

RESEARCH ARTICLE

Popular press portrayal of issues surrounding free-roaming domestic cats *Felis catus*

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Abstract

1. Domestic cats *Felis catus* have a complex and contentious history. They fill multiple societal roles (e.g. as pest controllers and companion animals), which has led to a variety of animal welfare, conservation, and human health concerns. Popular press articles play an important role in how people learn about key issues surrounding cats, but they may present some issues more frequently than other issues.
2. We conducted a global media content analysis of 796 articles in the English-language media from 1990 to 2018 on issues related to free-roaming cats, such as their environmental impacts, the threats and welfare issues cats face, and how they are managed. We aimed to determine whether non-experts learning about the issues around free-roaming cats exclusively from the popular press would be exposed to multiple stakeholder views or opinions.
3. Over 95% of articles analysed were from North America. Most of the people interviewed in the popular press were from non-governmental organizations, mainly from cat welfare or cat rights groups (which are often focused on only one side of the issue). Researchers, shelter organizations, veterinarians, and groups that have different opinions than cat rights or welfare organizations on how to resolve issues surrounding free-roaming cats were rarely interviewed by the popular press. Most articles focused on cat welfare issues and the management strategies of euthanasia or trap-neuter-release (TNR), whereas less than one-third of the articles acknowledged that cats have any impact on wildlife or the broader environment.
4. We found that the popular press often presented an oversimplified picture of issues related to free-roaming cats and provided unbalanced coverage. We also show evidence of framing by the popular press, including mainly presenting the

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viewpoints and perspectives from animal welfare and rights groups, focusing on TNR or euthanasia as the only viable cat management strategies when many alternatives exist and often have greater support from experts, and discussing the impacts of cats on birds and small mammals but not reptiles or amphibians.

KEYWORDS

animal welfare, conservation, feral cat, free-ranging cat, media content analysis, outdoor cat

1 | INTRODUCTION

Domestic cats *Felis catus* are our wild companions, filling complex roles in contemporary society and ecosystems as companion animals and pest controllers (Crowley et al., 2020). Cats that live or are allowed outdoors unsupervised (i.e. free-roaming cats) may have devastating impacts on wildlife through hunting, capturing, and killing animals (Blancher, 2013; Dickman & Newsome, 2015; Doherty et al., 2015; Piontek et al., 2020); they may transmit disease to other animals (Day et al., 2012; Salinas-Ramos et al., 2021) and may threaten native felids through hybridization (Fredriksen, 2016). Free-roaming cats also pose risks to public health (Gerhold & Jessup, 2013) and are a public nuisance (e.g. by fighting or spraying/fouling in private or public gardens; Grayson & Calver, 2004). The dual roles of cats, as companion animals and pest controllers with a propensity to hunt native wildlife, have contributed to deep divides between stakeholders, such as those between the animal welfare (i.e. those that prioritize cat well-being) and wildlife conservation communities (i.e. those that prioritize cat impacts on wildlife; Crowley et al., 2020; Wald et al., 2013; Wald & Peterson, 2020).

At the root of the problem and debate are human behaviours that have enabled cats to roam unconstrained and freely outside, regardless of ownership status. Large numbers of free-roaming cats are a major issue in several countries, such as the United States (US), Canada, and Australia (Canadian Federation of Humane Societies, 2017; The Humane Societies of the United States, 2020; Woinarski et al., 2019). In these countries and elsewhere, the growing numbers of free-roaming cats have emerged as political issues rooted in public concern for cat welfare and well-being, reduction of the negative impacts of cats on wildlife, and mitigating public health risks from disease transmission. High local abundances of free-roaming cats (also referred to as overpopulation) strain often already over-capacity shelter systems, increase human concern for cat welfare, and raise concern for the impacts that cats have on local environments and wildlife (Canadian Federation of Humane Societies, 2017).

There are numerous stakeholders concerned about issues surrounding free-roaming cats. For our purposes, we considered three broad stakeholder groups including (a) individuals or groups concerned for the well-being of free-roaming cats (e.g. shelters and veterinarians); (b) those concerned about the negative impacts of free-roaming cats on wildlife (e.g. naturalists, ecologists, and conservationists); and (c) people that do not specifically associate with the

above groups (e.g. cat owners and non-cat owners). Most of these stakeholders agree in principle that the number of free-roaming cats should be reduced, but they do not always agree on the best methods, as there are numerous management options whose benefits are context dependent (Cecchetti et al., 2020; Wald & Peterson, 2020; Woinarski et al., 2019). An appropriate management approach also depends on the types of cats being discussed—'owned', 'semi-owned' (may be fed by humans), or 'unowned' (do not associate with humans)—as well as the amount of control humans exercise over each population (Crowley et al., 2019), the risks and benefits to each type of cat (Tan et al., 2020), and the impacts of each type of cat on native wildlife (Blancher, 2013; Doherty et al., 2016). Furthermore, free-roaming cat management is influenced by how cats are viewed by society, how the practice of allowing cats access to roam unsupervised is perceived, and people's risk perception (Cecchetti et al., 2020; Escobar-Aguirre et al., 2019; Gramza et al., 2016; McLeod et al., 2019).

