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Transience of public attention in conservation science

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Societal awareness of, and engagement with, environmental problems is a critical prerequisite for effective conservation programs. Research has revealed a strong general pattern whereby public attention received by cultural products diminishes over time. If transposed to conservation, this transience of societal attention is likely to be of major importance because it can limit motivation to support conservation efforts. We address the concept of attention transience applied to conservation, discuss its major drivers and mechanisms, and provide a short overview of conservation issues for which this phenomenon is expected to be particularly relevant. Attention transience leaves a brief window of opportunity for conservationists to focus public awareness and to mobilize necessary support. In this context, it is critical to maximize the conservation benefits generated during these short bursts of attention, especially through tailored conservation marketing campaigns with targeted message framing and regular efforts to refocus attention on key issues.

Front Ecol Environ 2023; doi:[10.1002/fee.2598](https://doi.org/10.1002/fee.2598)

Societal interest is critical to the success of many conservation programs (Jarić *et al.* 2020). Greater societal interest can create windows of opportunity for policy actions, enhancing conservation efforts as well as increasing commitment

and investment (Clements 2013; Carpenter and Konisky 2019). However, as information dissemination and consumption accelerate due to the revolution in communication technologies, public attention may decay more rapidly, often within days to weeks (Lorenz-Spreen *et al.* 2019). Such transience of societal attention (for definitions of selected specialist terminology, see WebTable 1) is a pertinent issue in conservation. Interest may diminish as relevant topics become less newsworthy, limiting motivation to support conservation goals (Downs 1972). Furthermore, the perceived salience of an environmental issue, and how long it remains perceived as salient, determines its likelihood of being included in policy agendas and actions (Pralle 2009). Such societal attention transience affects a wide range of global issues, including climate change, environmental disasters, threats to declining populations, and extinction events (Pralle 2009; Acerbi *et al.* 2020; Fink *et al.* 2020).

Here, we provide a conceptual overview of attention transience in conservation and discuss its major drivers and mechanisms. We highlight conservation issues for which attention transience is relevant and illustrate these with examples drawn from conservation culturomics, using indices of online societal interest (Panel 1; Ladle *et al.* 2016). Finally, we outline major implications of attention transience related to conservation issues, and suggest key mitigation measures, policy recommendations, and future research directions.

■ The theory of attention transience

Public attention transience is especially manifested during focusing events, which can be defined as sudden, relatively uncommon, attention-grabbing events that often concentrate

In a nutshell:

- Transience of societal attention is an important issue in conservation, as it may contribute to the narrowing of windows of opportunity for generating public support of conservation goals and efforts
- Societal attention transience has been documented for a wide range of global issues, including climate change, environmental disasters, threats to declining populations, and extinction events
- Measures to cope with attention transience can aim to either affect attention dynamics or maximize efficiency of conservation interventions and advocacy during brief peaks of public interest
- To address attention transience effectively it is important to recognize people's cognitive and psychological constraints, and consider tried-and-tested media communication practices

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Panel 1. Culturomic indices of collective attention

The global communication revolution, brought about by the advent of the Internet and digital media, opened new possibilities to the study of human culture, attention, attitudes, and values (Michel *et al.* 2011). The emerging field of culturomics, which is focused on improving understanding of human culture through the quantitative analysis of large bodies of digital data, has also been applied in conservation science and practice (Ladle *et al.* 2016). These novel approaches offer a unique opportunity to directly measure, explore, and monitor spatiotemporal trends in collective attention (Lorenz-Spreen *et al.* 2019). Online engagement and information-seeking indices, such as search-engine query volumes (eg Google Trends platform), represent good

proxies for collective attention and have been increasingly used to study attention toward various conservation issues (Clements 2013; Carpenter and Konisky 2019; Verissimo *et al.* 2020). Other culturomics data sources that may be used to study collective attention include Wikipedia page views, social media activity, news coverage, and online images (Acerbi *et al.* 2020; Fink *et al.* 2020). Ultimately, using multiple data sources will considerably improve understanding of attention dynamics (Fink *et al.* 2020). It should be noted, however, that culturomics data are less suitable indices to measure cumulative effects and heuristics of attention. This topic represents an important frontier for future research.

