Many IUCN Red List Species have Names that Evoke Negative Emotions

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Abstract

Species common names underpin communication between researchers, stakeholders and the public. Changing unappealing (e.g., Rough-skinned Horned Toad), misleading (e.g., Lesser Bird of Paradise) or even immemorable (e.g., Little Grassbird) species names could be an effective, and inexpensive, way to improve engagement with and support for threatened species. We use two sentiment lexicons to analyze the common names of 26,794 IUCN Red List animal species to understand which words drive sentiment in species names. Words driving common name sentiment varied across taxonomic class and threat status; highly-frequent words associated with human emotions included anger, fear, disgust and joy. We identified key words for future targeted research on strategic name changes (e.g., greater, golden, least, lesser, false). This article provides essential grounding for future species common name research and improving public engagement with threatened species.

Keywords: interdisciplinary conservation science, public engagement, strategic communications, message framing, threatened species

Introduction

The words we use make a difference. Because of this, message design and framing theory are increasingly used to achieve public engagement objectives for threatened species conservation (Echeverri, Chan, & Zhao, 2017; Kusmanoff, 2017; Weinstein, Rogerson, Moreton, Balmford, & Bradbury, 2015). Fostering a public or stakeholder connection with individual species can be crucial for their conservation; for example, by using charismatic species as campaign flagships, or targeting species in particular need of local community support and protection (Novacek, 2008; Veríssimo et al., 2017; Woinarski, Garnett, Legge, & Lindenmayer, 2017). While previous research has identified traits of typical charismatic or flagship species (Smith, Veríssimo, Isaac, & Jones, 2012), few studies have investigated how common names may influence public enthusiasm for a species (Braithwaite, Morton, Burbidge, & Calaby, 1995; Ehmke, Fitzsimons, & Garnett, 2017; Karaffa, Draheim, & Parsons, 2012; Scott, 2015). None have specifically investigated the sentiment of a large database of species common names, such as the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (https://www.iucnredlist.org/), the most comprehensive global list of animal and plant species and their conservation status (i.e. risk of extinction).

Sentiment analysis is the analysis of text with the intention of measuring some aspect of opinion or feeling (i.e., sentiment), including polarity (i.e., positive, negative or neutral), intensity (e.g., continuous measure of positivity or negativity), or specific emotions (e.g., anger, sadness, joy) expressed in the text (Liu, 2012). Sentiment analyses have become increasingly popular as data becomes more available and accessible. In particular, social media data can be analysed to establish current attitudes towards particular products, corporations or social issues (Mäntylä, Graziotin, & Kuutila, 2018). Conservation science stands to benefit from the use of sentiment analyses, particularly for exploring the level of public engagement and public attitudes towards particular conservation issues or threatened species (Drijfhout, Kendal, Vohl, & Green, 2016; Toivonen et al., 2019). Freely-available lexicons are constantly improving in terms of size and sentiment scoring accuracy, and they can be rich datasets for analyzing the sentiment or emotional association of specific words, providing insight into the perceptions and emotions evoked by them.

We performed a sentiment analysis on the English common names of 26,794 animal species on the IUCN Red List of Threatened Species – a key resource for conservation scientists and decision-makers – to explore how species names might be connected to sentiment polarity (i.e., positive vs negative) and human emotions such as joy, fear, disgust and sadness.

Methods

We used data exported from the IUCN Red List (IUCN, 2017), incorporating all listed species within the kingdom Animalia, alongside sentiment data from two sentiment lexicons: the labMT 1.0 dataset ('dodds_sentiment') in the R package 'lexicon' version 0.7.4, and the NRC dataset ('nrc') from the R package 'tidytext' version 0.2.0 (Rinker, 2017; Silge & Robinson, 2016). The labMT sentiment scores are an average obtained from a U.S. survey in which participants scored (from 1–9) how a given word made them feel (n = 50 per word), with higher scores indicating greater positive feelings (e.g., $\text{labMT}_{\text{avg}}$(laughter) = 8.50, $\text{labMT}_{\text{avg}}$(hate) = 2.34) (Dodds, Harris, Kloumann, Bliss, & Danforth, 2011). The NRC sentiment lexicon associates words with one or more of 10 categories, including sentiment polarity ('positive', 'negative') and emotions ('anger', 'anticipation', 'disgust', 'fear', 'joy', 'sadness', 'surprise', 'trust') (Mohammad & Turney, 2010, 2013). These lexicons were chosen from five freely available datasets (Table 1) because they provided scores for the most words in the common names (n_{NRC} = 545, n_{labMT} = 1,595, covered 1,855 unique words together). Using both lexicons allowed for a more holistic sentiment analysis of common names. The labMT dataset's continuous measure of sentiment polarity (score of 1–9) allowed us to identify the 10 highest- and 10 lowest- scoring highly-frequent words (i.e., words driving sentiment), while the NRC lexicon's categorical attribution of human emotions allowed us to explore how words in common names might be associated with specific human emotions. By considering the sentiment polarity or emotion of each word individually we avoided common pitfalls of sentiment analyses (e.g., homonyms, sarcasm) that aim to establish overall sentiment of a text by adding or averaging multiple sentiment scores across the desired level of analysis (i.e., a sentence, paragraph or entire text) (Liu, 2012).

