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Global Ecology and Conservation 38 (2022) e02270

Contents lists available at ScienceDirect

Global Ecology and Conservation

journal homepage: www.elsevier.com/locate/gecco

Discussion of wildlife trade before and during the COVID-19 pandemic in professional opinion pieces and scientific articles

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ARTICLE INFO

Keywords:
Coronavirus
Discourse analysis
Endangered species
NGO report
Policy
Public-facing media
Wildlife trade ban

ABSTRACT

Wildlife trade is a multi-billion-dollar sector that impacts a wide range of species, and thus is of significant research and conservation interest. Wildlife trade has also become a prominent topic in the public-facing media, where coverage has intensified following the outbreak of the global COVID-19 pandemic due to the potential connection between wildlife trade and the origin of the SARS Cov2 virus. Given the importance of the media in shaping public understanding and discourse of complex topics such as wildlife trade, this could impact the implementation of and public support for policy decisions. In this study, we followed a standardised protocol to extract wildlife trade-related discussion from 285 professional opinion pieces (NGO reports or articles in conservation-themed forums) and 107 scientific articles published in two time periods: "pre-COVID" (June 1–December 31, 2019) and "during-COVID" (January 1–May 31, 2020). We compared opinion pieces and scientific articles across the two time periods and to each other to investigate potential differences in the presentation of wildlife trade and associated speakers. We found a shift in the way that wildlife trade was discussed in professional opinion pieces between the periods, in that the discussion became less specific in terms of defining the legality and purpose of trade, and the animal groups involved in the "during-COVID" period. The generalised framing of wildlife trade in our dataset also coincided with an increased discussion of highly generalised management strategies, such as blanket bans on wildlife trade. We also found that publications included more quotes from researchers in the "during-COVID" period. In both professional opinion pieces and scientific articles, we found that quotations or research were often from speakers whose affiliation region was different to the geographic range of the trade they were speaking about. This highlights the importance of incorporating local knowledge and considering the diversity of speakers and interviewees in both research and the public-facing media about the wildlife trade.

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https://doi.org/10.1016/j.gecco.2022.e02270
Received 13 June 2022; Received in revised form 19 August 2022; Accepted 23 August 2022
Available online 26 August 2022
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1. Introduction

Wildlife trade is one of the main concerns for biodiversity conservation due to the threats it poses to the survival of many species (Morton et al., 2021). More than 7000 species are traded globally, with this number expected to increase in the future (Scheffers et al., 2019). Notably, wildlife trade not only impacts ecosystems and biodiversity but also poses threats to human society, such as reducing ecosystem services and facilitating zoonotic disease transmission (Cardoso et al., 2021). As such, many have called for urgent action to manage wildlife trade and protect threatened species (Borzée et al., 2020; Esmail et al., 2020). On the other hand, the market value of the legal international wildlife trade has been estimated to reach hundreds of billions of dollars annually and such trade contributes to the livelihoods of many people (Andersson et al., 2021; Hughes, 2021). Moreover, billions of dollars are invested into enforcement or measures tackling illegal wildlife trade worldwide every year (Holden et al., 2019). Human activities are fundamental to the very existence of wildlife trade and therefore understanding the human dimensions of wildlife trade (e.g., public perceptions of trade) is crucial for its management (Shairp et al., 2016; Bennett et al., 2017).

The general public is a key target group for both scientific research and management interventions where they are often regarded as consumers or potential consumers (Zhang and Yin, 2014; Wang et al., 2020). Many kinds of public-facing information around wildlife trade, such as education campaigns or popular science articles, aim to change public behaviour or attitudes as part of wildlife trade management strategies. In this information, the medium, messenger, and message content are key factors that are identified and analysed when investigating the information and the impact of the information. The medium refers to the platform through which the information, i.e., the message, is released, while messenger refers to the speaker who conveys the message (Ortega and Scartascini, 2020). Celebrities and authorities are some of the often-used messengers in public-facing information to gain a wide base interest and trust from the target audience (Olmedo et al., 2020). The impact of messenger identity on public perception has been investigated and significant differences were found between different messengers such as scientists and NGOs (Whiting et al., 2019). On the other hand, different messengers might hold different views on the same issue, thus who gets to speak out is an interesting topic due to the potential stronger impact on public perception from the dominant voice (Wang and Mumby, 2022). In terms of medium, studies have shown that media, such as reports from NGOs or non-peer-reviewed articles can both reflect and influence public perceptions, and that such influence can be long-term (Coppock et al., 2018; Shiffman et al., 2020). Furthermore, because the peer review process is not required, they can be responsive to changing events and potentially be published more quickly in comparison to peer reviewed scientific articles. For this reason, non-peer-reviewed articles from NGOs or other professionals represent an interesting data source for analysis under conditions of a rapidly developing situation, such as a pandemic.