attention on previously dormant issues (Birkland 1998). The process of attention propagation through media following such events has been recognized as “moment inertia” (Thaler *et al.* 2017). Focusing events can arise from news coverage of environmental disasters, new scientific findings, or reports from high-profile organizations or key opinion leaders; locally, they can also be driven by direct experiences. Following an initial peak of public attention to the event, attention tends to decline quickly and return to background levels (Figure 1). Within a conservation perspective, such focusing events can be driven by observed or predicted threats to biodiversity or ecosystems and the services they provide, and also relate to threats to human safety and well-being.

Conservation attention dynamics can be conceptualized through the issue-attention cycle (Downs 1972), which consists of five stages: (1) pre-problem; (2) alarmed discovery and euphoric enthusiasm, which includes increased public awareness of the problem; (3) gradual realization of the high costs of solving

the problem; (4) decline of intense public interest, driven by discouragement or boredom; and (5) post-problem, wherein attention to the issue fades and eventually is diverted to other matters and events. Downs (1972) suggested that such dynamics are mainly driven by a systematic, intrinsic, and predictable cycle of heightened and declining public interest, and to a lesser degree by changes in the actual conditions, whereas Djerf-Pierre (2013) contended that environmental attention dynamics are driven mainly by social interactions and competition for attention. Recent findings support the latter notion, showing that modern attention transience is driven by intensifying content production and information flows that compete for temporally and cognitively limited public attention (Lorenz-Spreen *et al.* 2019).

■ Attention dynamics and decay characteristics

Attention decay following a focusing event is often very rapid, with the attention half-life (Figure 1) often spanning a few days or weeks, using culturomic indices as an imperfect proxy (Panel 1). For example, publication of the “World’s 25 Most Endangered Primates” list led to a spike in online search volume followed by a quick decline, with an attention half-life of about 2 days (Acerbi *et al.* 2020); public reactions following the death of the last male northern white rhinoceros (*Ceratotherium simum cottoni*) also lasted only a few days (Fink *et al.* 2020); the killing of “Cecil”, a male African lion (*Panthera leo*), by a trophy hunter caused a surge of public interest, which then declined by two-thirds over the course of a week (details below; Figure 2b; Carpenter and Konisky 2019); and the observed half-life of the so-called “climategate” controversy was 6 days, and declined further to 10% of the peak attention within 3 weeks (Anderegg and Goldsmith 2014). Nevertheless, the “climategate” controversy might have also produced

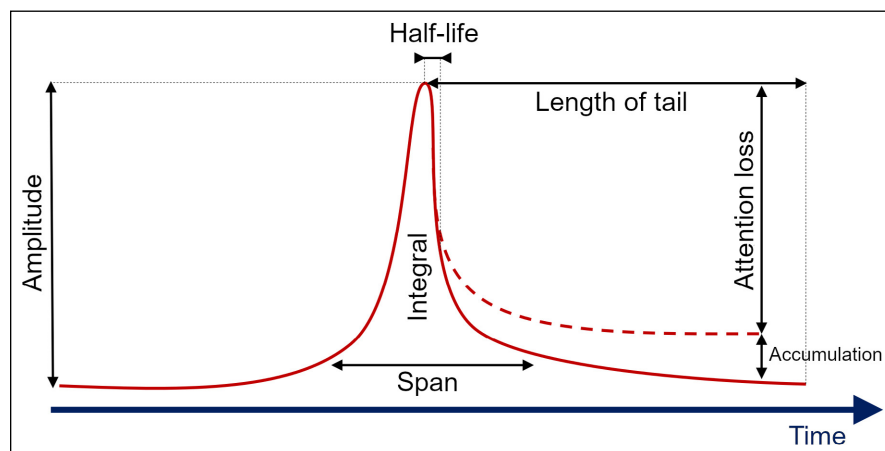


Figure 1. Components of the issue-attention cycle, which can be used to measure, characterize, and study attention-transience dynamics. Amplitude: relative height of the peak attention as compared to the average background level during the preceding period; span: duration of the issue cycle; integral: cumulative attention allocated during the issue cycle; length of tail: period between the peak of attention and its decline to background levels; attention half-life: time required for attention to decline by half as compared to the peak level. Attention (solid line) can also decline to a new, higher level (dashed line) as a result of accumulation of latent interest.

longer-lasting effects on public perceptions and decision making beyond this period. High levels of attention may be sustained over longer periods when the events develop or unravel gradually (Figure 2a) or are surrounded by ongoing controversy (Djerf-Pierre 2013).

