos Pegas et al., 2015).

Public perception, examined most frequently in the Western world, has highlighted the aesthetic appeal and value of charismatic species (e.g., valuing traits such as rarity, endangered status, beauty, impressiveness or danger; Albert et al., 2018). The use of flagship species, charismatic species capable of eliciting positive attitudes and outlooks as discussed by Wang et al. (2023), can be an effective way to raise awareness and support for conservation (McGowan et al., 2020). Some researchers, however, point out that there is no correlation between a species' risk of extinction or ecological value and its marketing potential (Veríssimo et al., 2011), that flagships are often foci of human–wildlife conflict (Douglas & Veríssimo, 2013) or that flagship species choice could be optimised to better reflect biodiversity values and conservation requirements (Wosnick et al., 2021). For example, among the 27 Brazilian states, birds are the primary representatives of flagship species (29 species; e.g., Blue-and-yellow macaw—*Ara ararauna*), followed by mammals (five species; e.g., Amazon River dolphin—*Inia geoffrensis*), while other terrestrial faunal groups were not represented at all, that is, reptiles and amphibians (Wosnick et al., 2021).

Flagship species as symbols or icons can also serve to build identity for individuals, communities, social groups as well as entire nations (Clark et al., 2021; Hammerschlag & Gallagher, 2017; Rüdisser et al., 2019). However, Tshikombeni et al. (2023) highlight that the potential support for conservation flagships may be limited where there is little knowledge of national biodiversity symbols. This lack of awareness of national symbols is of concern, particularly where these species might be threatened and Hammerschlag and Gallagher (2017) have previously highlighted that 35% of global national animal symbols are threatened, with 45% experiencing population declines despite their emblematic status.

There is prolific use of wildlife as symbols in society where they reflect social, cultural, religious, economic, political or intrinsic associations with people, as well as societal values and norms (Root-Bernstein et al., 2013). For example, wildlife imagery and symbols are used for branding of goods and services (Good et al., 2017), as cultural totems, national emblems and heraldry (Bortolamiol et al., 2018; Raven et al., 2021), as well as on currencies (i.e., coins and banknotes; Lawson, 2019). Analysing this imagery has received attention in the fields of wildlife tourism destination marketing (Castley et al., 2013), human–wildlife interactions and the rise of social media (Mangachena et al., 2023; Shaw et al., 2022), securing conservation funds (Braczkowski et al., 2021; Courchamp et al., 2018; Good et al., 2017), analysing conservation attitudes and sentiment (Kim et al., 2022) and also currency iconography (Hymans, 2004; Penrose & Cumming, 2011).

Images of wildlife often serve to promote wildlife tourism or raise awareness about conservation issues (Castley et al., 2013; Shaw et al., 2022). In contrast, the images on currency (e.g., banknotes and coins) reflect a choice that mirrors the values of a country's citizens, including their political leaders, religion or achievements in arts and science (Lawson, 2019; Morgan, 2022). As money can be referred to as the most universal form of public imagery (Efrati, 2018), currency iconography, that is, the study of the images on banknotes and coins, could offer a means to explore the meaning behind the use of specific images that could promote public consciousness or national values (Champagne, 2014; Hymans, 2004). It has been common practice to use currency iconography for assessing nationalism (First & Sheffi, 2015; Penrose & Cumming, 2011; Sheffi & First, 2019), national identity and nation branding (Hymans, 2010; Hymans & Fu, 2017; Sørensen, 2016; Unwin & Hewitt, 2001) and more recently to measure institutional quality (Lawson, 2019; Penrose & Cumming, 2011). These studies considered how political figures, notable people, industry and entrepreneurship, as well as scientific and education endeavour builds a scalable identity for individuals, social groups and the nation, but also global recognition (Lawson, 2022; Sørensen, 2016). However, there is limited evidence in the current literature to suggest its use in assessing how wildlife is represented. Previous studies have considered the representation of landscapes and plants at a single-country scale (Sheffi & First, 2019) or included plants, animals and scenic landscapes in generic 'other' categories (Lawson, 2019). Furthermore, the correct identification of species depicted in iconography is important as this affects how these symbols are used and may influence the perceptions of nature (Binnberg et al., 2015). A more detailed assessment of the use of wildlife on banknotes is therefore timely, as Hymans and Fu (2017) suggest that the use of imagery that shifts away from traditional state-based depictions of icons may represent an evolution of national values.

Our study aimed to analyse wildlife imagery depictions displayed on banknote currency at the global scale as a measure of wildlife contributions to national identity, with a focus on native fauna. Given the scale of the study, it was beyond the scope to explore societal knowledge and awareness of wildlife depicted on banknotes. However, by completing a comprehensive analysis of wildlife currency iconography we can discuss patterns associated with over- or

under-representation of species depicted on currency. Therefore, this study sought to answer the following questions:

1. How well-represented are native fauna on global banknote currency?
2. What are the taxonomic patterns in native fauna representation on currency?
3. What are the geographic patterns in native fauna representation on currency?
4. Do endemic and/or threatened native species receive relatively more representation on banknotes than other species? Here we predict that there will be greater representation of such species on banknotes given the global attention given to threatened species.

2 | METHODOLOGY

2.1 | Data collection—Banknote selection

The *Standard Catalogue of World Paper Money, Modern Issues, Edition 25* (Augustsson et al., 2019) provides the most recent published record of all banknote currencies (circulated and discontinued) across all nations between 1961 and 2017. The catalogue includes relevant information regarding banknote issues, including monochrome imagery, denominations and expanded text descriptions of issue categories (provisional, commemorative, collector series and no date issues). Text descriptions may include details of iconography used, but for wildlife these are typically brief and refer only to common names. For example, for the Guatemalan quetzal/Quetzales note series, the Resplendent quetzal (*Pharomachrus moccinno*) is only referred to as the 'quetzal bird'. We adopted the national banknote iconography approach used by Lawson (2019) to access and determine the overall native fauna representation depicted on currency.

We systematically examined the banknote records published within the catalogue and assessed visible faunal depictions in banknote imagery. While many banknotes use a combination of watermarks and imagery only visible under ultraviolet light, we did not include these in our analysis. We examined currency from all countries and specific geographic domains recorded in the catalogue from 1980 to 2017. These dates follow the increased emergence of international environmental agreements and conventions, such as the Convention of Biological Diversity (1992), which may have influenced wildlife representation in currency iconography.