There have long been concerns raised about conflicts between the goals of biodiversity conservation (represented by a desire among some stakeholders to minimize environmental harms caused by free-roaming cats) and the goals of animal welfare (represented here by the desire among some stakeholders to ensure minimal or no cat suffering). Rawles (2003) describes a case study of a wildlife cull designed to stop an overpopulated species from damaging its environment by overgrazing—a move supported by conservationists but strongly opposed by those concerned with the welfare of the animals being killed to protect the environment. This wildlife cull resulted in heated emotional discussions and even violence between stakeholder groups, and Rawles (2003) highlighted that there was no easy solution to avoid such conflict. These ethical concerns are no less serious when the species being culled is not native to the ecosystem (Minteer & Collins, 2005). Recent attempts to generate ethical approaches to wildlife control (Dubois et al., 2017) suggest that any efforts must present unequivocal evidence of harm caused by the species in question and factor community values into management approaches.

Issues surrounding free-roaming cats, such as managing their populations, are complex international challenges entrenched in conservation science, social science, policy, management, and human behaviour. The popular press (defined as print or online news articles meant for a general audience, as opposed to technical or trade publications) is an important source of information that may

affect how people understand and view issues surrounding free-roaming cats (Wald & Peterson, 2020), including helping to inform people about topics they do not personally experience. Cats are one of the most popular pets worldwide and while most people have seen free-roaming cats, few people have witnessed a cat hunting or killing other animals, being hit by a car, or eaten by a predator. Few people have participated in a TNR programme or other management programme. Most people also do not have the means, resources or time to fully understand the risks, uncertainties, and ambiguities on the issues and debates around free-roaming cats (Wald & Peterson, 2020). Presenting people with scientific information about issues surrounding cats may not in itself influence public decision (i.e. the knowledge deficit model; Sturgis & Allum, 2004), but how the media frames and communicates information may influence or persuade audiences and ultimately affect support for policy decisions surrounding free-roaming cats (Lecheler & de Vreese, 2012). For the popular press to present issues surrounding free-roaming cats in a way that portrays to the public (i.e. the readers of popular press articles) the complexity and multiple sides of issues, it should provide fair representation of all issues. While there is no clear one-size-fits-all formula for how much attention to give each side of the story, when one side is overwhelmingly featured in media coverage, this can falsely suggest to readers that this viewpoint or issue is more reasonable, mainstream or important.

Popular press coverage of scientific and environmental topics can provide insight into what the media values as important topics or issues (Scheufele & Tewksbury, 2007). Framing of an environmental issue in the popular press can also indicate whether the media perceives an issue to be important to their audience, which sometimes may result in the public supporting solutions distinct from those endorsed by technical subject area experts. For instance, frequent blame was directed at threatened shorebirds (Dayer et al., 2019), wolves were framed and portrayed as frightening (Houston et al., 2010), and certain policy solutions for threatened sharks got much more attention than other issues surrounding the conservation of threatened sharks (Shiffman et al., 2020).

The popular press may also influence the public's understanding of an issue using principles such as agenda-setting, priming, and cultivation (Scheufele & Tewksbury, 2007). Agenda-setting refers to the idea that the popular press can influence the public's concern for a subject by repeatedly covering certain issues. Priming involves attempting to sway people's view, framing an issue as good or bad, or as important or unimportant. Cultivation occurs when the media repeatedly exposes the public to one side of a policy debate with the goal of increasing sympathy for one side. These concepts have been studied in relation to geopolitics and foreign policy (de Vreese & Boomgaarden, 2003; Entman, 2003), as well as environmental problems and their policy solutions for sharks (Shiffman et al., 2020). Media content analysis provides a quantitative measure of what is said, who is presented as an expert, what perspectives are shared, and how stories are framed, which can provide insights into what information non-expert members of the public are exposed to regarding environmental problems (Boykoff & Boykoff, 2004), climate

change (Johns & Jacquet, 2018), and ocean conservation. Coverage in the popular press may influence people's understanding of the issues involving free-roaming cats in two ways (discussed in: Wald & Peterson, 2020). First, people may be influenced by the amount of coverage devoted to specific issues surrounding free-roaming cats. Greater attention and coverage of specific topics associated with an issue may, for instance, indicate to people that a particular side of a debate is more important, well supported, and urgent. Second, the popular press may influence how people perceive the issues involving free-roaming cats by selectively framing the issues and tailoring storylines. The narrative, for instance, may focus on specific attributes of cats, such as their hunting of small birds, or emphasize particular perspectives to tell a story, such as the conflict between bird enthusiasts and cat advocates.

Relational values are a way of understanding how a person's interactions with wildlife or nature influence their perspectives on a variety of environmental issues (reviewed in: Chan et al., 2018). When an environmental issue is framed so that humans are part of and affected by the story instead of as abstract science, people are more likely to feel connected to the problem and motivated to help solve it (e.g. local conservation action from ecotourists; Olmsted et al., 2020). Domestic cats have unique and strong bonds with humans, and have helped connect people to the environment and nature both historically and currently (Read, 2019; Walsh, 2009), but the relationships between humans and domestic cats are often complex as they differ based on a person's values (e.g. concerns for cat welfare vs. impacts on wildlife) or experiences (Woodward & Bauer, 2007). Additionally, groups of people who interact with wildlife or nature in different ways are likely to have different values with respect to issues that influence wildlife, with possible implications for their policy preferences. For instance, SCUBA divers and fishermen interact differently with sharks than a member of the public without a personal connection to the ocean (Skubel et al., 2019). Different groups of people have varied experiences with cats, which is likely to inform their thoughts on the threats to—and the environmental harms caused by—free-roaming cats, as well as possible solutions to these issues.