As well as medium and messenger, the content of the message is also an important research focus. For example, the negative impacts of wildlife trade on people and the natural environment are often highlighted, including the risk to public health (Karesh et al., 2005; Smith et al., 2009). Zoonotic diseases, particularly those that are widespread or cause high fatality rates, such as Ebola, can lead to a concentrated and short-term public interest in wildlife trade (Towers et al., 2015). Similarly, the recent COVID-19 outbreak sparked intense discussion of wildlife trade and its management due to its potential association with the SARS CoV2 virus origin and initial transmission (Aguirre et al., 2020; Borzée et al., 2020). Many countries implemented special regulations concerning wildlife trade in response to COVID-19. For example, China banned the consumption of terrestrial animals for food purposes, which prompted widespread discussion of this policy in both public-facing media and scientific research (Borzée et al., 2020; Xiao et al., 2021). This timeline of events provides the opportunity to investigate the framing of wildlife trade in public-facing information before and after the outbreak of COVID-19, opening up questions about how that might influence public attitudes and understanding of wildlife trade.

In this study, we analyse the discussion of wildlife trade as presented in publicly available, written, professional opinion pieces. We focused on five main aspects related to messenger and message, including overall article focus, messenger or speaker identity (e.g., affiliation), trade information (e.g., involved taxa), proposed or implemented management strategies, and relationship between COVID-19 and wildlife trade. We identify changes in how wildlife trade was framed and what details were presented before and after the COVID-19 outbreak. We also contrast these aspects with corresponding information in peer reviewed scientific articles to assess differences in the two kinds of literature. Finally, we discuss the observed patterns in the context of wildlife conservation and wildlife trade management.

2. Material and methods

We collected wildlife trade related professional opinion pieces, defined as environmental organisation reports and articles published in online conservation forums, and scientific articles from peer-reviewed academic journals, published from June 1, 2019, to May 31, 2020, in English. We collected data from two time periods, "pre-COVID" (June 1, 2019, to Dec 31, 2019) and "during-COVID" (January 1, 2020, to May 31, 2020). For the professional opinion pieces, we extracted a list of 488 environmental organisations, including local and international, from Wikipedia (2021). We searched the official websites of these environmental organisations using the keywords "wildlife" and "trade". Using these search terms, we extracted online forum articles published in Mongabay and The Conversation, due to their thematic focus on conservation science and wide readership. To collect scientific articles published during the study period, we searched the Scopus, ISI and PubMed databases using the same keywords.

We excluded articles with no date and removed duplicate articles from the same platform. We read each article to extract general information and target information. General information included publishing date (and study period for scientific articles), publishing platform and the URL or DOI (for scientific articles). For targeted information, we extracted the following pieces of information ("aspects") about article content, following a detailed protocol (see Appendix 1): 1) the overall focus of the article (six predefined categories). The goal of extracting article focus was to capture what the whole article is about. Thus, short (one or two paragraphs)

discussions were not regarded as article focus. In the extraction process, more than one choice was allowed but not encouraged to maximise clarity. A maximum of three foci were allowed if the article discussed multiple aspects, for example, an article about pet trade (purpose of trade) of one group of animals (species/taxa) in one country or region (country/region) would have foci summarised as "species; country; purpose" with the sequence corresponding to the relative importance of the foci; 2) speaker identity, who may or may not be the author of the article (e.g., their affiliation type using predefined categories, affiliation country), 3) trade information (e.g., taxa and common name of animal group traded, where the trade happened, legal or illegal etc.), 4) management strategies proposed or implemented, and 5) the relationship between trade and COVID-19, if any was discussed or reported (five non-mutually exclusive predefined categories, with only one choice allowed). Details of these five aspects are presented in Fig. 1. We removed articles that were not relevant to the study (such as conference advertisements or news-style seizure reports), those that were primarily about COVID-19 and only briefly mentioned wildlife trade, and those not about animal trade. We excluded non-animal-related wildlife trade since its connection with COVID-19 or zoonotic diseases was minimal and therefore not likely to impact attitudes towards trade.