We used a PRISMA style approach (Moher et al., 2015) to systematically extract the relevant banknotes depicting native fauna in three filtering stages (see Figure 1). Banknotes could have wildlife depictions on either face of the note (i.e., front/back), and there could also be multiple depictions of wildlife on a single banknote. Stage 1 manually recorded the number of banknote releases ($n = 4541$) during the relevant time period and we subsequently excluded those

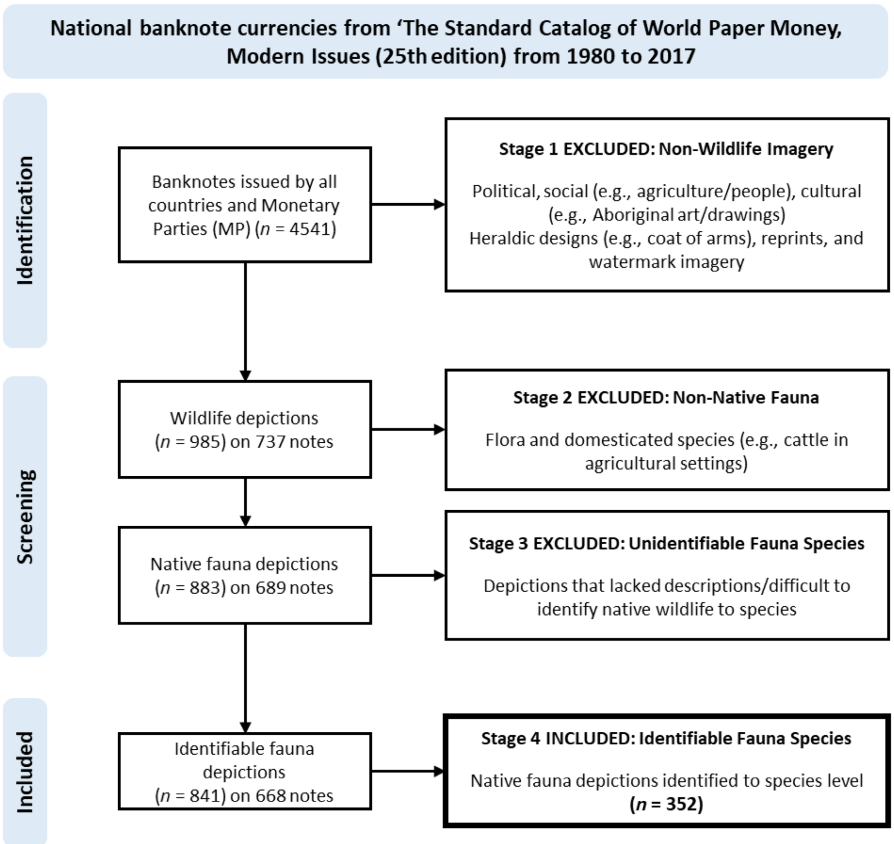

FIGURE 1 Preferred Reporting Items for Systematic Review Recommendations (PRISMA) flow chart summarises this study's framework (Moher et al., 2015). MPs = Monetary Parties where several countries have a shared currency, for example, East Caribbean States.

with non-wildlife imagery (e.g., political representation, persons and socio-cultural imagery) as well as any with other stylised or generic animal representations used in watermarks, symbols and coats of arms and Aboriginal drawings, etc. For this study, physical design features, such as the variation in colour, size and the introduction or removal of authority signatures, were deemed an insufficient design change to warrant inclusion as a new issue.

In Stage 2, we excluded non-fauna species, non-native and/or domesticated fauna, specifically flora depictions and animals with a domesticated nature, for example, cattle in an agricultural setting. However, when a banknote featured imagery of an animal considered domesticated in some countries, for example, camels, yet the species occurred naturally within a country's boundaries in wild populations, we included the species in the data set for those countries (see Appendix S1). We determined a species' native status using online databases (such as the IUCN Red List of Threatened Species), as this information was not available in the catalogue or on the banknote itself (see Appendix S1). We expanded the definition of 'cattle' to include all domesticated species (e.g., sheep and horses), rather than exclusively using *Bos taurus*.

In Stage 3, we removed all records containing unidentifiable species, for example, generic doves or pigeons or deer that could not be identified to species. We used personal knowledge of species (GC, CM, BN) as well as online resources to identify fauna to the species level where descriptive texts and banknote images did not have sufficient information. Depictions that remained unclassified were labelled 'unknown'. For all banknotes deemed relevant to the study (containing 841 depictions of 352 species), we recorded information such as date descriptions, name of the issue, denomination, currency value and details pertaining to any wildlife displayed (i.e., count of depictions, banknote side, taxonomic classifications, binomial and common name) for subsequent analysis (see Figure 2 for example of banknotes with native fauna depicted and Table 1 for data summary).

The catalogue includes specific monetary parties (herein MPs) that are not classified as countries but rather a collection of countries that share economic or political bonds (e.g., 'European Union' and 'West African States'). These parties, country associations and currencies are presented in Appendix S2. In cases where the MPs shared the same currency for the duration of the study period (1980–2017), we did not allocate the fauna depiction data to each country in the group but analysed them as a collective. In the case of the European Union when the Euro only came into effect as physical currency in 2002, we analysed any data post-2002 as a collective and any data prior to 2002 were allocated to the individual countries. Where a nation experienced a change in name (acquired independence or by a referendum), we updated the details regarding the current name (see Appendix S3) and combined the fauna depiction data from before and after the country name change to ensure that the country was represented accurately. We did not include any country banknotes released outside the study's parameters (prior to 1980 or post 2017).