Here we present the findings from a global media content analysis of articles from English language sources between 1990 and 2018 on topics and issues related to free-roaming cats. We assessed the relative coverage of the various issues surrounding free-roaming cats, including the environmental impacts, welfare issues, and management strategies or methods. We also examined who was quoted in these articles (i.e. the messengers). Overall, we aimed to assess whether someone who learned about the issues involving free-roaming cats exclusively from popular press articles would be exposed to the numerous and complex issues surrounding free-roaming cats and multiple stakeholder views surrounding cat welfare, cat management, and the impacts of cats on wildlife and the environment. We also discuss how the information presented by the popular press may differ from public perceptions, and the limitations of media content analysis for examining the issues surrounding free-roaming cats.

2 | METHODS

2.1 | Search

Using the academic search engine LexisNexis, we found 866 articles from a keyword search relating to free-roaming cats and their impacts on wildlife conservation (see Supplement Part 3 for keywords). We focused on English language news articles from both print and online news sources, and used LexisNexis native similarity filter to eliminate repeat articles. Each article was manually scanned to confirm its relevance before being downloaded and added to the corpus of articles for coding, scoring, and further analysis. After preliminary evaluation and filtering to exclude replicate or irrelevant articles, our final article set included 796 articles (92% of those samples from LexisNexis) for coding and analysis.

2.2 | Coding and scoring

All coders (authors of this study) were trained in media content analysis and the basics of the impacts of cats on wildlife, cat health and welfare, and cat management. We followed the methods of Shiffman et al. (2020) and Riffe et al. (2005). Training involved each coder receiving and coding the same set of 20 randomly selected articles from the corpus of 796 articles. Intercoder reliability was 97.3% for the 20 articles read by all coders. All but three questions had an intercoder reliability of 100%, and the remaining three questions that did not had an intercoder reliability of 91.7% (i.e. Are 'cruelty, abuse, inhumane, torture, or killing' mentioned in the article?; Are 'predation, depredation, predate, depredate, or attack' mentioned in the article?; and Does the article mention 'feline immunodeficiency virus (FIV)', 'Feline Leukemia Virus (FeLV)', 'Rabies', 'worms', 'Toxoplasmosis', 'panleukopenia/feline distemper', 'Bartonellosis (cat scratch fever)', 'ringworm', 'ticks', or 'fleas'). Intercoder reliability was calculated per question per article, then averaged across all questions and articles. Questions were refined where responses were inconsistent to reduce intercoder variation, and the only question resulting in repeated confusion (i.e. consistently higher intercoder variability) was dropped from subsequent analysis. The remaining questions were designed to minimize any possible opportunity for misinterpretation and included many presence-absence questions (i.e. is a concept or term mentioned or discussed).

Following intercoder reliability assessment on a shared analysis of 20 articles and subsequent refinement of the codebook, we then assigned each coder 110–140 unique articles to code within a 2-month period with each article read by one coder. Most coders received articles published falling within a 1-year time span. Each article was coded by one coder. Coders answered 72 questions for each article. Coders responded to questions with a response of yes, no, or maybe (e.g. 'Are cats referred to as predators?'; see Supplement Part 4 for questions and the codebook) and copy and pasted text from the articles to verify their response. Coders were instructed to only use 'maybe' if they were unsure if the information was included, and

those questions were flagged, revisited by a single coder and then assigned to a yes or no category. Coders specified 'maybe' in <3% of responses (1627/57312 responses). Questions focused on three main issues surrounding free-roaming cats: cat health and welfare, cat numbers and impacts on the environment (including how they are perceived, e.g. as a natural part of the environment vs. invasive or non-native), and cat management. Coders also recorded the messengers. Representative quotes illustrating key points that were frequently present in scanned articles are shown in Supplement Part 5 and as examples in results. These representative quotes are meant to show examples of how certain topics are frequently discussed in the analysed articles.

2.3 | Messengers

We defined the article messengers as people interviewed and quoted in an article, or cases where the journalist summarized an organization's position statement on an issue, as distinct from a journalist summarizing their own thoughts on an issue not attributed to an expert source. Messengers were sorted into one of the following seven categories: (a) Researchers, defined as those conducting research with a postgraduate degree or someone working to obtain a graduate degree that could be employed by universities, research institutes, non-profit organizations, (NGO) or governments, such an affiliation had to be explicitly mentioned in the article; (b) NGO employed advocate who is a non-researcher, including anyone that works at a non-profit not represented in the other categories; (c) shelter organizations, including humane societies, or members of the Society for the Protection of Animals (SPCA); (d) politicians or policymakers (i.e. those that make decisions as either elected officials or civil servants); (e) members of the public (e.g. people that did not fall into any other groups, including outdoor cat owners); (f) veterinarians or representatives from a veterinary clinic (including veterinary technicians); (g) messengers who were not easily placed into any of the above categories or whose affiliations were unclear or unknown were scored as *other*. While we did not specifically code for medical doctors (MDs) directly, there were none indicated as messengers in any articles through the *other* category.

3 | RESULTS

3.1 | Distribution of articles

The 796 coded articles included publications from 14 countries, with most (95%; 758 articles) from North America (Supplement Part 1). There was a cumulative increase in the number of articles over time, with the highest proportion of articles (13%; 107 articles), published in 2013 (Supplement Part 1). Most (78%; 621 articles) of the coded articles were published in media sources in North America. Of the articles from North America, 18% (136

articles) were published in Canada (with articles from 9 of 13 provinces/territories), and 82% (621 articles) were published in the United States (with articles from 38 of 50 states and the District of Columbia; Supplement Part 1), and no articles from English media sources in Mexico, the Caribbean, or Central American countries. The majority of articles published in Canada were from Ontario (80 articles, 10% of total, 59% of Canadian articles; Supplement Part 1). The largest number of articles from the United States were published in Florida (108 articles, 14% of total and 17% of US articles) and California (89 articles, 11% of total and 14% of US articles). Given that the majority of articles are in North America, our discussion will mainly focus on the issues and perceptions surrounding free-roaming cats in a North American (namely Canada and the United States) context.