[Table 1. placed around here]

To determine which words were driving sentiment of common names, we used the labMT lexicon ('happiness_average' variable, 1–9) to identify the 10 highest- and 10 lowest-scoring words that are frequently-used; prioritizing sentiment score (i.e., values close to the polar extremes of 1 and 9) and frequency of occurrence. To identify high- and low-scoring words we first filtered out neutral scoring words (defined as words with sentiment scores between 4.5 and 5.5; 5 is true neutral in the labMT dataset), and then ranked the remaining words by sentiment score, with low- (< 4.5) and high- (> 5.5) scoring words ranked separately. We then prioritized high frequency words within these subsets by setting a required frequency (n = 160) and then decreasing frequency thresholds (by n = 5 each iteration) until 10 high- and 10 low- sentiment scoring words were identified. This method resulted in effective prioritization of frequently-used words with the highest (or lowest) sentiment scores preventing a bias towards very highly frequent words with only mildly positive (or negative) sentiment (e.g., color and morphology words, such as 'white', 'blue', 'headed'). We targeted these words because of their capacity to have the strongest overall influence on common name sentiment, due to their affect (i.e., high or low sentiment scores eliciting a strong emotional effect) and ubiquity (i.e., being highly frequent in common names). To determine whether the words driving sentiment varied across taxonomic class and IUCN threat status, we carried out this same process across five taxonomic classes (each had more than 10,000 words within the list of common names: *Actinoterygii* (ray-finned fishes), *Amphibia* (amphibians), *Aves* (birds), *Mammalia* (mammals) and *Reptilia* (reptiles)), and across the eight IUCN Red List threat statuses (i.e., *Extinct*, *Extinct in the Wild*, etc.). In the case of the *Extinct in the Wild* threat category, no words had a sentiment score below 4.5 (Figure. 2cii), however only 21 species fell into this category.

To identify frequently-occurring words in common names that are associated with specific human emotions, we used the NRC lexicon to identify words across all common names that are associated with emotions - anger, fear, disgust, sadness, anticipation, joy, trust, and surprise - but are not captured by the labMT lexicon (i.e. we excluded the NRC lexicon sentiment categories, ‘positive’ and ‘negative’). We then identified the 10 most frequently occurring words in each of the eight emotion categories. We carried out all data processing and analysis in R v3.5.1 (R Core Team, 2018).

Results

Together, the labMT and NRC lexicons analysed sentiment for 1,855 unique words within the IUCN Red List English common names (11% of unique words); 26,794 listed species were at least partially analyzed (69% of listed species with English common names). The number of words and species analysed varied across individual lexicons (Table 1). The words analyzed were distributed as expected by chance across IUCN Red List threat status and animal class (Table 1) and covered 56 of the 100 most frequent words in the IUCN Red List English common names. Of the 44 unanalyzed but frequently occurring words, most were related to taxa (59%, e.g., ‘gecko’) or morphology (39%, e.g., ‘crested’).