2.2 | Data collection—Native fauna species information

We collected data for each of the 352 native fauna species identified on the banknotes for subsequent analysis. In addition to the

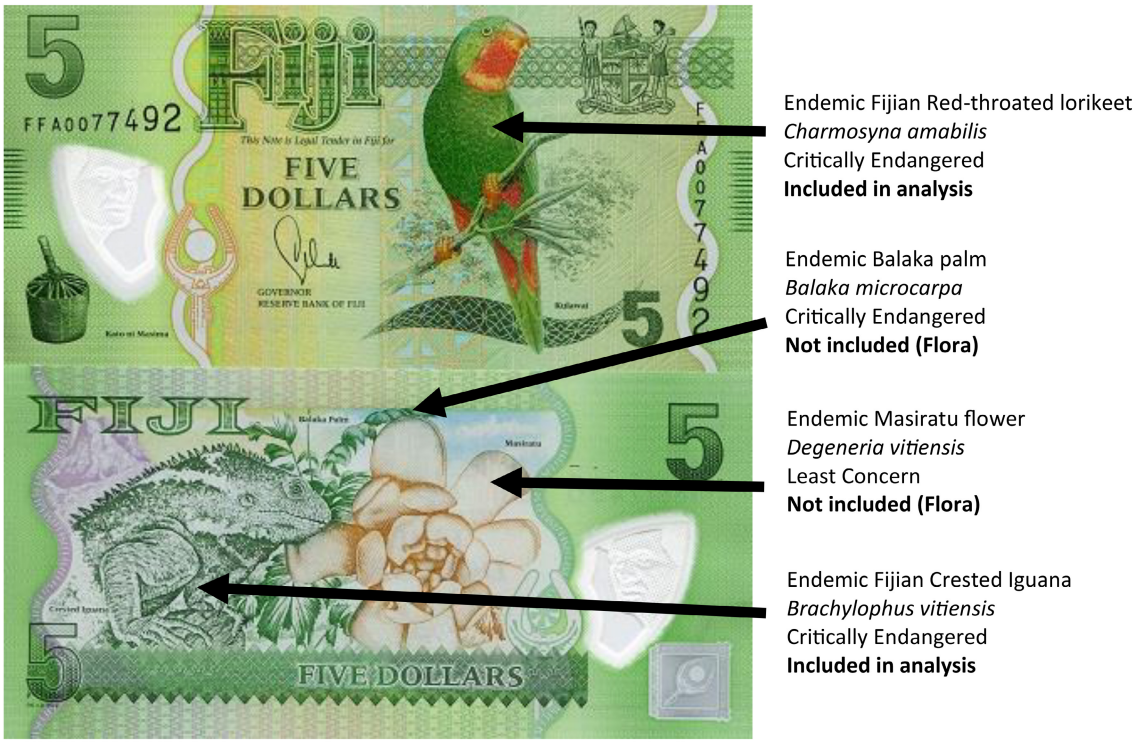

FIGURE 2 Exemplar Fijian five-dollar banknote with native fauna and flora depicted on both sides of the banknote. Banknotes were included based on the depictions of native fauna only.

TABLE 1 Summary of data collected on native fauna species depicted on banknotes. All banknote data were collected from the *Standard Catalog of World Paper Money, Modern Issues*, Edition 25 (Augustsson et al., 2019).

Banknote data	Native fauna data
Country	Species name—common and scientific
Year of issue	Major taxonomic group, that is, mammal, bird and reptile
Denomination	Major habitat, that is, terrestrial or aquatic
Number of fauna images	Geographic range (i.e., number of countries and global regions, e.g., Africa, Europe and South America)[a]
	Global threat status, for example, Critically Endangered, Endangered and Vulnerable[a]

[a]Collected from the IUCN Red List of Threatened Species (www.redlist.org).

information about the banknotes themselves, these data included assessment of the taxonomic group, geographic distribution, habitat preference and threat status (Table 1).

We classified species into one of seven broad taxonomic groups: mammals, birds, reptiles, amphibians, fish, terrestrial invertebrates and marine invertebrates. Species were also classified as either aquatic or terrestrial based on their primary habitat requirements. For instance, the marine iguana (*Amblyrhynchus cristatus*) is commonly considered a marine reptile; however, since it spends most of its life on land, we categorised it as a terrestrial species. We determined the geographic distribution and threat status of a species using the IUCN Red List of Threatened Species as a primary reference, supplemented by additional online web sources. Global threat status was chosen over local threat status for its broader perspective on conservation needs.

We arranged the data by country (or MP country groups where relevant, e.g., East Caribbean States) to investigate a series of geographical and taxonomic patterns and trends in the native fauna species depicted. Exploratory analyses summarised the total number of banknotes by country/MP group along with the total depictions of fauna to create a relative fauna representation ranking. We calculated species abundance to allow for an evaluation among habitat type (terrestrial and aquatic) and taxonomic groups. We created distribution maps by collating information associated with key taxonomic groups (birds and mammals) and overall wildlife depictions by visually representing the global geographic and taxonomic patterns. We quantified the popularity of species depicted using a simple index that averaged the product of the number of depictions (i.e., total banknotes) and country/MP representation (i.e., spread of depictions).

2.3 | Data analysis

We assessed the country rankings of the faunal depictions on banknotes using a simple index that summed the total number of wildlife species depicted on all notes, divided by the number of unique banknotes circulated and then expressed as a percentage. We used simple generalised linear regression models based on the Poisson distribution to determine whether the diversity of wildlife among taxonomic groups in each country (independent variable—species richness) affected the representation of wildlife iconography on banknotes (dependent variable—richness from banknotes). That is, were certain taxonomic groups more readily depicted on banknotes if there were more species recorded from those countries? All analyses were completed in R (ver 4.4.0) and Excel.

3 | RESULTS

Using the systematic approach, we examined the currency imagery of 4541 banknotes from 207 countries (162 individual countries and six MPs comprising an additional 45 countries). We recorded a total of 883 native fauna depictions on 689 banknotes from 92 individual countries and five of the six MPs (comprising 25 countries and excluding the European Union MP with no native fauna depictions). However, successful identification at the binomial level was only possible for 841 depictions (95.1% of all native fauna depictions) resulting in 352 species being identified (see Appendix S4 for full list of species). There were 42 wildlife depictions of a potential 35 species that could not be identified. Of this imagery there were 13 depictions of birds, 10 of molluscs, eight of mammals, six of fish, four of invertebrates and one reptile.

3.1 | Broad taxonomic patterns

Of the broad taxonomic groups for species that could be identified on banknotes, birds ($n=195$ species) and mammals ($n=96$ species) display the greatest species richness while fish ($n=25$), reptile ($n=15$), aquatic invertebrate ($n=6$), terrestrial invertebrate ($n=9$) and amphibian ($n=6$) species richness are lower. Bird species, overall, are represented on banknotes from the greatest number of countries (61 individual countries and four MPs), however, individual mammal species are more frequently found on banknotes from multiple countries. Terrestrial species display a much greater representation comprising 89.7% (315 species) of the identified species, while aquatic species represent only 10.6% (37 species; Table 2). While trends were positive, there was no significant relationship between global mammal or bird species richness and the number of mammals ($F=1.786$, $R^2=0.026$, $p>0.05$) and birds ($F=0.285$, $R^2=0.004$, $p>0.05$) depicted on banknotes suggesting that the number of mammal and bird species depicted on banknotes is not primarily determined by the species richness of these groups. We found a greater rate of wildlife depictions following 1992 when the Convention on Biological Diversity (CBD) was adopted with almost double the number of wildlife depictions on banknotes post-1992.

