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News selection and framing: the media as a stakeholder in human–carnivore coexistence

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Abstract

The media widely covers large carnivores and their impacts on human livelihood and plays an important role in their conservation. Yet, we know little about how species identity affects news selection, framing, accuracy and information flow. We investigated the online coverage of two cases of attacks or alleged attacks on humans alternatingly attributed to wolves and dogs in Greece and Germany. The period during which wolves were considered the primary suspects for the attacks was covered by up to two times more articles than when dogs were suspected. Wolves were presented as more likely suspects for the attacks than dogs, and wolf articles contained more inaccuracies measured as title-text mismatches. Press agencies played a significant role in the selection and dissemination of wolf news. We suggest that conservation scientists, journalists and policy makers work together to ensure an accurate representation in the media of human–carnivore coexistence and its challenges.

1. Introduction

Human–carnivore coexistence is an intensely debated topic with a corresponding broad resonance in the media (Chapron *et al* 2014, Chapron and López-Bao 2016). The mass media can be defined as a key stakeholder in conservation (Reed 2008, Durham *et al* 2014), because of the impact of media agenda on public agenda, i.e. its agenda-setting role (McCombs 2005). Hence, news organizations can play a positive role in conservation, e.g. by raising species awareness (Fernández-Bellon and Kane 2020). They can also affect species management, e.g. when voicing public protests against shark hazard mitigation measures (McCagh *et al* 2015). Four topics are especially important for conservation scientists to better understand the role of the media for human–carnivore coexistence: how news are selected, how they are framed, what is the level of news accuracy (i.e. level of title-text mismatch), and how the information flows among news organizations.

First, one needs to understand what makes news about large carnivores worth publishing. Journalists tend to select news stories according to ten major criteria of newsworthiness: power elite, celebrity, entertainment, surprise, bad news, good news, magnitude, relevance, follow-up and newspaper agenda (see Harcup and O'Neill 2001 for a full description). It

follows that stories involving carnivores in European human-dominated landscapes often satisfy the criteria of entertainment (charismatic animal), surprise (depredation events, drama), bad news (livestock loss, injury or fatality), good news (conservation success) and relevance (currently ongoing wolf range expansion in many regions).

Second, news framing, i.e. the way an information is interpreted by the journalist and presented to the public (Brüggemann 2014), can have an important impact on public opinion (Scheufele 1999). Since only few people directly interact with large carnivores (i.e. farmers, hunters), public opinion of human–carnivore coexistence is often shaped by media coverage and news frames (Bombieri *et al* 2018). The media portrayal of large carnivores tends to focus more on negative aspects of their presence (Bombieri *et al* 2018), which can artificially increase public's risk perception and have long-lasting consequences on public support for carnivore conservation (Gore *et al* 2005). Such negative framing is critical because negative perceptions have greater impact on attitudes than positive perceptions (Kansky and Knight 2014). Eventually, the media-induced risk amplification can affect stakeholders' behavior and support for management and policy, and can therefore affect conservation efforts (e.g. mitigation strategies, communication campaigns) (Gore and Knuth 2009).

Third, reporting accuracy is a fundamental, if not the primary principle of journalism (e.g. Tuchman 1972, Editor's Code of Practice 2019). Inaccuracies consist of misleading or distorted information, including headlines not supported by the main text. In the context of carnivore conservation, inaccuracies are problematic as they mislead the audience on the reality of human–carnivore coexistence, and affect news organizations' credibility on the topic (Maier 2005).

Fourth, it is essential to understand how the information flows between news organizations (De Lange *et al* 2019), to identify key actors of news selection and dissemination at a time where news quickly spread across borders. It can reveal important telecoupling processes (i.e. social and environmental interactions over distances) (Liu *et al* 2013), whereby news quickly affect distant audiences' perceptions of large carnivores (Macdonald *et al* 2016) and can trigger management decisions (e.g. calls for population control of predators).

Perception of risk is a fundamental component of human–wildlife coexistence, as high levels of perceived risk can lead to disproportionate impacts on wildlife (Dickman 2010). In fact, the media plays a decisive role in shaping risk perception, and is thus one of the many factors potentially contributing to conflict escalation or de-escalation (Cusack *et al* 2021). Despite their potential importance for conservation, news selection, accuracy, framing and information flow have received little attention and certainly have not been studied in combination. Furthermore, news selection, framing and accuracy have not been investigated in relation to species-specific differences, although this is critical to identify species that are of particular concern with regard to news coverage.

Here, we investigated news selection, framing, accuracy and information flow in relation to two cases of alleged wolf (*Canis lupus*) and dog (*Canis lupus familiaris*) attacks on humans. The two cases mirror each other in that (a) news coverage was split in two phases as the respective attacks have been alternatingly attributed to wolves and dogs, (b) they recently occurred in Europe (Greece—2017, Germany—2018) in the absence of witnesses except the victim; and (c) they rapidly triggered an important peak in local and national media coverage. These two cases provide a unique, quasi-experimental design to investigate differences in (a) news selection (number of articles), (b) framing (article content), (c) accuracy (title-text mismatches) and (d) information flow (publication networks) among news featuring the alleged wolf and dog attacks.