2.1. Data analysis

The extracted original texts were re-reviewed to conduct qualitative and quantitative analysis. First author conducted this step to avoid inconsistencies between coders. In this phase, we generated codes based on the extracted text and codes were grouped into categories to understand patterns (Newing, 2010). To test whether there was a difference in the proportion of discussed categories between the "pre-COVID" and "during-COVID" periods, we first calculated the frequencies of occurrence of these categories within each period and compared results using a proportion Z-Test. We used a p value threshold of less than 0.05, Cohen's H index greater than 0.2, and whether the sample size was sufficient (at least 5 counts in each group; Agresti and Franklin, 2007) to define significant difference (Rosenthal et al., 1994). In addition to differences between time periods, we also compared professional opinion pieces with the scientific article to investigate potential differences in wildlife trade discussion. Spearman's rank correlation was used to identify general trends in category relationships between different time periods or information sources.

3. Results

We collected 664 professional opinion pieces using the keywords search on major environmental organisation websites or online conservation forums. After filtering, a total of 285 opinion pieces ("pre-COVID" = 92, "during-COVID" = 193) from 50 publishing platforms were included in the analysis. We gathered 184 scientific articles and 107 of them ("pre-COVID" = 55, "during-COVID" = 52) were used for further analysis.

3.1. Professional opinion pieces

From the professional opinion pieces, 386 target information entries or discussions were extracted ("pre-COVID" = 115, "during-

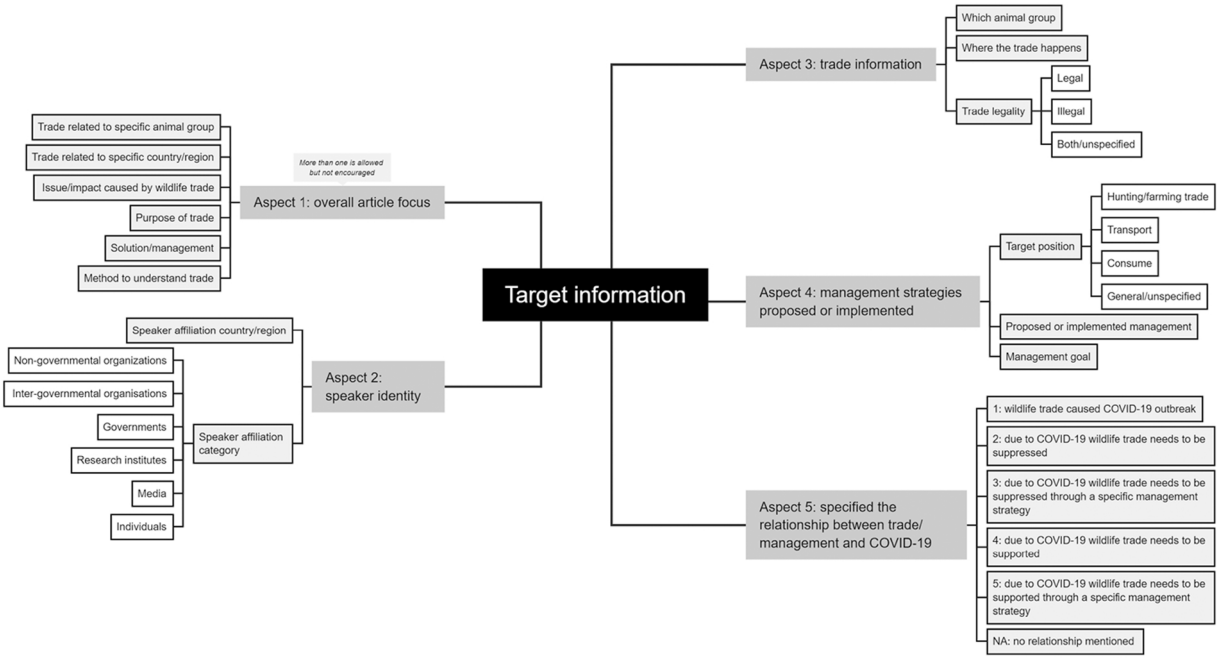

Fig. 1. The target information extracted from the professional opinion pieces and scientific articles.