TABLE 2 Summary of taxonomic representation on banknotes and country data rounded to the nearest integer value.

Taxon	Unique species	Number of countries (+ MPs)	Species in multiple countries[a]	Country range[b]
Bird	195	61 (4)	21	1–3
Mammal	96	52 (2)	31	1–12
Fish	25	19 (2)	4	1–3
Reptile	15	21 (2)	3	1–8
Amphibian	6	6	0	1
Aquatic invertebrate	6	6	0	1
Terrestrial invertebrate	9	8	0	1
Aquatic species	37	33 (2)	7	1–8
Terrestrial species	315	85 (5)	52	1–12

Note: MPs = Monetary parties where all countries share the same currency.

[a]MPs count as a single country as they share the same currency.

[b]Represents the range of the number of individual countries in which a single species is found on banknotes. MPs count as one country. Aquatic species includes both freshwater and marine species.

3.2 | Geographic patterns

As individual nations, the Seychelles, Belize, Zambia and the United Arab Emirates rank in the top five countries for the total number of faunal species depicted on banknotes, with multiple representations of species across all banknotes. The seven countries comprising the East Caribbean States collectively rank third overall (Table 3). Seventeen of the top ranked countries/MPs listed are island nations/MPs, with individual African nations having the second greatest representation (see Table 3).

Countries that represent native fauna on banknotes are widely distributed across Africa, Europe, Asia, Oceania and North and South America (see Figure 3a). However, patterns in the use of wildlife imagery globally can only be explored for bird and mammal species richness due to limited representation for other taxa. Banknotes from North and South America, as well as various African and Asian countries, exhibit relatively high bird and mammal species richness in comparison with other countries (see Figure 3b,c). Colombia has the greatest bird species richness representation with 16 species although these were all depicted on a single commemorative note issued in 1992, while Nepal and Zambia had the highest mammal species richness with 11 and 12 species, respectively. There is a considerable overlap in the representation of birds and mammals among countries with hotspots for both taxa as evident in central Africa and South America.

3.3 | Threat status and endemism patterns

The proportions of threatened fauna represented on banknotes appear to be higher for all vertebrate taxa, with the exception of amphibians, compared with global threatened levels for each taxonomic group (Table 4). Threatened mammals, amphibians, reptiles and terrestrial invertebrates are more common on banknotes (range 33%–67%) than threatened fish and birds (range 23%–28%) (Table 4). While the sample size is very small, 60% of depicted reptiles are species threatened by extinction such as the Vulnerable Aldabra giant tortoise, *Geochelone gigantea* (Figure 4), Endangered green sea turtle, *Chelonia mydas* and the Critically Endangered Fijian crested iguana, *Brachylophus vitiensis* (Table 4). Only 81 species found on banknotes are endemic to a particular country (Table 4). While there are more endemic birds ($n = 50$) and mammals ($n = 10$) on banknotes overall, amphibians and terrestrial invertebrates exhibit the highest endemism rates, at 83% and 56%, respectively, despite their low species representation overall (Table 4). Global endemism and banknote endemism are most similar for birds and amphibians (30% vs. 26% and 71% vs. 83%, respectively).

3.4 | Most popular species globally and regionally

Mammal species represented on banknotes are dominated by depictions of charismatic species (e.g., large herbivores and carnivores), with most of these from the African continent (Table 5). Overall, the 11 most frequently depicted mammals have the greatest country representation (range of 4–11 individual countries with five species also included on banknotes from two MPs), with these species featured a combined 128 times on banknotes. The African savanna elephant, *Loxodonta africana* and African buffalo, *Syncerus caffer*, have the greatest country range (11 countries and one MP, see Figure 5), while the leopard, *Panthera pardus*, has the greatest banknote representation (49 depictions). Of the 11 most frequently depicted mammal species, one is Endangered, four are Vulnerable, four are Near Threatened, one is Least Concern and one has not been evaluated (Table 5). All of the most frequently depicted mammal species, except the jaguar, *Panthera onca*, are native to the African continent and have extensive distributions.

Bird species represented on banknotes show a dominance of Latin American species including Caribbean Island countries (comprising the East Caribbean States). Unlike the top mammal species which are depicted on notes from multiple countries, bird species depictions are far less widespread (Table 5). Cumulatively, the top six bird species listed in Table 5 are featured 95 times on banknotes, about two-thirds that of the top six mammal species (145 depictions). While the saker falcon, *Falco cherrug*, has the greatest country range (three countries), the African fish eagle, *Haliaeetus vocifer* (33 depictions), resplendent

TABLE 3 The relative proportion of faunal depictions to banknote abundance ranked across the top 40 countries and/or Monetary Parties (MP) (in italics).

Rank	Country or MP	%	Rank	Country or MP	%
1	Seychelles*	221	18	Colombia	62
2	Belize	208	19	Cook Islands*	57
3	*East Caribbean States**	190	19	Fiji*	57
4	Zambia	176	20	Rwanda	56
5	United Arab Emirates	133	21	*Netherland Antilles**	55
6	São Tomé and Príncipe*	127	22	Somaliland	52
7	Botswana	120	23	Venezuela	51
7	Trinidad and Tobago*	120	24	Sri Lanka*	50
8	Falkland Islands*	114	24	South Africa	50
8	*French Pacific Territories**	114	24	Qatar	50
9	Namibia	100	24	Cyprus*	50
9	Guatemala	100	24	South Sudan	50
10	Congo, Democratic Republic	94	25	Mozambique	48
11	Nepal	93	26	Bermuda*	47
12	New Zealand*	91	27	Bahamas*	46
13	Tanzania	86	28	Uganda	45
14	Gambia	80	29	Ethiopia	43
15	Aruba*	71	30	Madagascar*	41
16	Suriname	67	30	Cayman Islands*	41
17	Costa Rica	64	30	Lithuania	41

Note: Island nations are represented by *. Percentage values >100% indicate that there were multiple faunal depictions on each unique banknote from these countries/MPs. *East Caribbean States* include Anguilla, Antigua and Barbuda, Grenada, Montserrat, Saint Lucia, Saint Kitts and Nevis and Saint Vincent and the Grenadines. *French Pacific Territories* include French Polynesia, New Caledonia and Wallace and Futuna. *Netherland Antilles* include Curacao and St Maarten. For complete list of countries with relative proportion of faunal depictions see Appendix S5.

quetzal, *Pharomachrus moccinno* (28 depictions) and red-billed toucan, *Ramphastos tucanus* (14 depictions) have the highest representation, although these depictions are primarily from only a single country. Unlike the top 10 mammal species where the majority are threatened species, only three bird species are threatened: the saker falcon from Kuwait, UAE and Qatar, the red-billed toucan from Suriname and the resplendent quetzal from Guatemala (Table 5).