2. Methods

2.1. Case studies descriptions

The first case refers to the death of a British hiker in Greece on 21 September 2017 ('Greek case' hereafter). In the first phase (22–25/9), the media mainly reported it as a dog-related fatality, as the victim—before her death—called her family to say that she was under attack by dogs. In the second phase (26–29/9), the media mainly reported wolves as responsible for the attack, after the coronary was quoted in an article from The Times (London) saying the victim 'may have been attacked by wolves' and potentially 'rabid wolves or jackals' (De Bruxelles and Carassava 2017). Later investigations led to the charge of a local shepherd for negligent homicide, for not properly controlling his livestock-guarding dogs (court decision pending).

The second case refers to an incident in Germany on 27 November 2018, when the local police published a press release stating that 'a worker from the Bülstedt municipality was bitten by a wolf at the cemetery in Steinfeld' ('German case' hereafter) (Kreiszeitung 2018). In the first phase, the media mainly reported a wolf-related injury (28/11–3/12). In the second phase (4–9/12), the media mainly reported the results of the environmental DNA investigation, which showed no evidence of wolves being present in the area, and only evidence of dogs, roe deer (*Capreolus capreolus*) and domestic cat (*Felis catus*). See supporting information methods S1 (available online at stacks.iop.org/ERL/16/064075/mmedia) for more details.

We could not find any other modern record of a carnivore attack on somebody that involved a similar reporting where two species were alternatingly

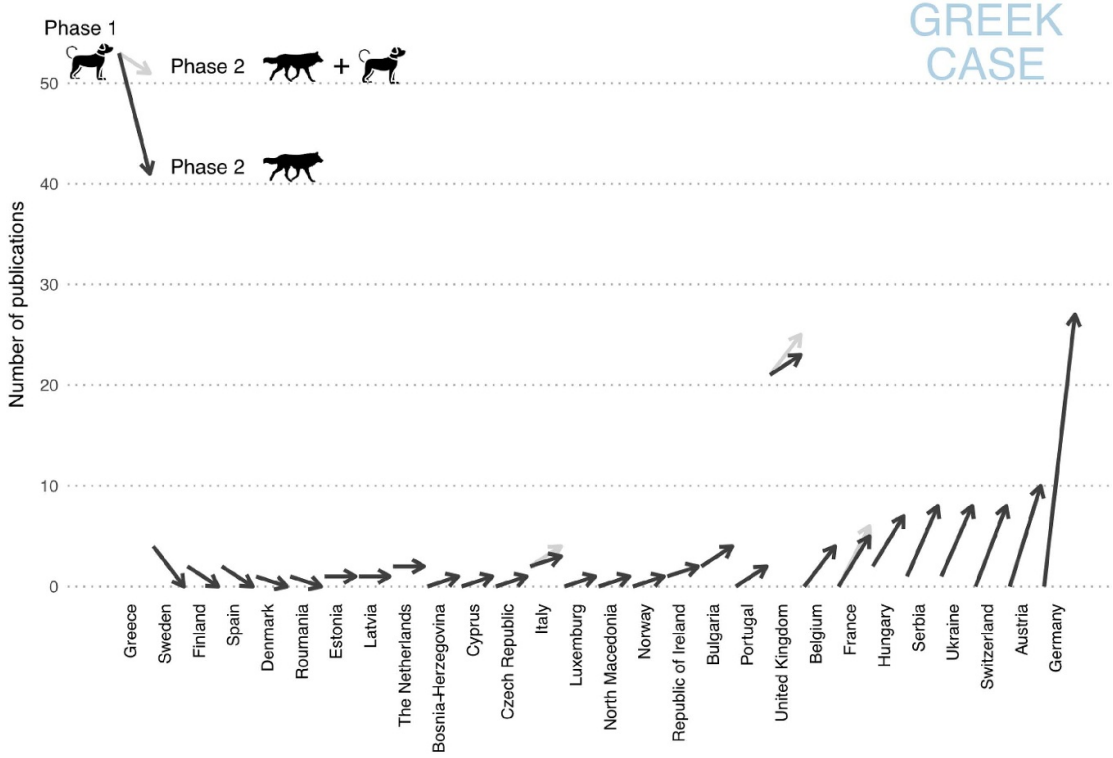

Figure 1. News selection in the Greek case, as indicated by the rate of change in the number of online publications in Europe covering this case (i.e. a British tourist presumably attacked by dogs or wolves in Greece) between two publication phases. For each country, the black arrow start displays the number of publications reporting on the case during phase 1 (from 22 to 25 September 2017) and the black arrow end displays the number of publications mentioning wolves as (at least) 'possibly responsible' for the attack (phase 2, from 26 to 29 September 2019). The grey arrow displays the total number of publications in phase 2 (i.e. adding also publications not mentioning wolves).

blamed for the incident (i.e. providing the same quasi-experimental set-up).

2.2. News selection

We searched for free-access, online articles pertaining to both case studies. For the Greek case, we searched for articles in the 27 European Union countries and the European countries for which the European Journalism Centre provided a description of the 'media landscape' (EJC, http://ejc.net/ during our research; currently at https://medialandscapes.org) ($n = 33$ in total). For each website listed in a country's 'Print Media' and 'Digital Media' section of the EJC website, we searched for articles matching the following keywords in the local language: the victim's name, Greece, wolf, dog, attack, Maroneia, Rodopi, Komotini, British tourist, and checked all online articles for the period spanning over phase 1 and phase 2. Additionally, we searched for articles using the same key words in local language using Google and Google News. Finally, we checked all online articles quoted by the ones we had already detected, and included them for the analysis. We used the same approach for the German case, but since the incident was mostly covered by German media, we focused our analysis on German articles. We searched for publications matching the following keywords in German in Google: Steinfeld, wolf, animal bite, attack, cemetery, DNA.