COVID" = 271). We found that in both time periods most of the speakers held NGO affiliations (75.7 % in the "pre-COVID" period and 60.1 % in the "during-COVID" period). The "during-COVID" opinion pieces included significantly more research institute-affiliated speakers than "pre-COVID" pieces (8.7 % in the "pre-COVID" and 21.0 % in the "during-COVID") and fewer NGO affiliations (for both $p < 0.005$; Cohen's $H > 0.3$). No significant difference was found in other affiliation categories, such as the media, individual, government, or intergovernmental organisation. The most frequent speakers' affiliation country was the USA (44 %) followed by the UK (18 %). No significant differences were observed between time periods regarding the speaker affiliation country/region frequency. We found that wildlife trade or policy in 43 countries/regions was discussed in opinion pieces. The USA was the most frequently discussed country in the "pre-COVID" period (22 % out of 115) while China became the most frequently discussed country in the "during-COVID" period (24 % out of 271) with a significant increase comparing to "pre-COVID" ($p = 0.008$; Cohen's $H = 0.4$).

The content of the opinion pieces differed between the pre- and during-COVID periods in several aspects significantly ($p < 0.006$; Cohen's $H > 0.3$). We first looked at the focus of the whole article (aspect 1) and found that significantly more opinion pieces primarily focused on issues caused by wildlife trade in general (such as public health risks or welfare problems) in the "during-COVID" period (71 %) compared to the "pre-COVID" period (54 %) while significantly fewer opinion pieces primarily focused on animal groups, indicated by the "trade related to specific animal groups" category, in the "during-COVID" period (11 %) compared to the "pre-COVID" period (29 %). No significant differences were found in other focus categories including solutions to trade-related issues, countries/geographical regions, methods to study trade, and trade purposes.

When looking at animal groups discussed in opinion pieces, we found that the "during-COVID" pieces (76 %) discussed trade more in relation to general wildlife rather than regarding a specific animal group compared to the "pre-COVID" period (43 %; $p < 0.0001$; Cohen's $H = 0.69$). The percentage of articles focusing on mammals was significantly lower in the "during-COVID" period (19 %) compared to before (33%; $p = 0.002$; Cohen's $H = 0.33$) (Fig. 2). Regarding trade legality, a lower percentage of the opinion pieces clearly defined wildlife trade as legal or illegal in the "during-COVID" period (47 %) compared to the "pre-COVID" period (67 %; $p = 0.0003$; Cohen's $H = 0.41$). Discussions from the "during-COVID" period explicitly specified the purpose of the trade less frequently compared to the "pre-COVID" period. For example, discussion on trade without specified purpose comprised 50 % of the discussion in the "during-COVID" period compared to 37 % in the "pre-COVID" period ($p = 0.02$; Cohen's $H = 0.27$). While we observed a significant increase in discussion of wildlife traded as food products, other trade purposes including ornaments, pets, and cloth, were discussed less "during-COVID" than "pre-COVID" (Fig. 3).

We extracted a total of 263 specific management strategies, i.e., what to implement, (75 from the "pre-COVID" period and 188 from the "during-COVID" period) and 273 specific goals (76 from the "pre-COVID" and 197 from the "during-COVID" period) mentioned in opinion pieces about wildlife trade. We grouped management strategies into 16 categories (Fig. 4). We found a significant positive Spearman's rank correlation between the management strategies discussed in the two time periods suggesting that the same management strategies were discussed to similar extents in articles in the pre-COVID and during-COVID periods ($p = 0.007$ and $rho = 0.64$). However, large differences in percentage were observed in a few categories, namely: recommendations for an overall ban, for precautionary regulations (e.g., restricting trade or raising trade permission standards), for a partial/temporal ban, public campaign recommendations, and recommendations for better monitoring strategies (e.g., adding more zoonotic diseases checks). Opinion pieces from the "during-COVID" period discussed directly banning or reducing wildlife trade more than in the "pre-COVID" period, in terms of either overall or partial bans or more precautionary regulations. In contrast, opinion pieces from the "pre-COVID" period included more discussion of using public campaigns and better monitoring of the wildlife trade. Strengthening enforcement, reforming policy or law, and emphasising cooperation between stakeholders were focused on across both time periods. Due to the limited count number in certain categories, for example, "overall ban" was not mentioned in the "pre-COVID" period, a statistically significant difference was only found in the category monitoring, which suggested better or stronger monitoring of wildlife trade as a management strategy ($p = 0.045$; Cohen's $H = 0.27$).