After focusing events, attention can decay to pre-event levels, or establish a new higher baseline level (Downs 1972), with the difference representing accumulating carryover effects (Figure 1; Ryo *et al.* 2019). Conservation issues can also experience recurring attention peaks that produce a wave-like pattern: for instance in the case of annual commemoration days of an environmental accident or an extinct species (Djerf-Pierre 2013).

■ Attention transience of different conservation issues

Attention decay may occur with many conservation threats, including habitat loss, climate change, biological invasions, and pollution. We focus here on a few relevant conservation issues and events, specifically (1) environmental accidents and disasters, (2) emerging threats and impacts, (3) species extinctions and rediscoveries, and (4) conservation marketing and advocacy campaigns. Although we tried to identify as diverse a set of examples as possible, the list is not intended to be systematic or exhaustive.

Environmental accidents and disasters commonly attract considerable public attention (McDonald 2009). Such disasters are more likely to generate focusing events if they both affect the environment and threaten public health, livelihoods, amenity, or safety. Environmental accidents and disasters that have led to strong focusing events include oil spills (eg *Deepwater Horizon* in 2010 and the *Sanchi* oil tanker collision in 2018); mining and industrial disasters (eg Baia Mare cyanide spill in 2000); nuclear accidents (eg Fukushima Daiichi radiation leaks in 2011, following a major earthquake and tsunami); and natural disasters such as fires, floods, and hurricanes (Ashlin and Ladle 2007). Attention decay tends to occur quickly, with attention half-life typically spanning days or weeks (Figure 2a). However, interest in disasters may persist when the incident develops over longer periods or involves follow-up activities, such as cleanup efforts, public debates, or commemoration events (Djerf-Pierre 2013).

Focusing events are often initiated by reports about ongoing or emerging threats and impacts. They typically present

environmental alarms, new scientific evidence pointing to serious risks, or worsening impacts. They may also represent scandals or morally questionable behavior that draw collective disapproval. Such was the case with the killing of Cecil the lion, formerly a tourist attraction in Zimbabwe's Hwange National Park (Carpenter and Konisky 2019). This killing led to an intense global focusing event, prompting strong expressions of anger and criticism, and also drew collective attention toward general ethical and conservation concerns associated with trophy hunting. Attention toward this event