2.3. News framing

We categorized the content of each article title and text in relation to the animal species that were described as being potentially responsible for the attack, namely: dogs, wolves or other animals (jackals—*Canis aureus*—and unknown wild animals). To investigate species framing, each species was categorized as being 'responsible', 'probably responsible' or 'possibly responsible' for the attack in the main text as well as in the title of each article, adopting a conservative approach for ambiguous content, i.e. using the most cautious category of those occurring in the same title or text (see supporting information methods S2). We adopted the same approach for the German case and we categorized articles' titles and texts in relation to the two species (dogs and wolves), in six categories: 'responsible', 'probably responsible', 'possibly responsible' for the attack, 'no proof of wolf attack', 'probably not responsible' and 'not responsible' for the attack. Furthermore, we recorded the occurrence of violent terms in the articles' titles (e.g. containing words like 'attack', 'horror', 'bloody', 'mauled to death', etc.). Finally, to investigate the variability in the individual articles' content and ensure that the results on accuracy and framing do not solely hinge on the few news outlets that did the original reporting of the two cases, we conducted a corpus data analysis. We investigated text

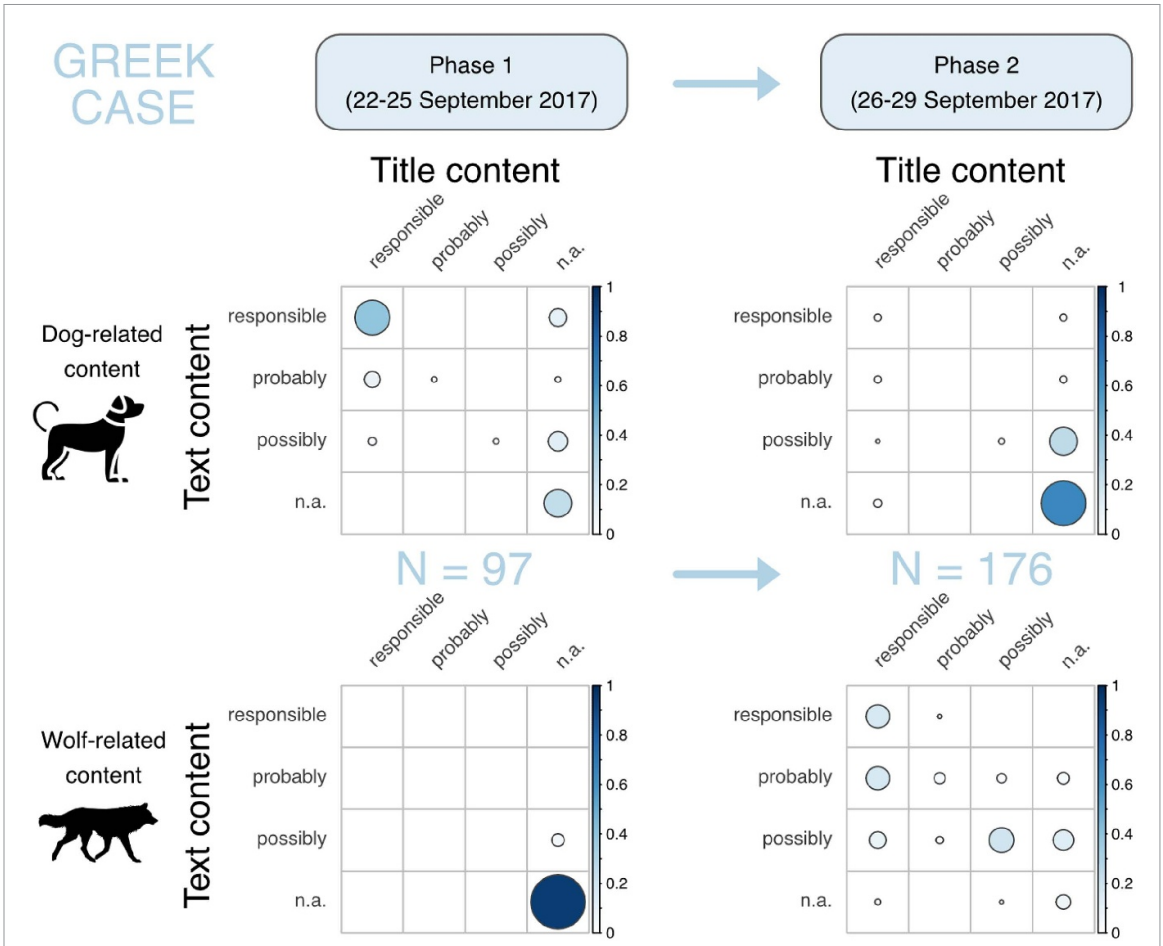

Figure 2. Framing and accuracy of online articles featuring dogs and wolves in the Greek case. The figure shows the comparison of publications' title and text content in relation to a potential attack of dogs (top panels) or wolves (bottom panels) of a British tourist in Greece during two phases of media reporting—before (left panels) and after (right panels) a coronary's interview in The Times where he said the person 'may have been attacked by wolves'. Circle sizes represent the proportion of publications in each category. 'n.a.' = species not mentioned in the text and/or title.

dissimilarity using hierarchical clustering and Natural Language Processing for three languages, namely English, German and Greek languages (figure S1 in supporting information).