The goals mentioned in opinion pieces were grouped into 14 categories (see Fig. 5). Preventing a future pandemic was the most frequently mentioned goal in the opinion pieces from the "during-COVID" period (45 % out of 197), followed by ending or reducing

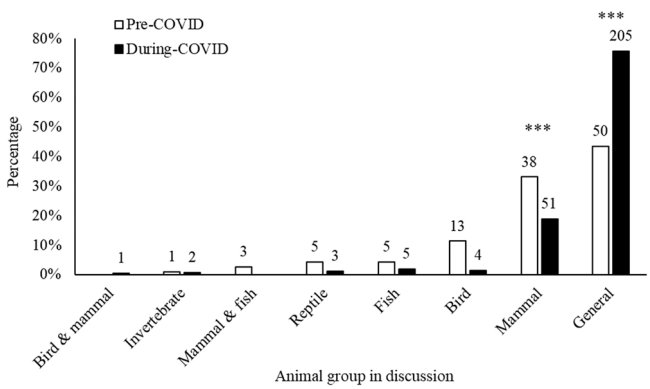

Fig. 2. Animal group discussed in professional opinion pieces. Asterisks indicate significant differences in proportion between time periods. $N_{pre\text{-}COVID} = 115$; $N_{during\text{-}COVID} = 271$.

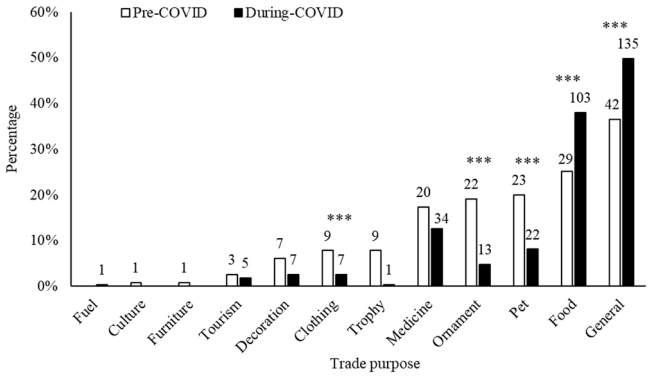

Fig. 3. Purpose of the trade as discussed in professional opinion pieces. Asterisks indicate significant differences in proportion between time periods. $N_{\text{pre-COVID}} = 115$; $N_{\text{during-COVID}} = 271$.

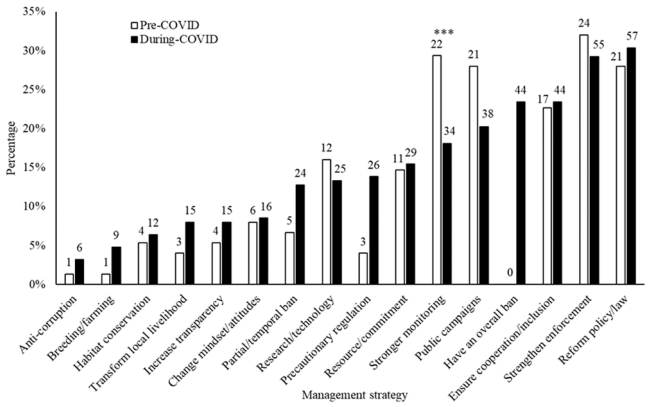

Fig. 4. Management strategies mentioned in professional opinion pieces. Asterisks indicate significant differences in proportion between time periods. $N_{\text{pre-COVID}} = 75$; $N_{\text{during-COVID}} = 188$.

trade (38 %) and protecting ecosystems/species (24 %). Ending or reducing trade (43 % out of 76) and protecting ecosystems/species (45 %) were also the main goals discussed in the "pre-COVID" period, with significantly more focus on ecosystems/species in "pre-COVID" than "during-COVID" ($p = 0.0007$; Cohen's $H = 0.443$).