The absolute number of reptiles and fish species found on banknotes in multiple countries is much lower than for mammals and birds. Prominent depictions of reptiles ($n = 34$) and fish ($n = 21$) are recorded from 16 countries and two MPs (East Caribbean States and French Pacific Territories) and seven countries and one MP (East Caribbean States), respectively (Table 5). The green sea turtle, *Chelonia mydas*, swordfish, *Xiphias gladius* and blue marlin, *Makaira nigricans*, are the most widely depicted of these taxa.

4 | DISCUSSION

4.1 | Geographic and taxonomic patterns

While our study found 841 records of identifiable native fauna depictions on global banknotes, only 57% (118) of countries displayed at least one depiction of native fauna on banknotes with 95% of these representations identified to a binomial classification. Species depicted on banknotes are typically native to the countries that used their imagery on national currency, although there was an example where a generic hummingbird was used on the English £10 note showcasing the explorations of Charles Darwin who is also depicted on the same side of this note. Binnberg et al. (2015) note that the correct identification of species depicted in iconography is important. Only 5% of wildlife depictions could not be identified to a species level and were typically those using generic imagery for the animals shown or were of lower order taxa (e.g., invertebrates). For example, mammals we could not identify included images of antelope, deer, seals and dolphins, while common representations of birds were doves. We could not identify these species as there are multiple morphologically similar species present in the countries where they are depicted, and no species-specific details could be found through exploration of other online sources. While generic images of doves are used for some countries, they lack any identifiable features. However, doves are frequently used to symbolise peace and love in religious circles (Gayley & 'tsho, 2016), but are also used to symbolise those in politics who adopt more peaceful and cooperative approaches in handling conflict or debate (Kesgin, 2020; Maoz, 2003). While the use of doves on banknote imagery may infer some of these views, other generic images of fur seals, deer and dolphins depicted on banknotes could have been any number

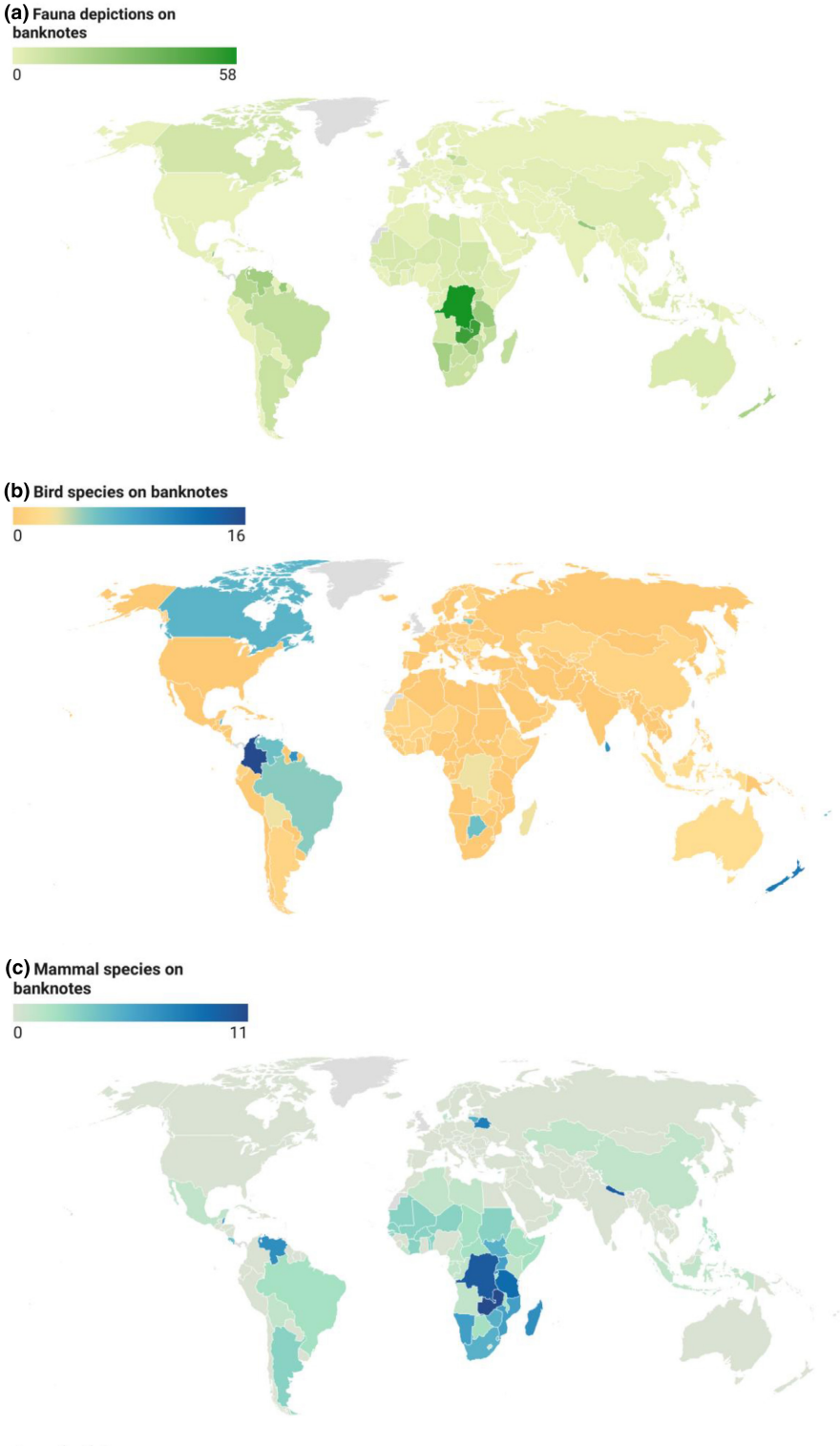

FIGURE 3 Visual representations of the geographic range of countries that depict native fauna on banknotes where (a) reports the total number of faunal depictions, (b) the species richness of birds and (c) the species richness of mammals. Note that Scotland (4 depictions) is not represented (mapping program combines these data into a single non-accurate value for the whole United Kingdom) nor is Somaliland (11 depictions, recognised internationally as de jure part of Somalia not an independent country); however, data from each country are included in the study (see Appendix S5).

of species, and in the case of deer could also be introduced (Burgin et al., 2015; Davis et al., 2016; Flueck & Smith-Flueck, 2012).