3.2 | Messengers

Of the coded articles, 754 contained at least one messenger. The most common messengers were NGO employees representing ~33% of all messengers (37%, 33%, and 30% of primary, secondary, and tertiary messengers, respectively), with the majority of these messengers from cat-centred groups (e.g. Alley Cat Allies, an NGO known for the introduction of TNR in the United States). Only a minority of NGO employed messengers were from environmentally focused NGOs (7%, 12%, and 13% of primary, secondary, and tertiary messengers, respectively). Politicians or policymakers were the second most common messengers consisting of 19%, 25%, and 17% of primary, secondary, and tertiary messengers, respectively, and members of the public were the third most common messengers constituting 16%, 14%, and 14% of primary, secondary and tertiary messengers, respectively. Researchers (8%, 7% and 11% of primary, secondary, and tertiary messengers, respectively), veterinarians (4%, 6%, and 5% of primary, secondary, and tertiary messengers, respectively) and shelter organizations (11%, 10%, and 11% of primary, secondary, and tertiary messengers, respectively) were rarely quoted as messengers (Figure 1).

3.3 | Cat impacts on the environment

Cats were specifically described as predators in 17% (137 articles) of sampled articles (Figure 2a). By comparison, 32% (254) of articles mentioned the potential impacts of cats on birds, 27% (215 articles) mentioned their potential impacts on mammals (e.g., 'It sounds extreme, but it may be something more communities should be considering: after all, cats are responsible for the death of billions of birds and mammals each year—and, according to some, it is all our fault'; *The New Nation*, 2018), but few articles mentioned the impacts of cats on reptiles and amphibians (8%, 66 articles, Figure 2b). Overall, few articles (4%, 33 articles) mentioned that cats pose a specific conservation threat to wildlife populations, or that they are considered to be invasive (6%, 46

articles) or non-native (7%, 52 articles; Figure 2a; e.g., 'Cats are a globally invasive species'; Helmuth, 2013).

The most commonly mentioned impact of cats on the environment was high numbers of free-roaming cats which was discussed in 39% (314) of articles, although not all of these articles specifically mention that free-roaming cats had negative impacts on the environment; Figure 2a; e.g., 'We have a huge cat problem'; Marks, 2013). Of those articles that described cat populations, 63% (200/314 articles, 25% of total) provided an estimate of the feral or free-roaming cat population size (Figure 2a). More than twice as many articles mentioned that cats belong or should remain indoors (17%, 135 articles; e.g., 'This is a horrible perpetuation of the notion that it is natural and normal to allow cats to hunt outdoors'; Milloy, 2014), compared to those that included mention of cats belonging or should be outdoors or were a natural part of the ecosystem (7%, 57 articles; Figure 2a) (e.g., 'These cats are wild animals'; *Horry Independent*, 2012).

3.4 | Threats to cat health and welfare

A variety of threats to free-roaming cats were mentioned in the coded articles (Figure 2c, d). Human actions, whether direct cruelty or abuse (11%, 90 articles), poison (7%, 52 articles), or vehicle collisions (15%, 120 articles; e.g., 'They get run over by cars'; Leskey, 2008) represented only a subset of the threats that free-roaming cats were reported to face (Figure 2c). Native predators, such as coyotes, were also reported to be a major threat to free-roaming cats (22%, 172 articles; Figure 2c; e.g., 'Death by coyotes, which find cats quite tasty'; Shalaway, 2007). Diseases and parasites were the most commonly mentioned threat to outdoor cats (47%, 378 articles; Figure 2c; e.g., 'They're susceptible to a range of painful diseases, including Feline Leukemia Virus (FeLV), Feline Immunodeficiency Virus (FIV), Upper Respiratory Infections (URIs), heartworm, ringworm, toxoplasmosis, fleas and others'; Rob Tonus, 2018). Among diseases, rabies was mentioned most often (35%, 279 articles) followed by feline leukaemia virus (FeLV; 13%, 104 articles; Figure 2d). A variety of other diseases were mentioned at relatively low frequency, including other viruses (e.g. feline immunodeficiency virus; FIV), as well as endoparasites and ectoparasites (e.g. toxoplasmosis, ringworm, fleas and ticks; Figure 2d).

3.5 | Cat management strategies

TNR or similar methods were the primary methods discussed in the articles about the management of cat populations (79%, 627 articles; Figure 2e). Within articles that mentioned TNR or affiliated methods, there was both support (e.g., 'Cat supporters endorse a trap-neuter-release program for feral cats, contending that limiting the breeding population eventually will cause the number of cats to decrease without killing captured animals. Alley Cats Allies describes its plan