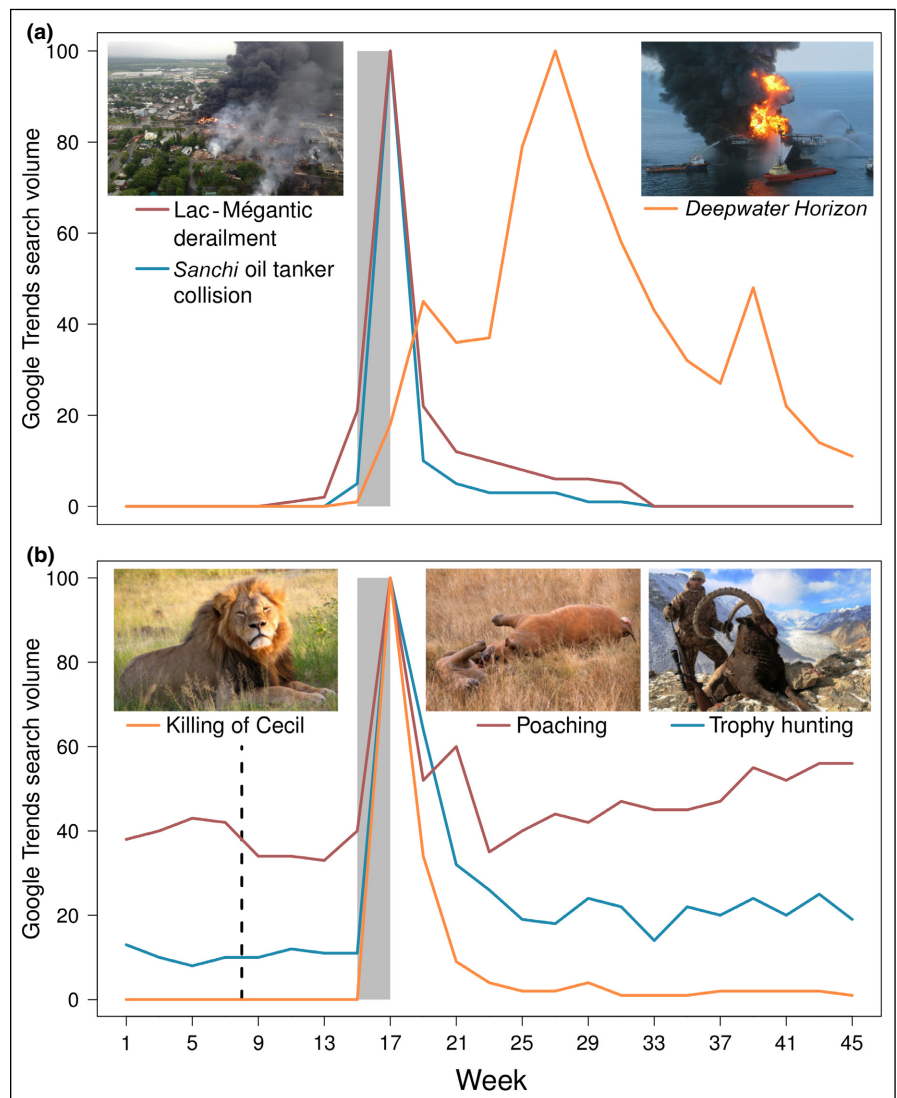


Figure 2. Trends in attention decay following major environmental accidents and conservation issues, based on Google Trends data (WebPanel 2). (a) Attention peaks and decay for the *Deepwater Horizon* oil spill in 2010 (image credit: USCG/Wikimedia Commons), Lac-Mégantic derailment in 2013 (image credit: Sûreté du Québec/Wikimedia Commons [CC BY-SA 1.0]), and *Sanchi* oil tanker collision in 2018. Approximate time of the three accidents is set to match in the figure (gray area). (b) Killing of Cecil the lion (*Panthera leo*) on 2 Jul 2015 (dashed vertical line) led to a massive focusing event (gray bar) (Carpenter and Konisky 2019) (image credit: Daughter#3/Flickr.com [CC BY-SA 2.0]), which also drove attention toward the issues of trophy hunting (image credit: Hesham Usama Khan/Wikimedia Commons [CC BY-SA 4.0]) and poaching (image credit: Hein Waschfort/Wikimedia Commons [CC BY-SA 3.0]) (see WebPanel 1).

and related issues decayed quickly (Figure 2b), without evidence for direct impacts on the adoption of new policy measures (Carpenter and Konisky 2019). Similar transient focusing events also occur following reports of invasive or introduced alien species. For example, discovery of an invasive fish, northern snakehead (*Channa argus*), in a new region of the US was followed by a strong but short-lived surge in news and social media attention and calls for action (Jarić *et al.* 2021).

Species extinctions often capture public attention (Clements 2013). Extinctions highlight anthropogenic impacts on the environment and are often associated with environmental grief and shame and tend to increase societal attention (Jarić *et al.* 2022). Consequently, declaring a species extinct often generates strong focusing events, which are nevertheless transient, with attention rapidly declining back to baseline levels (Figure 3). For instance, the announcement of the extinction of the Chinese paddlefish (*Psephurus gladius*) (Zhang *et al.* 2020), a relict and iconic freshwater species, attracted considerable but transient media coverage and public attention. Similar patterns of rapid attention buildup and decay can also be produced by initiatives aimed at extinction reversal, such as reintroductions, rewilding, or de-extinction (Seddon *et al.* 2014). Moreover, rediscoveries of

species considered to be extinct (ie “Lazarus taxa”) can also increase public attention, as in the case of the rediscovery of the night parrot (*Pezoporus occidentalis*) in Australia. Nevertheless, attention afforded to extinct and rediscovered species varies substantially among species and depends on various factors, including species’ cultural heritage, charisma, and presence in everyday culture (Hopper *et al.* 2019; Jarić *et al.* 2022).