2.4. News accuracy

We investigated the extent to which title and text content matched for each species based on the categorization of title versus main text. We created contingency tables for each species in each publication phase. We calculated accuracy as the proportion of articles where title and text content were matching, i.e. they would appear on the diagonal of the contingency table. Note that this measure of news accuracy is not equivalent to news truthfulness.

2.5. Information flow

To understand the information flow among news organizations, we conducted a network analysis using the 'igraph' package (Csardi and Nepusz 2006) in R (R Core Team 2019). As articles quoted news organizations rather than specific articles, we created directed networks where network nodes represent news organizations, and compared them across the two phases of each case. We investigated the structure of each network based on edge betweenness and network modularity. Modular networks contain clusters of nodes with dense connections to each other within one cluster, but few connections to nodes belonging to other clusters, as opposed to centralized networks where nodes are well connected to each other and a few nodes have higher-than-average number of connections.

3. Results

We found 273 online articles in 28 countries for the Greek case (figure 1), and 287 articles for the German case. News selection (i.e. number of online articles) was 1.8–2 times higher in the period during which wolves were considered the primary suspects for the attacks than when dogs were suspected (Greek case: $n = 97$ articles from 77 sources in phase 1; $n = 176$ from 148 sources in phase 2; German case: $n = 193$ from 93 sources in phase 1; $n = 94$ from 62 sources in phase 2).

Framing of dog-related and wolf-related attacks differed (figures 2 and 3). In the Greek phase 1, most

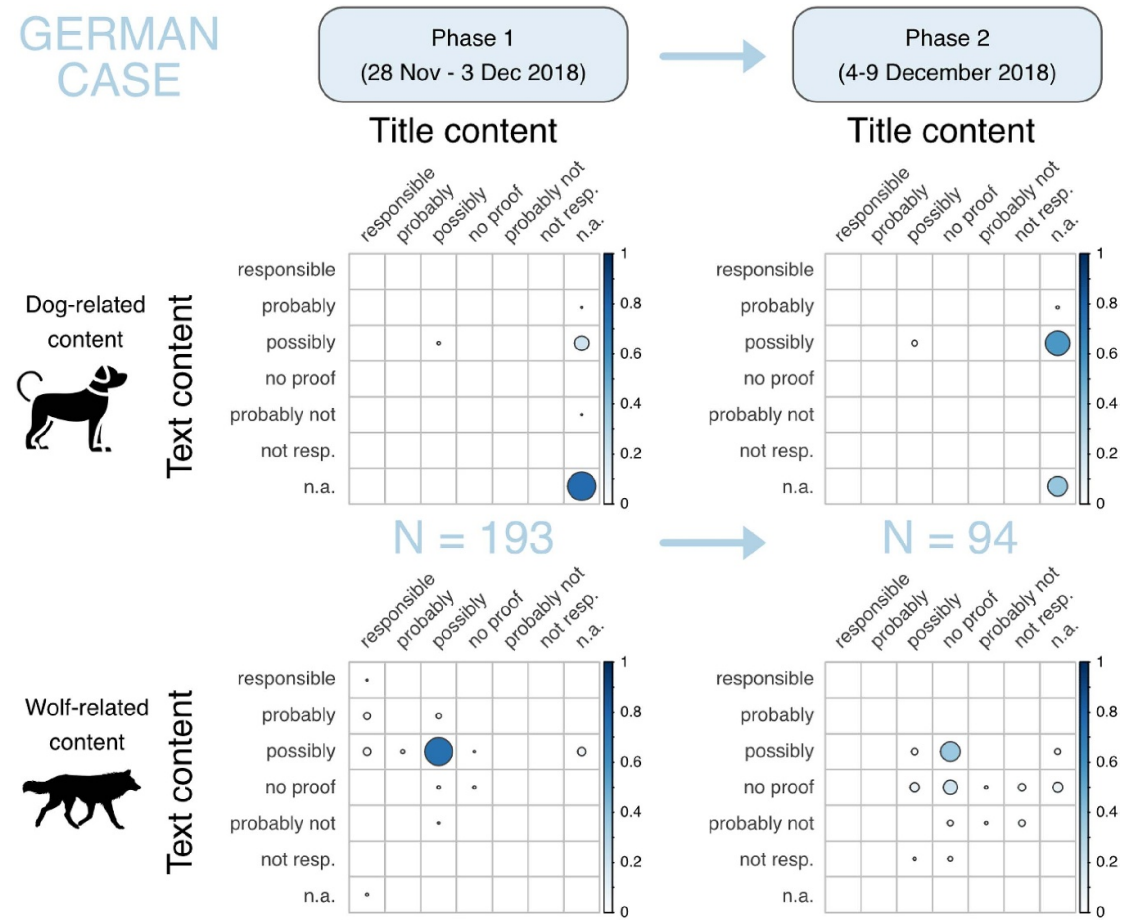

Figure 3. Framing and accuracy of online articles featuring dogs and wolves in the German case. The figure shows the comparison of publications' title and text content in relation to a potential attack of dogs (top panels) or wolves (bottom panels) of a person in Germany during two phases of media reporting—before (left panels) and after (right panels) the public announcement of a DNA investigation showing no DNA traces for wolves, but traces of dogs (plus roe deer and cat). Circle sizes represent the proportion of publications falling in each category. 'n.a.' = species not mentioned in the text and/or title.

articles depicted dogs as being 'responsible' (40%), 'probably' (10%) or 'possibly responsible' (15%) for the attack. In phase 2, after the coroner's interview, dogs were hardly mentioned in the titles (7%), and wolves were framed as being either 'responsible' (46%), 'probably' (7%) or 'possibly' responsible (6%) for the attacks in the titles (figure 2; see supporting information figure S2 for other species).