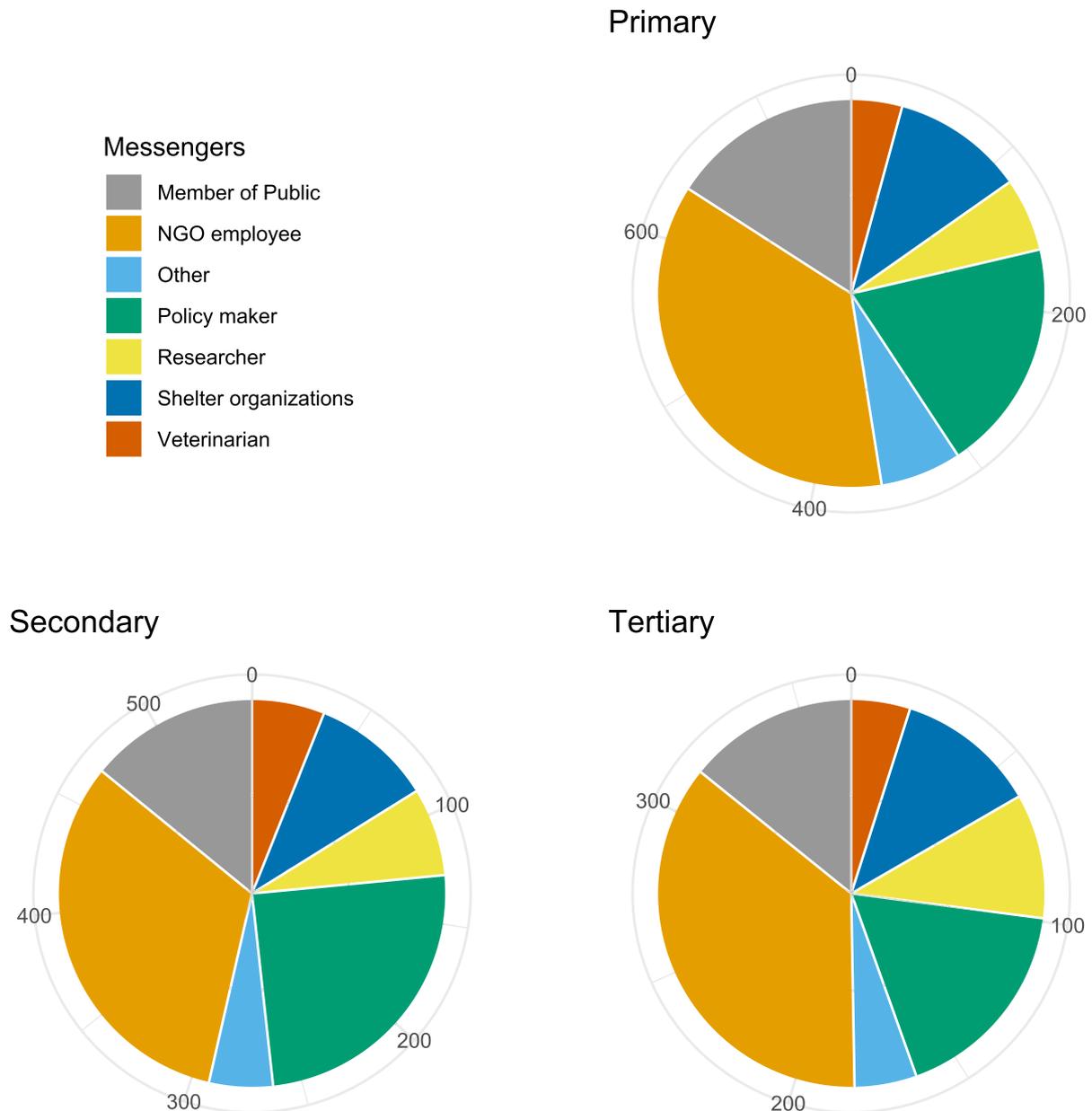


FIGURE 1 The number of interviewed people (messengers) from each affiliation. Primary refers to the first person interviewed, secondary the second, and tertiary the third. Numbers on the outside of the pie charts indicate the number of articles. Messengers were sorted into one of the following six categories: (1) Researchers, defined as those conducting research with a postgraduate degree or someone working to obtain a graduate degree that could be employed at universities, research institutes, non-profit organizations (NGO), or governments, and such an affiliation had to be explicitly mentioned in the article; (2) NGO employed advocate who is a non-researcher, including anyone that works at a non-profit not represented in the other categories; (3) shelter organizations, including humane societies or members of the Society for the Protection of Animals (SPCA); (4) politicians or policymakers (i.e. those that make decisions as either elected officials or civil servants); (5) members of the public (e.g. people that did not fall into the above groups, including outdoor cat owners); (6) veterinarians or representatives from a veterinary clinic (including veterinary technicians); (7) messengers who were not easily placed into any of the above categories or whose affiliations were unclear or unknown were scored as *other*

as “the humane and effective approach that stabilizes feral cat colonies and would offer a win-win solution for the entire Keys community”; Wadlow, 2011) and concern (e.g., ‘Some residents have argued against trap-neuter-release provision because cats prey upon local wildlife, especially birds’; Alba Soular, 2014) raised about this method

of population control (Supplement Part 5). A large number of articles also directly mentioned subsidized spay and neuter programmes (31%, 247 articles; Figure 2e). As an alternative to TNR, euthanasia was also mentioned prominently as both a negative outcome and common method of cat management (53%, 425 articles; Figure 2e),