[Figure 1. placed around here]

Frequently-occurring words driving positive sentiment in species common names included ‘golden’ (labMT = 7.30, n = 478), and ‘great’ (labMT = 7.88, n = 171). Frequently-occurring words driving negative sentiment included ‘rat’ (labMT = 3.04, n = 924), ‘lesser’ (labMT = 4.10, n = 343), ‘false’, (labMT = 3.18, n = 189), and blind’ (labMT = 2.58, n = 166)

(Figure. 1a). Words driving sentiment varied across taxonomic class and included taxon-specific words like ‘snake’ (*Reptilia, Actinopterygii*), ‘rat’ (*Mammalia*) and ‘dove’ (*Aves*) and non-taxonomic words such as ‘sucker’ (*Actinopterygii*), ‘poison’ (*Amphibian*) and ‘lesser’ (*Mammalia* and *Aves*) (Figure. 1b). No words drove sentiment across all taxonomic classes (though some drove across all but one e.g., ‘golden’, ‘dark’, ‘false’, ‘tree’). Words driving sentiment also differed slightly across IUCN threat categories but with less clear differences (Figure. 1c). Commonly-occurring words included ‘golden’ (across all 8 IUCN threat categories), ‘tree’, ‘snake’ and ‘rat’ (7 of 8 threat categories), and ‘great’ and ‘false’ (6 of 8 threat categories). At least one of ‘least’ and ‘lesser’ drove sentiment in all but *Extinct in the Wild* and *Critically Endangered*.

[Figure 2. placed around here]

The NRC lexicon identified high-frequency common name words that are associated with key human emotions (Figure 2): anger (e.g., ‘tyrant’), disgust, (e.g., ‘rat’), joy (e.g., ‘dove’), surprise (e.g., ‘worm’), anticipation (e.g., ‘long’), fear (e.g., ‘snake’), sadness (e.g., ‘blue’), and trust (e.g., ‘ground’). The emotions anger and surprise were least-commonly represented in species common names (Figure 2).

Discussion

We explored broad sentiment associated with species common names by drawing on the large IUCN Red List dataset, and focussing explicitly on the sentiment of individual words and associations with eight human emotions. This is, to our knowledge, the first sentiment analysis of species common names across such a comprehensive species list. The sentiment associated with common names may influence conservation outcomes in multiple ways, including by affecting the perception of and conservation support for species by the general public (Karaffa et al., 2012; Wright et al., 2015), as well as influencing decisions about which species to research or classify under particular threat listings (Clark & May, 2002; Clucas, McHugh, & Caro, 2008; Metrick &

Weitzman, 1996; Possingham et al., 2002). If common names have any influence at all on a species' likelihood of extinction, revising them may be a simple and cost-effective way to improve conservation outcomes. We discuss implications of our findings for perceptions of threatened species and future research below.

Using Sentiment Analysis to Target Strategic Name Changes

Commonly-occurring words driving sentiment in species common names included positive words (e.g., 'golden', 'great'), and negative words (e.g., 'rat', 'lesser', 'false', and 'blind'). Further investigation revealed that some positive scoring sentiment words were associated with particular human emotions, including 'dove' (joy, anticipation and trust), 'green' (trust and joy), and 'tree' (anger, disgust, joy, anticipation, trust, surprise). The same is true for negative scoring sentiment words such as 'snake' and 'rat' (disgust and fear), 'lesser' (disgust), 'worm' (anticipation and surprise), and 'dark' (sadness). These words, which are associated with emotions that may be off-putting in a public engagement or decision-making context, could be targeted for strategic name changes.

Our results also highlighted that the words driving sentiment across different taxonomic classes are different. This may be due to differences in the way taxonomic classes are named (Ehmke et al., 2017), or differences in typical morphology that tend to be named in similar ways. Regardless of cause, these differences mean that appropriate targets for strategic name changes in these groups may not always be the same.

Taxa-specific words dominate animal common name semantics, accounting for 40 of the 100 most frequent words. Some taxa-specific words are negatively loaded because of cultural associations that go beyond common taxonomic biases. The word 'rat', for example, is associated with the human emotions of fear and disgust (Figure 2) because of associations with disease, uncleanliness, and deceitfulness (Smith-Marder, 2008). Therefore, species with common names that include such words may be disadvantaged not only by broader taxonomic biases, but also by other associations the word invokes. While not always possible or desirable, alternatives to negatively-associated taxa-specific words could be considered. Take the *Data Deficient* Persian rat snake (*Zamenis persicus*), disadvantaged not only by the bias against its taxa (and the associated word, ‘snake’), but also by negative emotions evoked by the word ‘rat’. In this case, the presence of ‘rat’ in its name may not be entirely necessary. Examples of the adoption of non-taxa-specific common names can be found in Australia, where names from Indigenous languages have been adopted for some mammal species (e.g., the ‘water rat’ was renamed ‘Rakali’) (Braithwaite et al., 1995) (although we note that these names have not always been chosen with proper attribution to language source or the wishes of language communities). While the impact of such name changes on public perceptions is unknown, our findings suggest that there may be merit in avoiding culturally-loaded words such as ‘rat’, particularly if it is not the only, or most accurate, option.