In the German phase 1, wolves were mostly framed as being 'possibly' responsible for the attack (79% of titles), while dogs were hardly mentioned in titles (18%) (figure 3). In phase 2, after DNA results were known, dogs were framed as 'possibly' responsible for the attack only in news' texts (60%, only 3% in titles), while wolves were still mentioned both in texts and titles and mostly framed as 'possibly' responsible for the attack (44% of publications' texts) (figure 3). Additionally, the proportion of titles containing violent terms was higher in the Greek phase 2 than in phase 1 (73% vs. 54%), and higher in the German phase 1 than in phase 2 (69% vs 44%) (supporting information figure S3). The additional corpus data analysis in three languages demonstrated the variation in article content in each case study, with up to four identified clusters of publications (with variations in words used and text length within clusters), corresponding to as many original stories in each phase of each case study (figures S4–S10 in supporting information).

In both cases, accuracy was highest in phase 1 (66% accuracy in articles featuring dogs in the Greek case, and 76% in those featuring wolves in the German case). In phase 2 of the Greek case, accuracy was higher in articles featuring dogs than wolves (67% vs 31%, respectively). In phase 2 of the German case, accuracy was higher in articles featuring dogs than wolves (41% vs 24%, respectively). The variation in news accuracy was independent from the original reports on each case study (figures S11–S12 in supporting information).

The information flow differed between phase 1 and phase 2 of the Greek case (figure 4). In phase 1 (dog involvement), articles were mostly linked to Greek (ANA-MPA press agency, ERT) and British