While most taxonomic groups (i.e., amphibians, reptiles, fish and invertebrates) lacked adequate representation of identifiable wildlife images to discern any geographical patterns, we discovered hotspots in South America for birds and Central Africa for mammals. These wildlife iconography hotspots align with broad biogeographic realms and tropical/subtropical biomes that have been identified as species richness hotspots by others (Ceballos & Ehrlich, 2006; Orme et al., 2005). It is generally acknowledged that latitudinal gradients influence the global distribution of species richness (Davies et al., 2007; Orme et al., 2005).

Our results uncover a strong bias towards terrestrial species (i.e., birds, mammals, amphibians and reptiles) representation on banknotes. Depictions of terrestrial species comprised 89% of records, which aligns with previous studies of wildlife imagery that

TABLE 4 Summary table of the total abundance of endemic, threatened and non-threatened species by broad taxonomic group depicted on banknotes.

	Banknote species			Global species		
Taxon	Endemic	Threatened (VU-EX)	Non-threatened (LC-NT)	Endemic	Threatened (VU-EX)	Non-threatened (LC-NT)
Bird	50 (26%)	46 (23%)	148 (76%)	3303 (30%)	1400 (13%)	9578 (85%)
Mammal	10 (10%)	43 (45%)	52 (54%)	2775 (47%)	1341 (22%)	3707 (62%)
Fish	2 (8%)	7 (28%)	14 (56%)	10,808 (43%)	2012 (8%)	16,716 (66%)
Reptile	7 (47%)	7 (47%)	7 (47%)	6526 (64%)	1842 (18%)	6857 (67%)
Amphibian	5 (83%)	2 (33%)	4 (67%)	5311 (71%)	2606 (35%)	3697 (49%)
Aquatic invertebrate	0 (0%)	1 (100%)	0 (0%)	N/A		
Terrestrial invertebrate	5 (56%)	3 (67%)	1 (33%)	N/A		
Aquatic species	2 (6%)	9 (25%)	17 (46%)	N/A		
Terrestrial species	77 (24%)	99 (31%)	216 (69%)	N/A		

Note: Threat status data drawn from the IUCN Red List for species in each taxonomic group. Endemism represents the number of endemic species in each taxonomic group depicted on all banknotes. Values in parentheses (%) represent the number of species in each category divided by the total number of species in each taxonomic group found on banknotes (e.g., 50 endemic bird species/195 bird species in total × 100 = 46%). The global numbers and proportions of endemic, threatened and non-threatened species for the broad taxonomic groups examined are provided for comparison. 35 species were listed as 'unknown', including conservation statuses of data deficient (DD) or not evaluated (NE) hence totals of % threatened and % non-threatened in each category may not have = 100%.

FIGURE 4 Seychelles 100 rupee banknote showcasing the Vulnerable Aldabra giant tortoise, *Geochelone gigantea*.

reported preferences for mammals and birds in protected area visitation studies (Bhatt & Pickering, 2022; Castley et al., 2013; Mangachena et al., 2022), but also those that looked at the depiction of flagship species on magazine covers (Clucas et al., 2008). While these findings are somewhat surprising considering the number of countries with coastlines and extensive marine and freshwater habitats, island nations still rank highly in the overall representation of wildlife on banknotes, with many marine species such as turtles and large fish being depicted. The apparent preference for depicting terrestrial species on banknotes may be partly due to the familiarity and greater likelihood of observing terrestrial species as wildlife visibility has been suggested as a driver in the use of imagery in online wildlife tourism promotions (Castley et al., 2013). However, the decision-making processes in deciding which wildlife images to use on banknotes may also be more conscious, especially for threatened species. For example, in 2012 Fiji launched a new series of banknotes, referred to as the 'flora and fauna' series, that depict endemic and/or endangered wildlife to promote Fiji's biodiversity. This conscious decision was made after strong lobbying and arguments presented by Fijian conservation agencies (RBF, 2020). The representation of the golden lion tamarin, *Leontopithecus rosalia*, on the Brazilian 20-real banknote in 2002 was in celebration of a grassroots conservation effort successfully bringing the species back from the brink of extinction in the 1960s (Dominy, 2020). Regardless of how species were chosen, these banknote depictions of wildlife may raise public awareness and perceptions of the value of these symbolic species. For example, symbolic plant and animal species are widely recognised within the European Alps (Rüdisser et al., 2019), but they are also used in various visual representations, particularly within the tourism industry (Schirpke et al., 2018).

TABLE 5 Most common species depicted on banknotes for major taxonomic groups. Species depicted are ranked based on a simple popularity index (countries × depictions/2).

Scientific name	Common name	Individual countries (MPs)	Total depictions	Rank	Threat status
Mammal					
Loxodonta africana	African savanna elephant	11 (1)	29	1	EN
Panthera pardus	Leopard	5	49	2	VU
Syncerus caffer	African buffalo	11 (1)	20	3	NT
Panthera leo	Lion	10	19	4	VU
Giraffa camelopardalis	Giraffe	9	15	5	VU
Equus quagga	Plains zebra	9	13	6	NT
Camelus dromedarius	Arabian camel	7 (1)	13	7	N/A
Ceratotherium simum	White rhinoceros	5	7	8	NT
Hippopotamus amphibius	Hippopotamus	4 (1)	6	9	VU
Tragelaphus strepsiceros	Greater kudu	4	7	10	LC
Panthera onca	Jaguar	4	6	11	NT
Bird					
Haliaeetus vocifer	African fish eagle	2	33	1	LC
Pharomachrus moccino	Resplendent quetzal	1	28	2	NT
Falco cherrug	Saker falcon	3	7	3	EN
Paroaria gularis	Red-capped cardinal	2	7	4=	LC
Ramphastos tucanus	Red-billed toucan	1	14	4=	VU
Phoenicopterus ruber	American flamingo	1 (1)	6	6	LC
Reptile					
Chelonia mydas	Green sea turtle	6 (2)	13	1	EN
Eretmochelys imbricata	Hawksbill sea turtle	7	12	2	CR
Iguana iguana	Common green iguana	1	5	3	LC
Lacerta agilis	Sand lizard	2	2	4	LC
Geochelone gigantea	Aldabra giant tortoise	1	2	5	VU
Fish					
Xiphias gladius	Swordfish	1 (1)	7	1=	NT
Makaira nigricans	Blue marlin	2	7	1=	VU
Rhincodon typus	Whale shark	3	3	3	EN
Hydrocynus vittatus	Tiger fish	1	4	4	VU