Our findings did not present clear justification for targeting different words based on threat status. It is possible that names may influence conservation support and threat status of a species by influencing its perception and charisma amongst human populations. Disentangling the circular relationships between naming, naming practice, taxonomy and morphology, charisma and true conservation status was beyond the scope of our study. Future research that explores relationships between threat status, conservation support and common names would be valuable for understanding the power of common names for influencing conservation outcomes.

Considering how words with a particular taxonomic or historic background may be (mis)interpreted by a public audience or decision-makers may also be useful when naming species. For example, ‘lesser’, ‘least’, ‘greater’ and ‘great’ are typically used to differentiate similar species by size, while ‘false’ is used to describe species that are morphologically similar to another, taxonomically-different, species. These words may be misleading to a non-expert audience, giving the impression that these species are less important than others. By excluding sentimentally neutral words, our sentiment analysis may have missed highly-frequent words of this nature. One such example is ‘common’ (labMT = 4.92, n = 518). While the vast majority of species with ‘common’ in their name are of *Least Concern*, there are 5 *Critically Endangered*, 7 *Endangered*, and 18 *Vulnerable* species that have this sentimentally neutral but potentially greatly misleading word in their common name. Such words may also be important targets for future research regarding the strategic use of species common names to improve engagement with threatened species conservation.

Establishing an Empirical Evidence Base for Strategic Species Naming

Our findings showed that there are frequently-occurring sentimentally-positive and negative words in English species common names, as well as highly-frequent words associated with human emotions. Further research that focuses on empirically testing the effect of common names on perceptions, attitudes, and willingness to engage with and support threatened species conservation is needed to understand the nuanced effects of common names on human interpretation and engagement. For example, some negative words may be perceived as interesting or exciting in the context of wildlife conservation (e.g., ‘devil’ in Tasmanian Devil), and effects may differ across different audience demographics. In addition, our study focused on individual words, while the interaction between words within species common names also needs to be considered. For example, switching between ‘golden rat snake’ and ‘brown rat snake’ may not have a meaningful effect on perceptions if the taxonomic effect of ‘rat snake’ overpowers this change. While sentiment analyses can provide indications of overall sentiment by averaging scores across words, experimental approaches are needed to provide greater insight into these interactions and masking effects. Furthermore, experimental approaches in common name research may provide an opportunity to test psychological mechanisms behind the effect of different word types. It is possible that, by providing a more concrete construal of a species, descriptive morphological words (e.g., size, color) act to reduce the psychological distance between humans and non-humans, which is known to be linked to concern and action on issues like climate change (Spence, Poortinga, & Pidgeon, 2012). Such research would better inform strategic revision of common names to improve conservation outcomes for individual species.

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Table 1

Examples of Sentiment Lexicons

Lexicon	Sentiment variable	Original source	Number of words in lexicon	Number of unique words analysed	Number of species analysed	Notes
NRC	Categorical (multiple categories allowed): *positive, negative, anger, anticipation, disgust, fear, joy, sadness, surprise, trust*	Mohammad and Turney (2010)	14,000	545 (*3.1%*)[a] (excluding 'positive' and 'negative' categories for analysis)	12,745 (*32.9%*)	Used in analysis
labMT 1.0	Continuous score: *1–9*	Dodds et al. (2011)	10,222	1,595 (*9.5%*)[b]	25,681 (*66.4%*)	Used in analysis
Bing	Binary score: *positive, negative*	Hu and Liu (2004)	6,782	435	-	Binary polarity score not very informative compared to continuous score (e.g., in labMT and AFINN)
AFINN	Continuous score: *-5–5*	Nielsen (2011)	2,400	210	-	Intended for customer feedback analysis
Loughran	Categorical: *positive, negative, uncertainty, litigious, constraining, superfluous*	Loughran and McDonald (2011)	3,916	82	-	Intended for use in financial texts (e.g., 'share' is not necessarily positive)

Note. All lexicons were accessed through the 'tidytext' R package (v0.2.0), except for labMT 1.0 which was accessed through the 'lexicon' R package (v0.7.4).