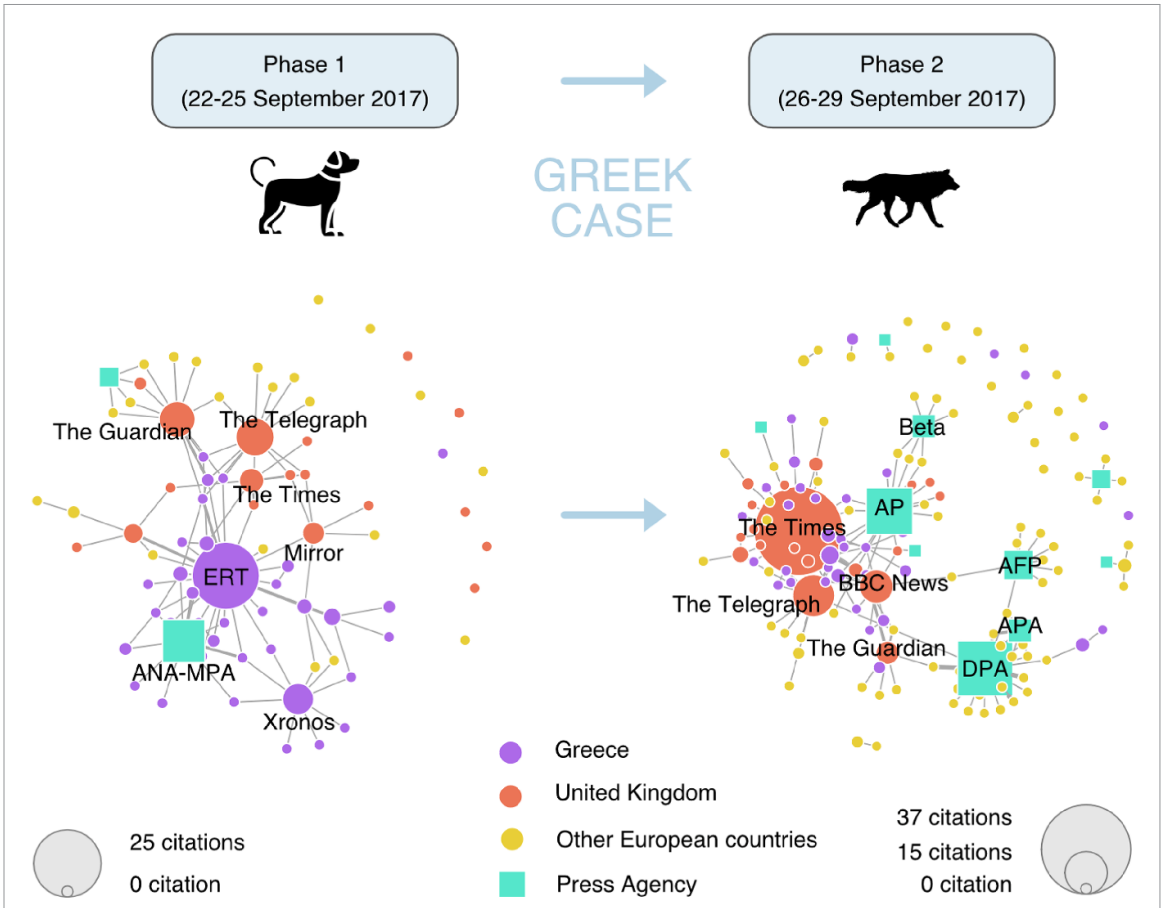

Figure 4. Information flow of the Greek case (i.e. a British tourist presumably attacked by dogs or wolves in Greece) during phase 1 (left, dominated by dog-related reports) and phase 2 (right, dominated by wolfrelated reports). Network nodes represent news organizations that have released at least one publication online during a specific phase. Network edges (i.e. grey links between nodes) represent a citation of one news orgnaization by another. Node size represents the number of times a specific news organization was cited during a specific phase. In phase 1, publications mostly relied on the releases of the Greek press agency (ANA-MPA) and national broadcaster (ERT), and British newspapers. In phase 2, publications became international and mostly related to British news organizations and national or international press agencies (squares, DPA, APA, Beta, AP) that relayed the information of a potential wolf attack on a person. News organizations that were cited at least five times are displayed in each phase. AFP = French Press Agency; ANA-MPA = Athens News Agency—Macedonian Press Agency; AP = Associated Press; APA = Austrian Press Agency; Beta = Serbian News Agency; DPA = German Press Agency; ERT = Hellenic Broadcasting Corporation.

media (e.g. The Telegraph, The Guardian, The Times, The Mirror). In phase 2 (wolf involvement), publications were more international and mostly related to British organizations or national (e.g. German and Austrian press agencies, Beta News Agency) and international press agencies (Associated Press). Hence, network modularity was lower in phase 1 (0.54) than in phase 2 (0.64) and we found more node clusters in phase 2 ($n = 14$) than in phase 1 ($n = 6$) (supporting information, figure S13). We detected 11 and 17 isolated nodes in phase 1 and 2, respectively (i.e. nodes with no connections).

The information flow was similar in the networks of both phases of the German case, which were focused around DPA press releases (figure 5, supporting information figure S14). They differed in that the modularity was higher in phase 1 (wolf involvement) (0.41, 4 clusters, 12 isolated nodes) than in phase 2 (dog involvement) (0.32, 5 clusters, 11 isolated nodes).

4. Discussion

Our results show that news organizations selected wolf over dog stories, that they tended to present wolves as more likely suspects for the attacks than dogs, and that accuracy of articles featuring wolves was lower than those featuring dogs. Our analysis of the information flow in the Greek and German cases revealed the significant role of press agencies in the selection and dissemination of wolf news. It is important to note that despite the presence of re-reporting of original information across news organizations, this alone did not explain the editorial processes that (purposefully or not) led to differential