Note: Faunal depictions on banknotes from Monetary Parties (MPs) are only counted once for the group rather than for each country individually to minimise bias.

However, Raento et al. (2004) note that despite the widespread use of money (banknotes and coins), any imagery used may actually go unnoticed. Furthermore, Tshikombeni et al. (2023) recently highlight that unless citizens are familiar with these national symbols, it may undermine efforts to use these species as flagships for conservation efforts.

The representation of mammalian wildlife on banknotes favours charismatic mammal species, where 14 of the top-20 charismatic animals (see Albert et al., 2018), are depicted, driven by the prevalence of charismatic African wildlife. Furthermore, 12 of the 14 species recurrently featured on banknotes from multiple countries (e.g., African savanna elephant, whale shark, grey wolf and humpback whale). Although the term 'charismatic species' remains poorly defined (Albert et al., 2018), charisma is a species-specific premise that follows public perception and is also akin to the aesthetic value of species that can raise awareness among the public and influence conservation efforts (Home et al., 2009; Knight, 2008; Liordos et al., 2017). In keeping with previous studies (see Mangachena & Pickering, 2021), popular mammal species from the African hotspot observed on banknotes from multiple countries include depictions of African savanna elephant, hippopotamus, lion, leopard, giraffe, plains zebra and rhinoceros.

The appeal of wildlife species has been used to predict their conservation status (Brambilla et al., 2013), and large charismatic mammals attract public appeal influencing perceptions and values that people may assign to species (Skibins et al., 2013). For example, the 'Big Five' (lion, leopard, African savanna elephant, rhinoceros and African buffalo) continue to be promoted as tourism

FIGURE 5 Examples of the most widespread (i.e., largest number of countries) species depicted on banknotes, the African savanna elephant, *Loxodonta africana*.

drawcards for many African nations (Lindsey et al., 2007; Okello et al., 2008), yet their portrayal on banknote currencies suggests that there is a wider cultural value attached to these species. These cultural values can adjust attitudes and behaviours (Fulton et al., 1996) and could thereby build support for the species' conservation, with some proponents arguing that the use of wildlife symbols and icons should be monetised (Braczkowski et al., 2021; Good et al., 2017). While it was beyond the scope of this paper to explore the cultural value that might be linked to banknote imagery, Gliozzo et al. (2016) have shown that it is possible to assess the extent to which people appreciate 'cultural ecosystem services', such as places, by analysing social media imagery. However, while highly charismatic species may be attractive to tourists and the public more broadly (Willemen et al., 2015), banknotes also include depictions of other species, such as panther, wolf, gorilla, shark, crocodile, dolphin, bear and whale, that have strong connections (e.g., sense of place, cultural identity and aesthetic pleasure) with the public in various regions (Ainsworth et al., 2019; Albert et al., 2018). Nevertheless, the relatively few species depicted on banknotes may perpetuate the existing 'charismatic wildlife paradigm' noted by others (Kerley et al., 2003; Mangachena & Pickering, 2021; Okello et al., 2008) reducing any opportunity to

raise public awareness about a broader suite of species more generally. Furthermore, it is telling that many western nations that argue for species conservation do not portray these species on their currencies.

4.2 | Endemism and threat status patterns

The selection of endemic and threatened species for display on banknotes was anticipated due to their increased risk of extinction and was there is generally a stronger selection for threatened wildlife across all taxa (except amphibians) than expected based on global threat levels. The deliberate choice to depict threatened wildlife could serve as a means to foster a national identity focused on the conservation of these species and to increase public awareness about their vulnerable status. Proportionally speaking, endemic species representation is highest in groups that have few unique species on banknotes, that is, amphibians and terrestrial invertebrates. Globally, amphibian species richness correlates with endemic species richness (Das et al., 2006), in that most amphibian species are endemic species. Although the sample size for amphibians is small, the high representation of amphibian endemism shown on banknotes may be an artefact of the greater likelihood that any species chosen for a banknote would be endemic given global amphibian endemism. Endemism did not appear to be a key factor affecting species representation on banknotes for other taxa as endemism levels on banknotes is typically lower than global levels of endemism for these taxa. For mammals, this may be due to their use of a broader range of habitats (Das et al., 2006), indicating a low proportion of endemic species. Congruency between the total number of global bird species and the number of endemic birds is also typically low (Orme et al., 2005). This may be attributed to the greater ability of birds to travel long distances by flight, providing a similar explanation for the comparatively limited representation of global endemism on banknotes.

Contrastingly, our results suggest that the global biodiversity crisis (Ceballos & Ehrlich, 2023) and the conservation status of species globally is reflected in the relatively high representation of threatened wildlife on banknotes. In the case of birds, mammals, fish and reptiles, the proportion of threatened species depicted on banknotes is higher than global proportions of threatened species in each group while that of amphibians is roughly the same. By comparison, Clucas et al. (2008) found that wildlife (bird and mammal) imagery on magazine covers was targeted to threatened charismatic mammals, while birds featured were of little conservation concern.