[a] Distributed as expected by chance across threat status (χ^2 = 56, *df* = 49, *p* = 0.23) and animal class (χ^2 = 620.6, *df* = 594, *p* = 0.23).

[b] Distributed as expected by chance across threat status ($\chi^2 = 56$, $df = 49$, $p = 0.23$) and animal class ($\chi^2 = 696$, $df = 648$, $p = 0.09$).

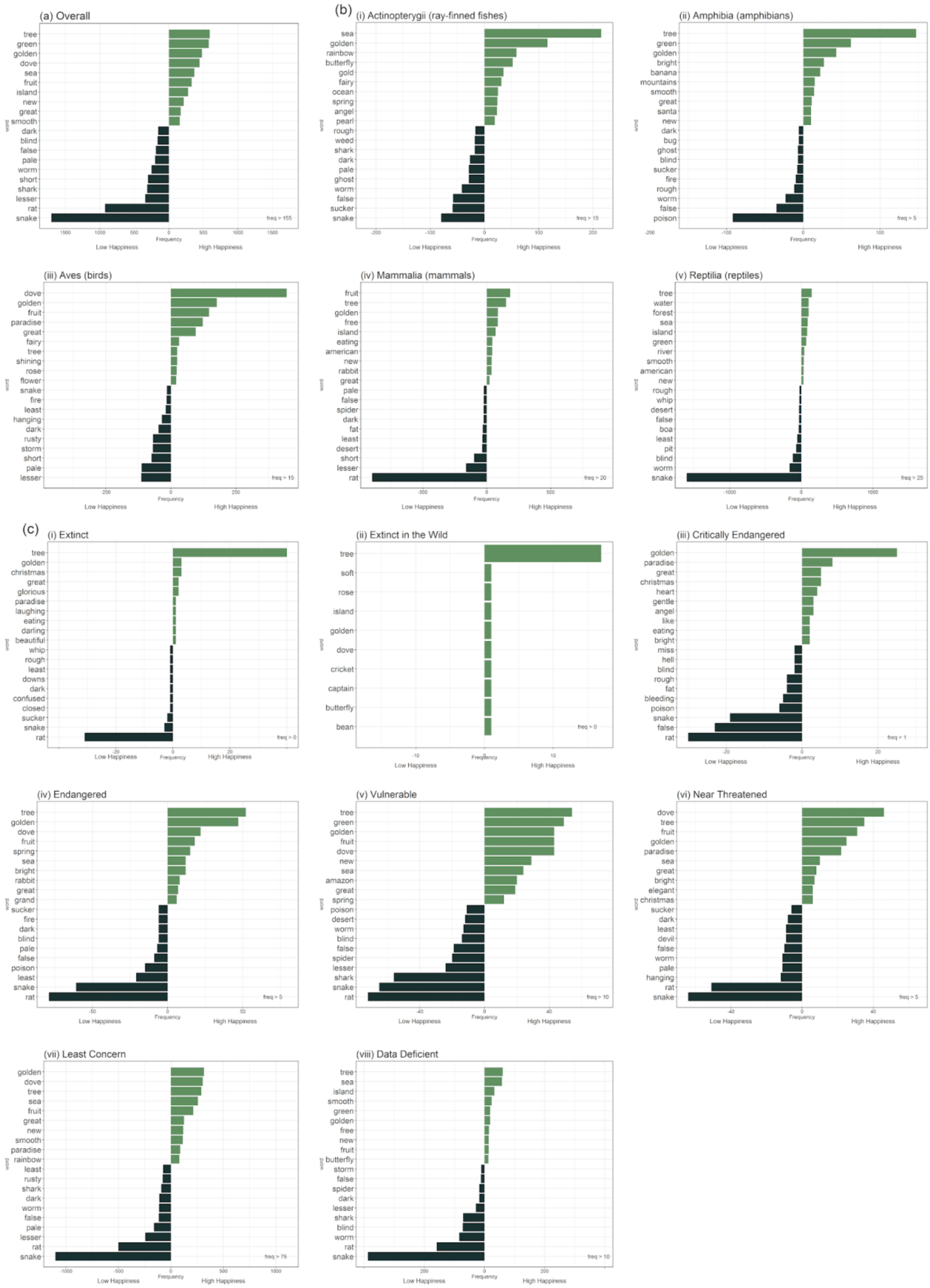

Figure 1 Words driving positive and negative sentiment in IUCN Red List threatened species English common names (i.e. 10 highest scoring and 10 lowest scoring labMT lexicon sentiment scores with high frequency), **(a)** overall, **(b)** across 5 taxonomic classes, and **(c)** across IUCN Red List threat statuses.