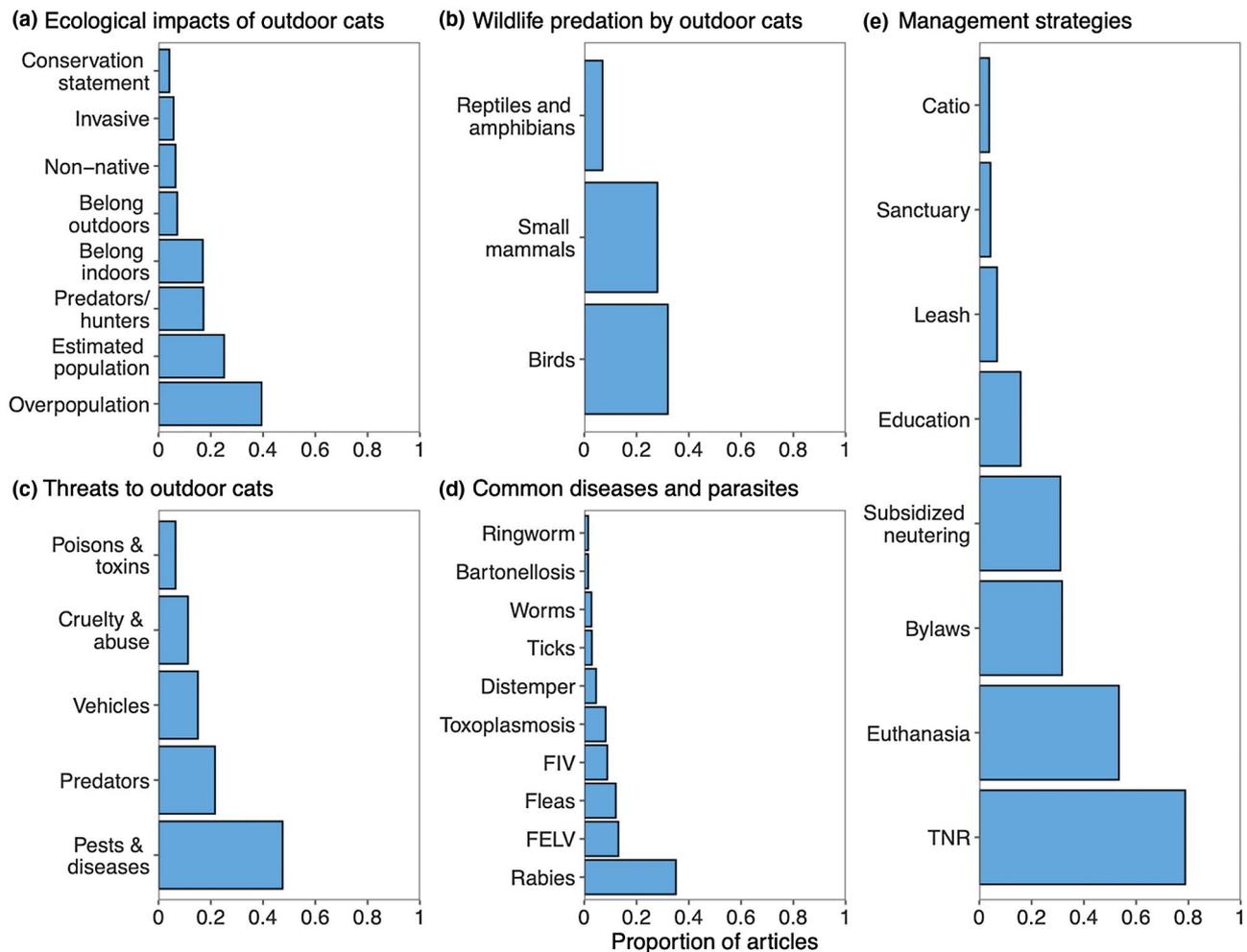


FIGURE 2 Proportion of sampled articles that describe impacts, threats, and management of outdoor cats. For each article included in our survey ($n = 796$), we evaluated whether the article discussed or included reference to (a) the ecological impacts of outdoor cats, and also looked more specifically at (b) the frequency of mentions of predation by outdoor cats on common groups of wildlife. In addition, we searched for mentions of (c) threats to outdoor cats, including (d) common diseases and parasites. Finally, we scored mentions of (e) various management strategies that have been proposed or implemented to abate the ecological impacts of and welfare threats to outdoor cats

but cat sanctuaries were rarely mentioned (4%, 34 articles). Several articles also focused on municipal-level strategies to limit cat impacts including bylaws and ordinances (32%, 252 articles) or education programmes (16%, 126 articles; Figure 2e). Proposed bylaws or ordinances that were included in media articles typically would either allow feeding of feral cats or create registration (e.g. licencing) programmes for cats. Methods to limit cat impacts also included several cat owner management solutions such as using leashes when owned cats were outdoors (7%) or building backyard outdoor cat enclosures often known as catios (4%, 30 articles; Figure 2e).

4 | DISCUSSION

Our media content analysis demonstrated that the popular press did not provide representative nor relatively equal coverage to different issues surrounding free-roaming cats. While there is no exact

formula for appropriate representation of all sides of a complex issue, in this case, for example, TNR was mentioned as a management technique for free-roaming cats in 18 times as many articles as cat sanctuaries, 1.5 times more frequently than euthanasia, and 7 times more frequently than catios and leashes combined. Most articles mentioned a cat management strategy (mainly TNR or euthanasia), while about half of the articles mentioned at least one cat health or welfare issue, and only about a third of articles mentioned an environmental impact from free-roaming cats.

Overall, people reading popular press articles would only be able to read about a fraction of the issues surrounding free-roaming cats and may not be presented with the diversity of potential solutions. This is unsurprising given that the media often frames stories to highlight specific issues and perspectives while neglecting others. This priming (see Introduction) involved more frequent coverage of some topics over others and may indicate to readers that issues surrounding cat welfare or the use of TNR are more urgent

and important than conservation and environmental issues. This is a common approach employed by some animal advocate groups and involves downplaying the risks cats pose to the environment by not mentioning them (Wald & Peterson, 2020). We also acknowledge that public sentiment may influence the tone and focus of media coverage (Scheufele & Tewksbury, 2007). However, popular press coverage of issues surrounding cats differs from peer-reviewed ecological and conservation literature that frames cats as a serious environmental and conservation issue (Blancher, 2013; Doherty et al., 2016; Loss et al., 2015), and social science literature that demonstrates that members of the public are aware of cat hunting behaviour (Crowley et al., 2019; Gramza et al., 2016; Grayson et al., 2002; Hall et al., 2016; Lilith et al., 2006; Van Patter et al., 2019a, 2019b). Overall, based on both the ecological and social science literature, the popular press is not providing adequate representation of issues of public concern, such as cat hunting behaviour, and may be intentionally or unintentionally attempting to downplay the risks cats pose to wildlife.