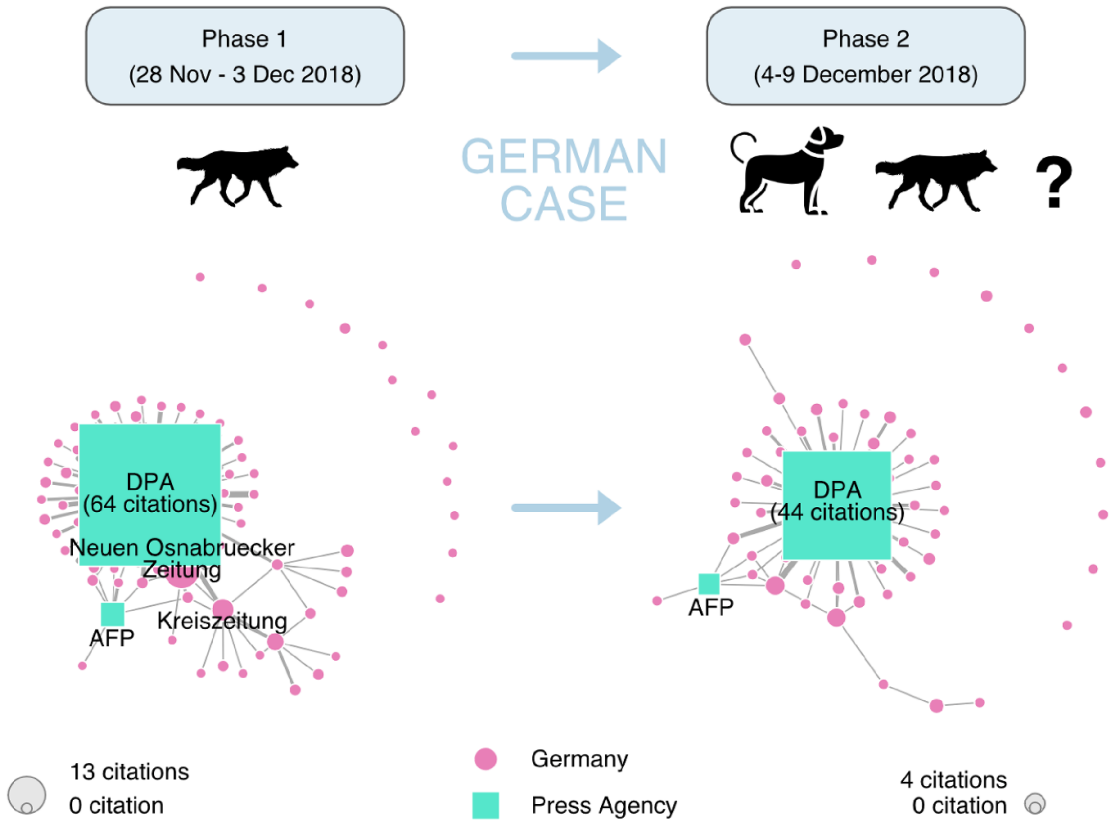

Figure 5. Information flow of the German case (i.e. a community worker presumably attacked by dogs or wolves in Germany) during phase 1 (left, dominated by wolf-related reports) and phase 2 (right, featuring the absence of wolf DNA after investigation). Network nodes represent news organizations that have released at least one publication online during a specific phase. Network edges (i.e. grey links between nodes) represent a citation of one news organization by another. Node size represents the number of times a specific news organization was cited during a specific phase. AFP = French Press Agency; DPA = German Press Agency.

news selection, framing and accuracy between wolf and dog publications.

4.1. Differential news selection, framing and accuracy

Both cases revealed differences in news selection, framing and accuracy between wolf- and dog-related stories. Both cases confirmed the newsworthiness of wolf stories despite the unlikeliness of such an attack in Europe (Linnell *et al* 2021). The media selection of such isolated events as news, and the framing around the attribution of wolf responsibility in the alleged attacks may divert attention from larger issues associated with wolves (e.g. implementation of prevention measures against livestock depredations in Germany, or free-roaming dog management in Greece; Kim 2015). The fact that news organizations relayed the Greek case intensely in some countries (e.g. Germany) illustrates the high local relevance and potential intensity of conflicts over wolf management (Cusack *et al* 2021). Besides, as stories with subjective writing style and polarized sentiments are more prone to be shared through social media (Harcup and O'Neill 2017), the more violent terms in the titles of wolf compared to dog stories may be especially problematic and public opinion of wolves may be altered at a large scale (Scheufele 1999). Recent studies have revealed changes in news framing of large carnivores over time (Killion *et al* 2018), between local and national scales (Chandelier *et al* 2018) and across carnivore species (Bombieri *et al* 2018), and future studies should look into the actual effects of such framing on people's attitudes towards large carnivores. The perpetuation of negative framings and increased media salience can transfer into increased personal salience (Atwater *et al* 1985), contributing to risk amplification in people's opinion and to decreasing support for conservation (Gore and Knuth 2009). Such coverage, which is often loaded with negative sentiments in the context of human–wolf coexistence (Arbieu *et al* 2021), may reinforce people's belief that wolves are dangerous to humans. Thus, over the long term, the media can directly or indirectly affect policy activity (Miller *et al* 2018). Finally, lower accuracy in wolf-related news tended to blur the message about wolf responsibility in these alleged attacks. Journalists usually use quotation (Tuchman 1972) and verification (Shapiro *et al* 2013) as strategies to ensure accuracy, yet e.g. only 20% of article titles in the Greek phase 2 referred to the coronary's opinion.