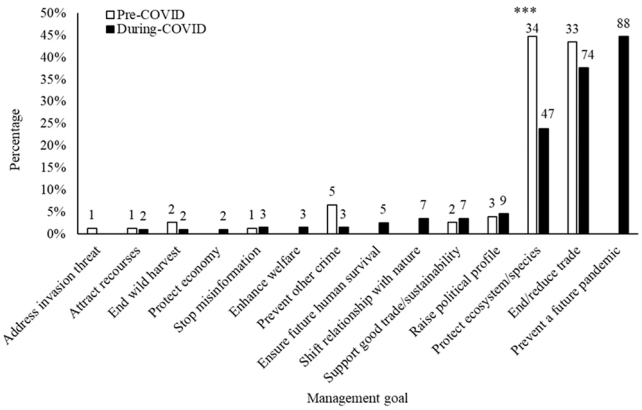

Fig. 5. Management goals mentioned in professional opinion pieces. Asterisks indicated significant differences in proportion between time periods. $N_{\text{pre-COVID}} = 76$; $N_{\text{during-COVID}} = 197$.

3.2. Scientific articles

In scientific articles, there were no significant differences between time periods in any of the aspects analysed. As with the professional opinion pieces, the most frequent speaker affiliation countries were the UK (24 % out of 107) and the USA (16 %). The top three most frequently discussed countries were Indonesia (15 %), China (7%) and Brazil (7 %). More than half of the discussed trade was specified as illegal (52 % out of 107), with legal trade discussion taking up 13 %, while the rest was not specified. In comparison to the opinion pieces, scientific articles focussed more on specific animal groups (44 %) and methods to understand trade (31 %), with less content focussing on the issues caused by wildlife trade (37 %) or solutions to these issues (7 %) (Fig. 3) ($p < 0.03$; Cohen's $H > 0.3$). Beyond food (23 %) and medicine (22 %) as the commonly discussed trade purposes, the pet trade (33 %) was the top focus in scientific articles. A total of 17 management strategies were categorised from sampled scientific articles and research/technology (36 %) was the most commonly discussed of these 17 strategies, followed by public campaigns (21 %) and better monitoring strategies (17 %). The concept or recommendation of an overall ban or partial/temporal ban was only mentioned three times in all the literature explored. Understanding trade (24 %), ending/reducing trade (20 %), and better enforcement (17 %) were the top three management goals mentioned in scientific articles.

4. Discussion

Managing wildlife trade is essentially managing related human behaviours, which can be influenced by various factors such as intentions and attitudes (Ajzen, 1991). Many conservation interventions target these factors through providing the public with specific messages aiming to subsequently change their behaviours (Green et al., 2019). Thus, understanding how wildlife trade is presented in the public domain is also important as it can influence behaviour related factors. The COVID-19 pandemic has sparked discussions on wildlife trade, as shown by the increasing opinion pieces on this topic across our study periods. This indicates an increase in public and media attention to wildlife trade which could benefit or harm the conservation of threatened species. In our study, we investigated the impact of the global COVID-19 pandemic on how wildlife trade was discussed in professional opinion pieces, e.g., NGO reports, and scientific articles, i.e., articles published in peer-reviewed journals. We observed shifts in how wildlife trade was discussed in professional opinion pieces over the two time periods, but no changes in scientific articles. We observed three main shifts in opinion pieces: first, wildlife trade discussion in the "during-COVID" period tended to be more general in terms of the content. Secondly, we observed a shift of the commonly discussed management strategies, from more mild "better monitoring trade" to more stringent regulations such as banning the trade. Finally, there was a difference in frequent speaker affiliations between the two periods, with an increase in research institute affiliations during COVID-19 outbreak. Some aspects remained stable across the two time periods, such as the most frequent speaker affiliation regions and the difference between speaker affiliation regions and the regions in the discussion. No significant differences were observed in scientific literature across the two time periods, most likely due to the long publication process required for peer-reviewed literature. However, this suggests that the observed shifts in professional opinion pieces were more likely due to the impact of COVID-19 rather than other potential factors such as changing scientific research findings.