Other conservation issues can develop gradually over many years or decades, and are typically characterized by relatively constant baseline attention levels, even when actual impacts are worsening. Attracting and engaging the public for such slow-developing issues is challenging (Anderegg and Goldsmith 2014) because marketing campaigns or new findings and reports tend to produce intensive but only transient surges of attention. Such patterns have been observed for attention related to climate change, the demise of the Aral Sea, and coral bleaching in the Great Barrier Reef (WebFigure 1).

■ Factors affecting attention transience

The diverse factors that affect attention dynamics can be grouped into three broad classes: intrinsic, psychological, and external. Intrinsic factors represent characteristics of the

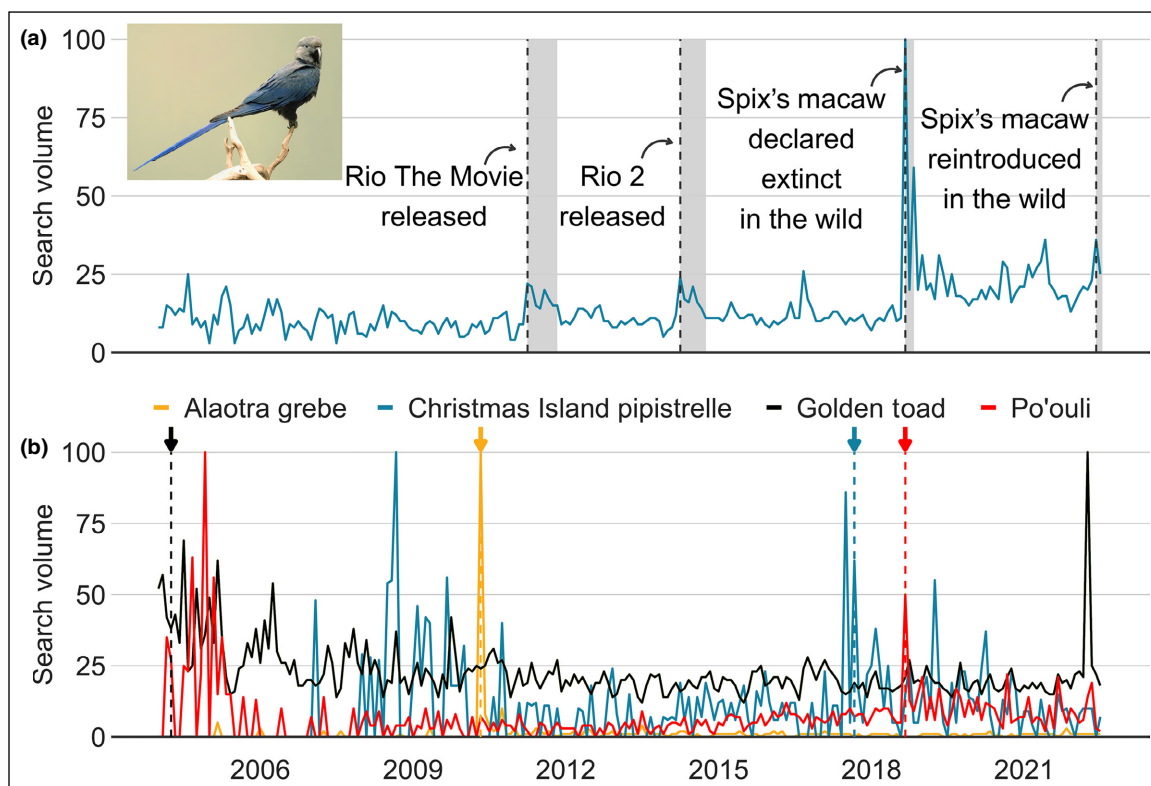


Figure 3. Temporal trends in societal interest toward threatened species, with attention peaks surrounding reports of their extinction and subsequent attention decay. Time-series are based on Google Trends entries for each species (WebPanel 2). (a) Relative search interest in Spix’s macaw (*Cyanopsitta spixii*). Gray bars represent half-life of search interest after each event (image credit: Daderot/Wikimedia Commons [CC0 1.0]). (b) Relative search interest in four species declared as possibly extinct: Alaotra grebe (*Tachybaptus rufolavatus*), Christmas Island pipistrelle (*Pipistrellus murrayi*), golden toad (*Incilius periglenes*), and po’ouli (*Melamprosops phaeosoma*). Dashed vertical lines and arrows indicate dates when species were declared possibly extinct by the International Union for Conservation of Nature.

conservation issue, including the magnitude and spatiotemporal scale of its impact. For example, major, global, and enduring events (such as climate change) are likely to generate a stronger response in public attention and experience slower decay than those that are less critical, more local, and/or short-lived. Psychological factors include various psychological aspects and cognitive limitations that drive attention decay. For instance, attention saturation constitutes an attention overload by the overabundance of information and messages commonly received through news media, while issue fatigue constitutes exhaustion of interest and attention following prolonged exposure to a particular issue (Djerf-Pierre 2012; Lorenz-Spreen *et al.* 2019). Other relevant psychological and cognitive factors include limited attention span, selective attention, the extinction of experience, shifting baselines, and loss of public knowledge (Soga and Gaston 2016; Jeschke *et al.* 2019; Lorenz-Spreen *et al.