Including multiple perspectives and representative coverage in tackling issues regarding free-roaming cats is valuable because it can help reduce conflict between stakeholders and contribute to solutions (Wald & Peterson, 2020). This involves communities and stakeholders coming together to acknowledge competing ideas and to, more importantly, find middle ground, which becomes more challenging when the media frames issues surrounding cats as a conflict (Wald & Peterson, 2020). In Canada, for example, it has taken years of effort to reduce conflict and mitigate the one-sided representation of issues in the popular press, and the process of mitigation is still ongoing. This involved developing collaborations between multiple stakeholders (e.g., Environmental non-profit organizations, members of Humane Canada and cat welfare organizations, policy-makers from Environment and Climate Change Canada and municipalities, veterinarians and researchers; Cartwright & Fast, 2016). These efforts were supported through programmes at the national (e.g. Nature Canada's Keep Cats Safe and Save Birds Lives campaign) and regional (e.g., Vancouver Cat and Bird Advisory Committee, a subcommittee of the Vancouver Bird Sub-committee) scales, as well as the development of position statements or collaboration agreements, such as those by the Canadian Veterinarian Medical Association (CVMA, 2020) and the Vancouver Cat and Bird Advisory Committee (Saunders et al., 2021) that acknowledge the multiple perspectives and issues surrounding free-roaming cats, and the formation of municipal collaborative strategies, bylaws, and education to reduce free-roaming cat populations (e.g., City of Calgary, AB, Canada; Nature Canada, 2017). While we cannot infer whether or how the popular press is impacting people's perceptions, by not covering multiple perspectives, the popular press may be increasing perceived conflict and hindering opportunities for effective and constructive dialogue among stakeholders by suggesting that such relationships among stakeholders are impossible, which is far from the truth (discussed in: Wald & Peterson, 2020). The popular press may benefit directly from not presenting multiple sides of issues if simplifying issues has a greater appeal to the general public. It may

be worth considering, with future research, what factors have led to a disproportionate coverage of some issues and if complementary strategies can be adopted by supporters of other issues.

Other media content analyses have found similar issues with a narrow subset of solutions receiving the majority of popular press coverage and raised concerns about how this may impact public support for solutions backed by technical subject area experts that tend to receive less attention. For example, Dayer et al. (2019) noted that many popular press articles blamed a threatened shorebird for a delay in coastal development in its habitat, a framing that may increase public resentment of that species at a time when conservation biologists are looking for solutions that require public buy-in. Boyd and Paveglio (2014) expressed concerns that low attention for carbon capture and storage as a solution to climate change may result in lessened public support for this emerging technology. Shiffman et al. (2020) found that the shark conservation policy solutions supported by technical subject area experts received far less media attention than newer, flashier policy solutions with less supportive scientific evidence. Public confusion about the most effective shark conservation policy solutions may lead to the public supporting suboptimal policies not endorsed by experts. These examples suggest that the types of solutions that are presented by the popular press are not solely informed by expertise, which may ultimately result in the public not being exposed to the full scope of the issues and breadth of available solutions. Public confusion about the most effective policy solutions may, in turn, lead to the public supporting suboptimal policies not supported by experts or the evidence.

Issues surrounding free-roaming cats were framed, or oversimplified, by the popular press in three ways. First, only some stakeholder voices were regularly presented as messengers. The viewpoints and perspectives of the animal welfare and rights community and cat owners were much more commonly presented by the popular press than were those incorporating evidence-based information, viewpoints, and perspectives from researchers, veterinarians, or shelter personnel. This is unsurprising as media officials often seek out organizations or groups with a specific focus, and cat owners are a major stakeholder constituting a large portion of members of the public. Furthermore, cat colony (clusters of unowned cats often provided food and shelter) caretakers and advocates, such as many cat-focused NGOs, have extensive experience working directly with free-roaming cats and have knowledge about the problems and priorities within their respective communities and, as a result, may be perceived as local experts by journalists (Wald & Peterson, 2020). However, many people with extensive background and knowledge including years of training, research, and specializations were rarely consulted as messengers. Knowledge stemming from the environmental, biological, and social sciences form important components in debates regarding free-roaming cats. The social complexities of issues involving free-roaming cats and the partial, or sometimes ambiguous, data from research on free-roaming cats suggest that multiple forms of information should be used to inform management decisions (Lepczyk et al., 2010; Wald & Peterson, 2020). Therefore, it is

important that multiple perspectives from a variety of stakeholders be sought out by the popular press when discussing issues surrounding free-roaming cats. We acknowledge that in many cases the complex and uncertain science imposes additional challenges for journalists to write stories in ways that are appealing and interesting to the general public, but this responsibility should not be solely left to journalists. Groups and individuals (especially welfare scientists, ecologists, and social scientists) spanning the diversity of perspectives surrounding free-roaming cats have a responsibility to help clarify and explain complex issues in easily digestible ways that resonate more with media outlets and a larger audience, and such advocacy is unlikely to risk harming personal credibility or the credibility of the scientific community (Kotcher et al., 2017).