The importance of public-facing information, such as NGO reports, lies not only in delivering knowledge but also in the potential to contribute to behaviour or policy change (Ladle et al., 2005). Many researchers have also highlighted the important role of the public-facing press in shaping agendas and policy directions (Feldman, 2007; Brulle et al., 2012; Shiffman et al., 2020). However, neither function is likely to benefit from less context-specific discussion of wildlife trade, such as not differentiating legal or illegal trade, as the effectiveness of both behaviour change and policy change relies on context-specific information (Shairp et al., 2016; Roe and Booker, 2019). We found that the discussion of wildlife trade in professional opinion pieces shifted towards a more general framing after the COVID outbreak, such as not specifying trade legality or traded taxa. This shift was shown in multiple aspects from trade legality to purpose of trade, and the animal group involved in trade. Researchers have frequently highlighted the complexity embedded within the term "wildlife trade" from the definition of wildlife to the context-dependent management (Challender et al., 2015; Roberts and Hinsley, 2020). Generalised and simplified discussion on complex issues may lead to wrong understanding and cause various negative impacts. Taking climate change as an example, studies have highlighted the issues such as climate scepticism and proposing oversimplified solutions resulting from miscommunicating climate change in mass media (Gavin and Marshall, 2011; Höök and Tang, 2013; Schroeter et al., 2015). Similarly, the more general framing of wildlife trade we observed during the pandemic could lead to ineffective solutions to this complex issue.

The concept of an overall ban on wildlife trade became one of the most frequently discussed management strategies after the COVID outbreak, while strategies such as monitoring wildlife trade were discussed less. This co-occurred with the observation that proposed management goals shifted from protecting biodiversity to preventing future pandemics. This shift might explain why the overall ban is increasingly proposed. Banning wildlife trade is discussed often as a measurement to prevent future pandemic since the COVID-19 pandemic and some previous zoonotic disease outbreaks originated from wildlife trade (Smith et al., 2009). Despite being commonly proposed in professional opinion pieces, the feasibility and effectiveness of an overall ban have been questioned in many scientific articles published in the "during-COVID" period (Eskew and Carlson, 2020; Roe et al., 2020; Roe and Lee, 2021). Arguments against an overall ban highlight negative impacts on livelihoods and are sceptical of the potential effectiveness of overall ban in preventing the next pandemic. Since banning wildlife trade alone cannot eliminate human wildlife interaction or spill over events in future, emphasis on banning wildlife trade can detract attention from management strategies, including strengthening health-care systems. Moreover, criticism of an overall ban as a solution to the wildlife trade issue was common even before COVID-19 (Cooney and Jepson, 2006; Rivalan et al., 2007; Conrad, 2012). The criticisms discussed in these studies, such as stimulating the black market and the absence of local voices in decision-making processes, apply also in the current scenario. In light of this, the discussion

concerning a general wildlife ban might also represent a difference between scientific research and the public-facing media. Further research could investigate whether this is indicative of a difference in positionality on bans or on the level of detail being reported by the two sources.

Professional opinion pieces in the "during-COVID" period included more research from academic institution-affiliated persons than in the "pre-COVID" period. The importance of science-based information in popular science has been discussed extensively in relation to other complex issues such as climate change (Ladle et al., 2005; Gow et al., 2021). Wildlife trade is a complex and constantly evolving issue that may also benefit from increasing the presence and contribution of academic research voices in public-facing media. This collaboration can support the general public in obtaining a more comprehensive understanding of wildlife trade and drive relevant policy development towards evidence-based solutions. Additionally, the pandemic may have created another incentive for governments to act and change how wildlife trade is managed (Halbwax, 2020). As shown in our results, preventing a future pandemic has become the top goal described for managing wildlife trade compared to the biodiversity narratives which dominated in the "pre-COVID" period. Reforming policy or law was also the most frequently discussed management strategy in the "during-COVID" period. Many countries have already responded to this, including China and Vietnam, by introducing several wildlife trade or farming regulations in response to the COVID-19 pandemic (Booth et al., 2021; Xiao et al., 2021). Context-specific and evidence-based wildlife trade discussions allow more insights into practical and effective management recommendations and thus might also help to maximise the potential outcomes using this policy-change window (Green et al., 2015; Phelps et al., 2016).

In a few cases, the discussion of an overall ban appeared to result from a misinterpretation of new policy in China. The "wildlife consumption ban" in China, which specified the scope to be terrestrial animals for food consumption (Xiao et al., 2021), was framed as an overall ban on wildlife trade or a general ban on wild animal consumption (e.g., in WWF, 2020). This misinterpretation could also be the result of the increasing generalised framing of wildlife trade, meaning that a ban on a specific type of wildlife products is generalised in discussion as an overall ban on wildlife trade. Either way, the potential negative consequences of such misinterpretation need to be considered, and including more local perspectives might benefit a more accurate presentation. The inclusion of diverse opinion-holders not only matters in terms of ethics but also helps to accurately understand the local context (Margulies et al., 2019).