* 2019). These factors, in turn, can be affected by internal and external effects, such as personal hardships or global crises. Constant exposure to negative news and issues may lead to compassion fatigue, emotional numbness, and solastalgia (distress produced by environmental change), and cause issue avoidance (Albrecht *et al.* 2007). Nevertheless, other psychological factors (eg identification with the place; Bonaiuto *et al.* 2008) may counteract such decay mechanisms and effects. Lastly, external factors mainly include conservation advocacy, media, and marketing efforts, but also various sociocultural aspects. High frequency and heightened turnover rate of news coverage and dissemination by the media is key to attention transience. Naturally, media saturates, challenges, and disrupts sustained attention (Lorenz-Spreen *et al.* 2019). News flow has drastically intensified with the advent of round-the-clock news services and online social media platforms. Competition for newsworthiness is considered the main driving force behind shortening attention spikes and intensifying news turnover (Djerf-Pierre 2012; Lorenz-Spreen *et al.* 2019).

Media can also influence public attention and perception of conservation issues by the selection of which stories are to be covered and their respective narratives (McCombs and Shaw 1972). Conservation stories also compete for attention with other topics. For example, the media's interest in climate change raised concerns that it will overshadow other important environmental issues, such as biodiversity loss (Veríssimo *et al.* 2014). Biodiversity issues are also often more ephemeral and neglected by popular media, especially during periods of economic problems, sociopolitical unrest, international conflicts, or other broad global issues (Pralle 2009). Attention transience is additionally strengthened by the tendency of media to focus on dramatic, polarizing, and novel topics, which further intensifies their turnover rate (Djerf-Pierre 2013).

Sociocultural differences affect the attention that news receives and its consequent decay. Conservation issues and events may trigger different responses among different people and social groups based on their pre-existing views (McDonald 2009). Attention toward environmental problems

is likely to be more enduring among politically and environmentally engaged individuals. Such attention also depends on personal predispositions and circumstances (Djerf-Pierre 2012). Attention will decay faster when the conservation issue is not well understood by the public; when the immediate, direct impacts have subsided; and when the problem is perceived as being solved or, conversely, when it is evident that attempts to solve it have failed (Pralle 2009).