The second way that the popular press framed and simplified issues surrounding free-roaming cats was by mentioning TNR in the majority of articles and euthanasia in about half of the articles while rarely mentioning other management strategies. There are many different, context-dependent ways to manage free-roaming cats, with each method differing in its feasibility, effectiveness, welfare implications and potential environmental impacts (Cecchetti et al., 2020; Woinarski et al., 2019). In the United States, where most of the coded articles originated, TNR is a commonly employed and popular yet highly controversial cat management strategy for unowned cats (Deak et al., 2019; Wald & Peterson, 2020). These characteristics make TNR of greater interest to the public (and journalists looking to capture their attention), so it is perhaps unsurprising that TNR was more frequently mentioned by the popular press than other management strategies. However, TNR is much less common in other countries, including in Canada where many of the articles in our analysis originated (Wald & Peterson, 2020; Woinarski et al., 2019). Based on our findings and the findings from several social science studies, the popular press's focus on TNR or euthanasia does not appear to be covering nor representing the diversity of opinions and views regarding cat management strategies (Grayson et al., 2002; Hall et al., 2016; Lilith et al., 2006; Loyd & Hernandez, 2012; Van Patter et al., 2019a, 2019b; Sherwood et al., 2019; Toukhsati et al., 2012) nor the diversity of other strategies that have received widespread attention in the scientific and veterinary literature, such as education, responsible pet ownership, development of cat sanctuaries, accessible low-cost spay and neuter, and euthanasia (reviewed in: Cecchetti et al., 2020).

The third way the popular press framed issues surrounding free-roaming cats was in their coverage of the types of animals free-roaming cats impact. In the instances where the environmental impacts of cats were mentioned, the popular press focused on cats' impacts on more charismatic species, such as birds, and species that may be considered pests by members of the public, such as small mammals (e.g., rodents). Although cats do hunt birds and mammals, they also hunt other vertebrates including amphibians and reptiles (Hernandez et al., 2018; Legge et al., 2020; Woinarski et al., 2018, 2020). While this framing is unsurprising due to peer-reviewed manuscripts on cats hunting birds and mammals (e.g. Loss et al., 2013), such framing and focus by the popular press on only charismatic or

pest species presents a false dichotomy of cat hunting behaviour as either positive (e.g. hunting pest mammals) or negative (e.g. hunting birds). Past research has shown that public bias towards certain animals, especially charismatic, large-bodied animals is common. For instance, media articles in India reported stories about charismatic megafauna (such as tigers) much more frequently than smaller-sized fauna such as birds, amphibians or reptiles (Lyngdoh et al., 2017), and large mammals received more care and welfare concern than smaller animals in zoos (Hosey et al., 2020).

While robust, our approach has limitations which should be considered when interpreting our findings. Most importantly, popular press coverage is not the only information pathway through which concerned members of the public gain information, especially in the current age of social media (e.g. Parsons et al., 2014). However, popular press coverage still has the power to inform millions, which is especially true for issues that people may not know enough about to seek out alternative information sources. For example, Glithero and Zandvliet (2020) found that more Canadians learn about issues facing the ocean through media coverage (e.g. news reports) than through any other information pathway (including schooling, museums and aquariums, or from friends and family). Additionally, our approach only reveals what information people have been exposed to, which is distinct from a direct study of peoples' knowledge and attitudes. However, our results clearly suggest that people are not getting the full story when it comes to issues surrounding free-roaming cats and this may influence public perceptions of the importance or urgency of some issues, which, in turn, could possibly have downstream effects on support for or against policy solutions. Finally, because it was necessary to appropriately code such a large number of variables across hundreds of articles, each article was only examined once by one coder. Despite this, our initial intercoder reliability assessment, in conjunction with carefully crafted questions, to minimize the possibility of misinterpretation, provide confidence that this approach accurately assessed the topics and content within these articles (Riffe et al., 2005).

The issues surrounding outdoor cats are inherently complex and complicated. The deep personal connection that people have with their pets further complicates these issues. We show that the popular press is giving more coverage to some topics over others, such as the extensive coverage of TNR and euthanasia and lack of coverage of the environmental impacts from free-roaming cats. We also show that the popular press simplified the issues surrounding free-roaming domestic cats by framing, including primarily presenting the views and values from animal welfare and rights organizations as well as focusing on cat hunting behaviour of only a subset of their prey. While people form political or policy preferences by incorporating much more than factual presentation of information, inaccurate and missing facts in the media can still contribute to public misunderstanding and subpar policy outcomes.

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CONFLICT OF INTEREST

Author E.A.G. was previously employed by a non-profit organization, Birds Canada, and is on the Vancouver Cat and Bird Advisory Committee. Author S.M.K. is currently employed at the time of publication by the non-profit organization, The Nature Conservancy of Canada. All other authors have no conflict of interest.

AUTHORS' CONTRIBUTIONS

E.A.G. proposed the initial idea for the media content analysis; E.A.G. and D.S.S. conducted the LexisNexis search; All authors were involved in generating the search terms, and code book, and scoring the articles; J.B.B., A.O.S. and N.E.F. collated and summarized the data, and wrote the results; E.A.G. and D.S.S. wrote the manuscript; D.S.S. provided the strategic feedback; All authors contributed to revising the manuscript for publication.

DATA AVAILABILITY STATEMENT

That data presented in this manuscript consist of information extracted from popular press articles obtained from the search engine LexisNexus. The raw coding data for all variables that we presented have been made publicly available on the Figshare open access repository <https://doi.org/10.6084/m9.figshare.16539942> (Gow et al., 2021).

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