4.3 | Wildlife iconography and identity

The depiction of imagery on currency (banknotes and coins) has been shown to build a national identity (Papadopoulos, 2015) as conscious choices are being made by countries as to what to depict on these economic tokens signifying the values and meaning assigned to this imagery (Lawson, 2019, 2022). Analyses of currency iconography in building a national identify typically focus on political and entrepreneurial investigation (First & Sheffi, 2015; Hymans & Fu, 2017), only recently considering the depiction of wildlife and plants (Sheffi & First, 2019). An example of the values placed on the use of wildlife imagery is highlighted by the South African Reserve Bank (SARB) who explicitly link the representation of the Big Five animals to the core Reserve Bank values of 'accountability', 'respect and trust', 'excellence', 'open communication' and 'integrity'. In linking these values, the SARB communicate that the rhino is an important symbol of protecting a shared future and accountability, that the African savanna elephant embodies stability and confidence and the building of social bonds to preserve respect and trust, that the lion is a symbol of leadership and guidance to achieve excellence; that the African buffalo exemplifies unity and cohesion through open communication and that the leopard reflects independence, integrity and honour (SARB 2023—www.resbank.co.za). This example illustrates how the ecological traits of the species depicted can be used to inform and give meaning to the values of a country and how these can be used to build a national identity. Countries that rely heavily on wildlife or nature-based tourism may depict species on banknotes that reinforce this value or identity at the national and global scale through connections with these destination (i.e., places; Folmer et al., 2013, Prideaux et al., 2018). This is expressed for example in Malawi where the 50 Kwacha note includes a depiction of a game-viewing vehicle near an elephant. While our paper explored the patterns of banknote wildlife iconography, we did not explore attitudes or sentiments towards such imagery by either residents or visitors to countries.

4.4 | Limitations

A fundamental step of this study was to identify the fauna species represented on banknotes to individual species. This process was hampered in some circumstances where there was a deficiency of available imagery, missing or inadequate text descriptions, and variable imagery colour choice that made identification of recognisable features difficult. While this meant that some fauna depictions were listed as 'unknown' at the species level, the majority (95%) of wildlife depictions were identified to species level. While it was possible to categorise unknown fauna into broad taxonomic groups, that is, mammal or bird, for broad-scale analysis, identifying fauna depictions to species level is important for examining more fine-scale patterns relating to endemism and threat status, but also for any further analysis of how countries and their citizens might value certain species. Limitations in available data on the IUCN Red List for some species may have affected the overall representation of threatened fauna. We also acknowledge that our analysis of the fauna iconography on banknotes presents only part of the picture as there are many wild flora species that are represented on banknotes as well as wildlife species that are depicted on coins globally (pers. obs.). It is also possible that countries have been able to retain some of their

national identity on coins where iconography on banknotes has been modified to reflect changes in monetary institutions. For example, when the Euro was launched in 2002, the imagery on banknotes reflected landmarks and architecture (e.g., bridges; Sassatelli, 2017), yet countries were able to retain their own imagery on coins (Raento et al., 2004).

5 | CONCLUSIONS AND FUTURE RESEARCH

Our analysis of wildlife iconography of banknotes globally has revealed widespread inclusion of species across all taxonomic groups from more than half of all countries examined. The prevalence of birds and mammals in the imagery align with previous work where the visual appeal and recognition of species may strengthen wildlife value orientations in individuals. We also show that threatened species are well-represented on banknotes. While this could raise awareness of the plight for many species, this depends on the knowledge and awareness of these species. Future studies could build on our work along several pathways. (1) increase the timespan and investigate different fiscal periods to examine the influence of international environmental legislative changes, including, but not limited to, the Convention of Biological Diversity (CBD) and the Nagoya Protocol, on fauna representation. (2) analyse the species-specific traits of fauna represented on banknotes to identify preferred traits and compare these with known 'charismatic' traits. (3) include native flora species in the analysis to provide a greater understanding of the perceived value and representation across all native wildlife. (4) develop a deeper understanding of the decision-making processes governing the representation of wildlife on banknotes, as there are only a few studies that delve into these selection criteria (Penrose, 2011; Sheffi & First, 2019), and how key decision makers may be guided by different international norms (Hymans & Fu, 2017). (5) assess resident and visitor awareness of, and sentiments towards, wildlife iconography on banknotes and whether this has fostered a sense of national identity. (6) undertake a complementary study of the wildlife iconography of coins to assess whether the species depicted on coins follow similar patterns to those observed for banknotes. There are already some studies that explore iconography of coins (including wildlife and nature representations) (Raento et al., 2004), but these have had a relatively narrow country or regional focus. Furthermore, while it is evident that wildlife imagery is used across various platforms (e.g., social media, press media, advertising and banknotes) and that these can raise awareness and foster an appreciation of the species, there is (7) a need to determine whether the depiction of threatened species without any supplementary conservation messaging can raise awareness of the myriad risk factors threatening species. Finally, it would be advantageous to assess the relative benefit gained for conservation through the depiction of wildlife on various platforms. For example, is the increasing use of social media a better avenue than banknotes given that many monetary transactions are switching to electronic banking and the public may not be handling paper money as frequently in the future.

AUTHOR CONTRIBUTIONS

Guy Castley conceived the idea. Beaudee Newbery, Clare Morrison and Guy Castley participated in conceptualisation and developed methodology for the research. Beaudee Newbery carried out data collection and curation. Beaudee Newbery, Clare Morrison and Guy Castley conducted the formal analysis. Beaudee Newbery wrote the first draft of the manuscript. Beaudee Newbery, Clare Morrison and Guy Castley contributed to visualisation, review and editing of the manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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DATA AVAILABILITY STATEMENT

Master Excel spreadsheet is accessible on the lead author's GitHub page: https://github.com/Beaudeenewbery/People-and-Nature-Wildlife-on-banknotes.

ORCID

Beaudee Newbery https://orcid.org/0009-0005-8607-1559
Clare Morrison https://orcid.org/0000-0002-3245-4280
J. Guy Castley https://orcid.org/0000-0002-8418-5828

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix S1: Summary list of the commonly found cattle and domesticated animals that were represented on banknotes but omitted from the analyses unless originally native to a country prior to domestication. Note that all *Bos taurus* are included.

Appendix S2: Countries comprising different monetary party groups.

Appendix S3: Summary table of countries that have been re-named, including previous and current name.

Appendix S4: Species depicted on global banknotes. '# D' is the number of depictions in total on banknotes, '# C' is the number of countries, including monetary parties, that depict the species on their banknotes.

Appendix S5: List of 181 individual countries and five MPs (comprising an additional 26 countries) with percent occurrence of native fauna species depicted on banknotes including frequency of depicted vertebrate taxa. Countries ordered from highest frequency of occurrence of fauna depictions on banknotes to lowest. (*) includes invertebrate species in total.

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