■ Mitigation and adaptation strategies

Mitigation and adaptation measures to cope with attention transience may aim to (1) affect attention dynamics by either increasing the strength of attention peaks, their recurrence and frequency, or slowing down the attention-decay process; or (2) maximize efficiency of conservation interventions and advocacy during those brief peaks of public interest (Figure 4). Both goals can be aided by efforts to predict the occurrence and frequency of attention peaks and the speed of attention decay. Attributes of attention dynamics (Figure 1) can help inform and guide conservation actions (Ryo *et al.* 2019). Mitigation measures directed at altering attention dynamics can be intensive short-term efforts or longer term continuous or periodic activities. Short-term efforts aim to strengthen, sustain, and extend people's attention to accomplish a particular conservation goal. Conversely, long-term efforts may focus on sustaining attention by reinvigorating it through periodic actions, such as environmental awareness and remembrance days. For example, the annually held National Threatened Species Day in Australia was initially established to commemorate the anniversary of the death of the last captive thylacine (*Thylacinus cynocephalus*) in the Hobart Zoo in 1936 (Zieger and Springer 2020). This commemorative day focuses attention on the tragedy of Australia's lost fauna and the need to take action to protect what remains. Long-term efforts are especially relevant for slow-moving issues such as ecosystem degradation (Web-Figure 1), for which engaging society and maintaining attention is particularly challenging (Anderegg and Goldsmith 2014).

Increasing media coverage – for instance, through the use of a wide range of platforms – can facilitate public engagement in an environmental issue (McDonald 2009). New communication media and more efficient use of key communication and marketing concepts (such as framing, priming, and agenda setting) can also help increase and sustain attention (McDonald 2009). Effective conservation-marketing approaches and strategies are also essential for these purposes (Ryan *et al.* 2020). Beyond broad campaigns, targeting particular societal groups or segmenting to select susceptible groups can produce effective outcomes (Metcalf *et al.* 2019). There are many valuable insights obtained in conservation marketing initiatives that can increase campaign effectiveness. Promising approaches include the use of positive or negative stories and language, dramatic storytelling, emotive language, moral framing, foregrounding solutions, emphasizing