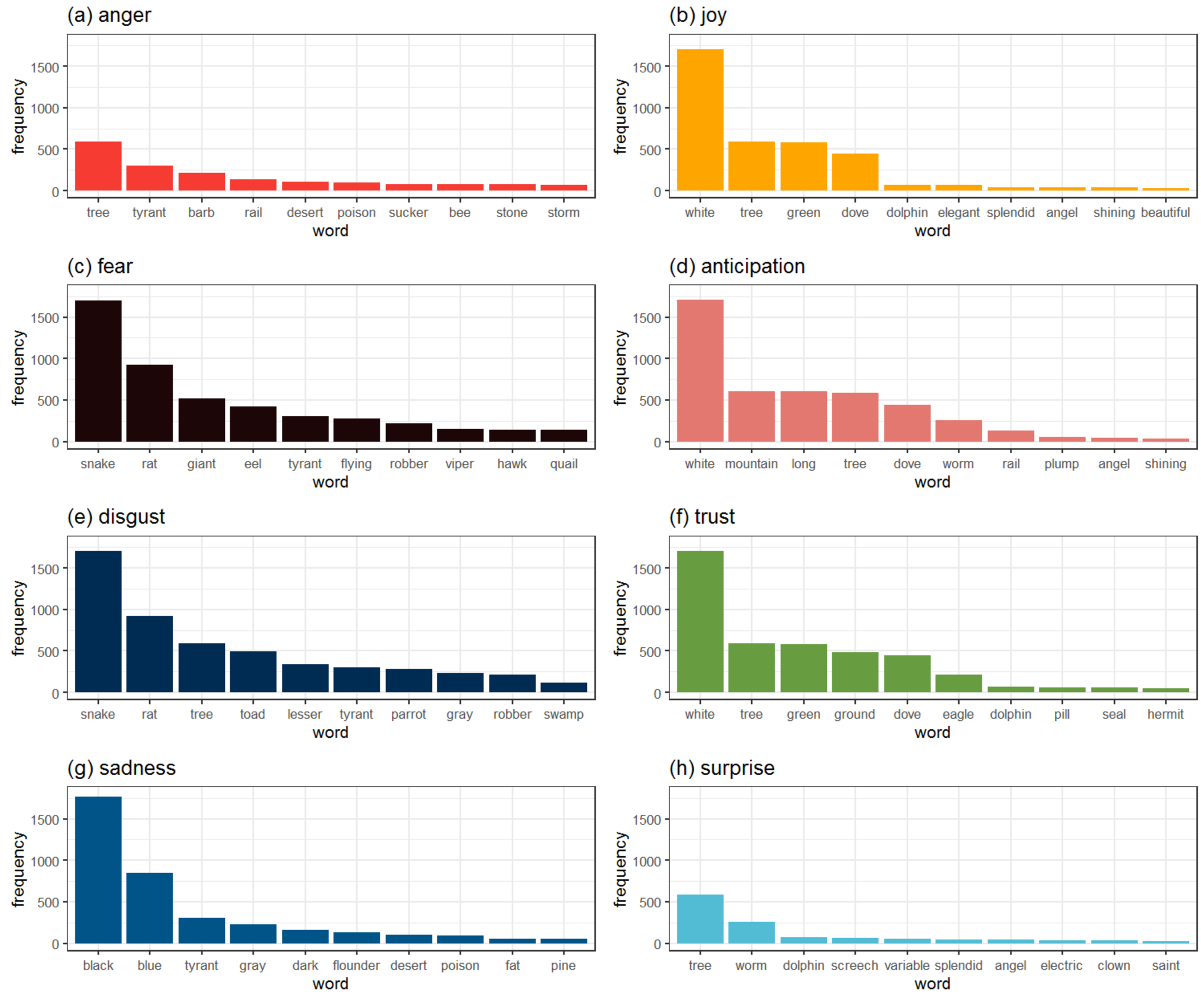

Figure 2 Top 10 most frequent words in IUCN Red List species English common names associated with different emotions, analysed using the NRC lexicon: **(a)** anger, **(b)** joy, **(c)** fear, **(d)** anticipation, **(e)** disgust, **(f)** trust, **(g)** sadness, and **(h)** surprise.