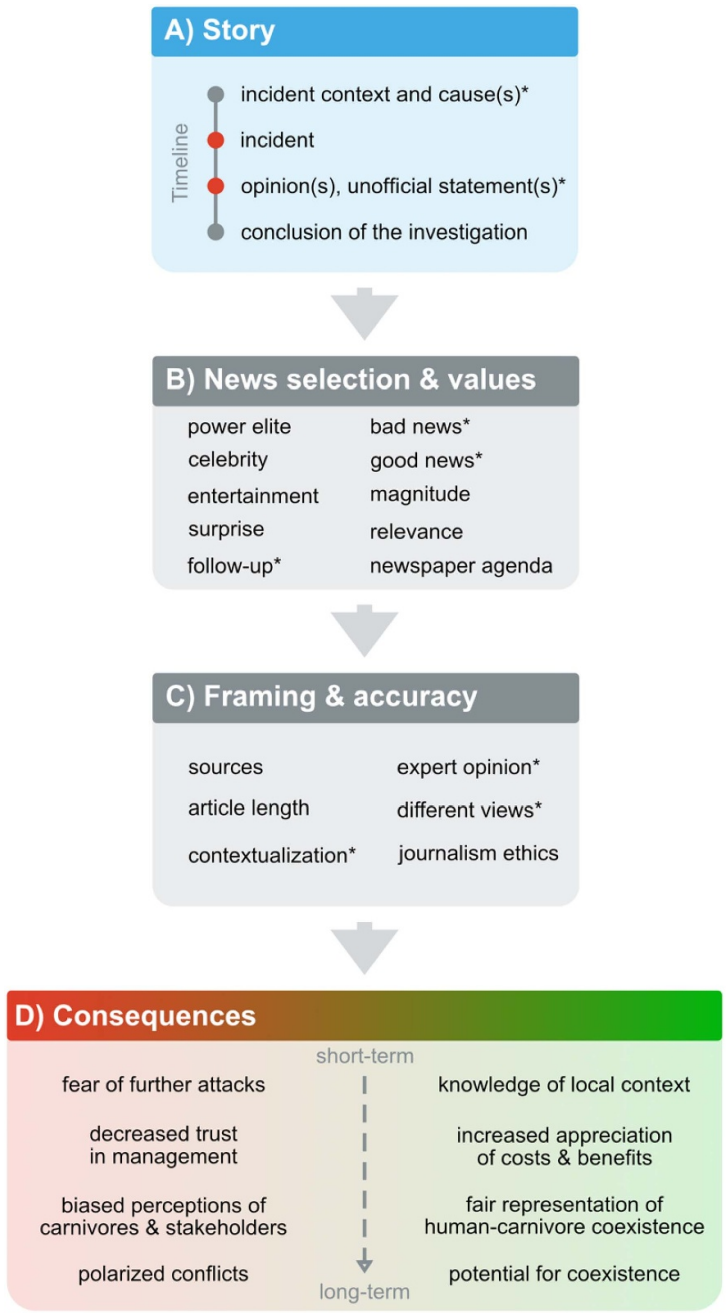

Figure 6. The different steps in the process of news selection, story framing, and the consequences on human–wolf coexistence. When a specific story (box A) matches news selection criteria and specific news values (box B), the way it is framed (box C) can influence local, regional, national and even international state of coexistence between carnivores and people (box D), with potential implications on the short-, medium- and long-term. The scientific community can act in multiple steps of this process (marked with an asterisk*), to help with the analysis and contextualizing of news involving carnivores (and go beyond reporting only incidents and opinions, marked with red dots) and to contribute to a fair representation of costs and benefits of human–wolf coexistence.

4.2. Telecoupling processes and key actors of information flow

Our results suggest important telecoupling processes, whereby the news of an alleged wolf attack in one location spread over most European countries (figure 1), triggering political stances and potential management decisions in other locations. Hence, after the incident in Greece, the German Federal Ministry of Agriculture publicly called for lifting the wolf's strictly protected species status (Heine 2017). Furthermore, 33 articles on the German case mentioned the until then 'unresolved case' of the alleged 'wolf attack' in Greece, perpetuating the representation of wolves as a public threat, although both alleged attacks most probably did not involve wolves (supporting information S1). Such telecoupling processes uncover the potential influence of the media in carnivore conservation, which trespasses ecological and socio-political boundaries (Dallimer and Strange 2015).

The analysis of publication networks highlighted the role of national and international press agencies in selecting, framing and sharing the news of alleged wolf attacks. Press agencies are major sources of information for news organizations that can quickly reach local to international audiences (Hamer 2006). In particular, the increasing homogenization and concentration of online news structures (Cottle 2009) facilitates the fast exchange of information at broad scales (see e.g. German media concentration: www.kek-online.de/medienkonzentration/mediendatenbank/#/). Thus, press agencies play a pivotal agenda-setting role in a journalism environment where the pressure for exclusivity may override concerns of accuracy (Johnston and Forde 2009). The rewriting of press releases, i.e. 'churnalism', is increasingly common in online news organizations (Johnston and Forde 2009), and the norm in journalism practices has shifted from information interrogation to information dissemination (Lewis *et al* 2008). As journalism is no longer exclusively defined by eyewitness reporting, conservation scientists should contribute knowledge and skills in both aspects of analysis and contextualizing, for example in trans-disciplinary workshops involving conservation scientists, journalists and policy-makers (Hathaway *et al* 2017) to maintain standards of accuracy in carnivore-related news.

4.3. Towards improved communication

Higher and more focused engagement of conservation scientists with the media could lead to improved communication on human–carnivore coexistence and governance. As conflicts between humans and wildlife are increasing worldwide with negative impacts on wildlife species and ecosystems (Woodroffe *et al* 2005), there is indeed a growing need for integrative approaches to transform human–wildlife conflicts into sustainable coexistence (König *et al* 2020). We therefore suggest that conservation scientists can participate at multiple steps of the publication process to make sure that accurate information is broadcasted to the public and that human–carnivore coexistence is not jeopardized by news selection, framing and accuracy (figure 6). Local and national press agencies are privileged points of contact in this regard.

Conservation scientists can help provide context on an incident (e.g. attack location, history of verified attacks, appropriate behavior) and share expertise on negative (e.g. depredation events, problematic individuals) as well as positive events (e.g. conservation success, tourism opportunities, positive public attitudes) (O'Bryan *et al* 2018). Providing follow-up coverage until the end of an official investigation should enable the public to know about the official conclusions of a case. Finally, engaging with journalists would offer different viewpoints on an issue (e.g. that of wildlife biologists, social and political scientists, etc) and avoid one-sided information (De Vreese and Boomgaarden 2006). On the other hand, journalists should use caution in the attribution of responsibility in case of alleged carnivore attacks and critically evaluate political stances on the topic of carnivore conservation and management.

The ongoing COVID-19 pandemic has had profound impacts on human–nature relations (Soga *et al* 2021), while revealing a widespread intensification of fake news and rumors in the media (Hartley and Vu 2020). This calls for increased scrutiny of the media landscape, to ensure that human–nature relations are not artificially distorted by misleading information. Therefore, our final recommendation for policy-makers is to establish a platform for fact-checking wildlife news. Fact-checking has become an important component of the media landscape (Graves and Cherubini 2016), and such initiative would help the public to critically evaluate online news concerning human–wildlife coexistence. Ideally, a fact-checking platform would be maintained by a partnership between news organizations and experts in wildlife conservation, with news outlets publishing timely checks of questionable reports.

Data availability statement

The data that support the findings of this study are available upon reasonable request from the authors.

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