In addition to differences observed between time periods, we also found a shared pattern in both professional opinion pieces and scientific articles in that speaker affiliation country/region and topic country/region were often different. This could partially be because we excluded articles written in other languages and thus institutions/organisations in English-speaking areas are more common. However, when the discussion of China as a topic country increased significantly in the "during-COVID" period, the number of speakers based in China has not increased correspondingly. Although globalisation has facilitated international research and allowed individuals to gain expertise beyond their country/region of affiliation, members of local communities who are affiliated with organisations in their home countries also represent important voices and these should be accessible in the English language-dominated discourse where possible (Cooney and Jepson, 2006). This is particularly important when considering locally relevant policies or management as highlighted in many studies (Baker et al., 2019; Trisos et al., 2021).

This study has limitations that could provide future research opportunities. Firstly, our study only included English articles. However, simply including other languages cannot easily solve this limitation. English as an internationally practised language has its unique status and application (Li, 2003). Other languages are often associated with one or a few countries/regions. Thus, investigating the difference between English articles and other languages needs to include country/region as a variable to account for such bias. However, since our study focuses on the discussion of wildlife trade before and after the COVID-19 outbreak, language difference is another aspect that we cannot cover but would be an interesting future topic. Secondly, we found relatively few scientific articles that discussed wildlife trade in this context following the COVID-19 outbreak. This could be due to the long publication process for scientific articles which as seen in our study is on average two years. However, our primary aim in including those articles was as a contrast to the public-facing articles that have a much faster publication time. Since our study focuses on public facing media, although scientific articles are potential information sources, they are not the main information source for the general public. Therefore, opinion pieces were the main focus of this study and the potential changes in scientific articles could be an interesting future research direction.

Moreover, the minimal differences in scientific articles in our study from the two study periods suggested that the observed differences in professional opinion pieces were more likely due to COVID-19 rather than changes in scientific research, which formed the basis of our discussion. We have detected the changes in professional opinion pieces that can respond more quickly than peer-reviewed scientific articles to major events such as the COVID-19 outbreak, while the peer reviewed scientific articles may take longer to reflect events. Besides scientific articles and professional opinion pieces, other public-facing media types, such as news reports and social media might also provide different and complementary perspectives on wildlife trade. For example, many studies have demonstrated social media data as a powerful tool in detecting illegal wildlife trade or monitoring public responses to major conservation events (Toivonen et al., 2019; Fink et al., 2020). Due to capacity limitations and our research interest, we did not investigate other information sources besides professional opinion pieces and scientific literature. Further investigation into different media types and how they are understood by the public may be important. Another potential future research direction could be to analyse the patterns in wildlife trade framing over an extended timeframe to investigate whether the changes observed in this study represent long-term trends.

5. Conclusion

We analysed the wildlife trade-related discussion in the public-facing media and scientific articles of two time periods: pre-COVID (June 1–December 31, 2019) and during-COVID (January 1–May 31, 2020). In terms of the message content, we found that the framing of wildlife trade in professional opinion pieces became less context-specific, and generalised management plans such as overall

banning of wildlife trade were discussed more frequently in the second half of our study period. In regard to the messenger, we found that professional opinion pieces also presented more voices from researchers compared to the "pre-COVID" period. However, local voices remained under-represented throughout the study period. The differences between the affiliation in terms of the country/region of the main speaker in the report and the topic country/region was also observed in scientific articles. Based on our findings and focus on the medium of reporting, we highlight that the public-facing media could include more context-specific wildlife trade discussions, which has the potential to better facilitate policy development and implementation. We also emphasise the importance of incorporating local voices in both public-facing media and scientific articles.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Hannah S Mumby reports financial support was provided by Branco Weiss-Society In Science Fellowship. Hannah S Mumby reports financial support was provided by Association for the Study of Animal Behaviour.

Data Availability

Data will be made available on request.

Acknowledgements

We thank the authors of the published literature and publications used in our analyses. HSM thanks the Branco Weiss – Society in Science Fellowship for funding, including to support positions for DM and KW. HSM also thanks the University of Hong Kong for start-up and seed grant funding (project 104006707), including PhD scholarships to HT and SP and positions for YW. HSM is grateful for the Christopher Barnard New Investigator Award from the Association for the Study of Animal Behaviour, which provided funding for computer equipment.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.gecco.2022.e02270.

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