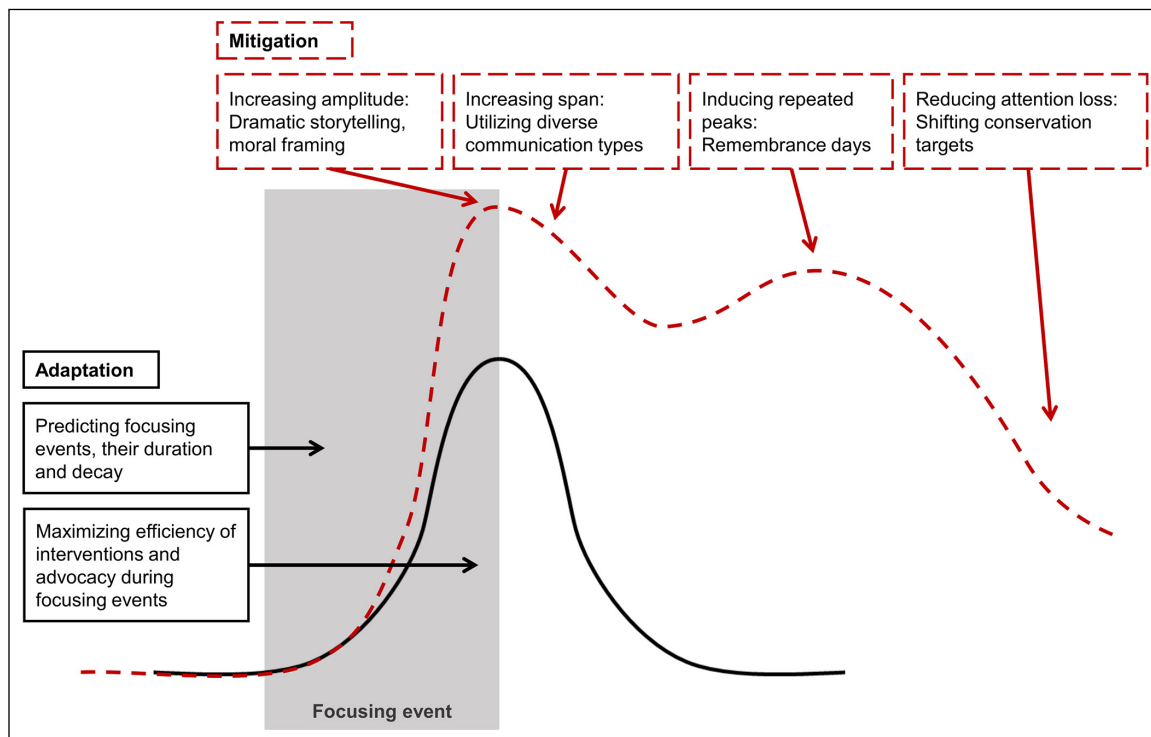


Figure 4. Visual summary of possible measures to mitigate or adapt to attention transience. The solid black curve indicates attention dynamics induced by a focusing event (gray bar); measures to adapt to attention transience are depicted in solid black frames toward the bottom-left corner. Mitigating measures (examples provided in dashed red frames at top) may help to alleviate attention transience (dashed red curve).

evidence-based decision making and scientific consensus, and focusing on human health impacts and personal experiences (McDonald 2009; Pralle 2009; Byerly *et al.* 2018).

Actions may also aim to sustain attention by shifting it to different conservation targets that share the same overarching goal, as a means to produce cumulative effects on salience. Intensive coverage of one environmental issue can also sensitize the public to related issues and may even lead to news waves, as a sequence of interrelated issues covered by media (Djerf-Pierre 2013). Such approaches can reduce attention saturation and fatigue that may arise from extended coverage of a single issue (Pralle 2009).

Predicting occurrence of focusing events, their duration, and their decay, while challenging, is critical. Past dynamics of peak attention can indicate the available duration to prepare an intervention once an issue emerges. Moreover, anticipating the likely span of the attention window is crucial for gaining public traction for any intervention, such as fundraising, education campaigns, or mobilizing public support for policy or management. Furthermore, anticipating when attention to conservation topics diminishes or disappears can inform investments to rekindle attention.

While necessary, public attention in and of itself is often insufficient to trigger conservation actions (Pralle 2009; Carpenter and Konisky 2019). However, brief periods of elevated attention represent optimum moments for conservation interventions and advocacy (Males and Van Aelst 2021). Focusing events commonly act as policy windows – brief periods of favorable conditions for policy change (Kingdon 1995; Carpenter and

Konisky 2019) that need to be used effectively to harness public support. Consequently, being proactive and prepared to react quickly is essential for capitalizing on focusing events, regardless of whether they were unexpected or anticipated (Birkland 1998; Clements 2013). There is also a need to develop future metrics, moving beyond societal attention, to assess whether such windows of opportunity were used to mobilize action.

■ Conclusions

Ultimately, there is a brief window of opportunity during and shortly after focusing events within which conservationists can effectively act to maximize support for their efforts. To address attention transience effectively, it is important to recognize people's inherent cognitive and psychological constraints and consider tried-and-tested media communication practices (Wright *et al.* 2015; Ryan *et al.* 2020).

The attention-transience phenomenon raises many pertinent questions, with important implications for conservation science and management. How do decay rates compare between conservation and other topics (compare with Candia *et al.* 2019; Lorenz-Spreen *et al.* 2019)? How does attention decay differ across conservation issues, and why are some topics more persistent? Do patterns of attention decay vary among species, ecosystem types, countries, and regions? What are optimum marketing strategies to mitigate the effects of attention saturation and fatigue? Can conservation benefit from the peak-shaped attention dynamics? Does conservation really benefit

from leveraging spikes in attention, or do lasting conservation outcomes derive only from ongoing engagements and interactions? These and other questions represent important areas for future research.

Many major and pressing conservation challenges lie outside the realm of traditional conservation biology. Understanding public attention and enhancing it through public engagement is one such challenge that we cannot afford to ignore.

Acknowledgements

This work was supported by the JE Purkyně Fellowship of the Czech Academy of Sciences (IJ); Australian Research Council Laureate (FL160100101) and Centre of Excellence (CE170100015) grants (BWB); the Academy of Finland (348352) and the Kone Foundation (202101976) (RAC); the AXA Research Fund and the 2017–2018 Belmont Forum and BiodivERsA joint call for research proposals, under the BiodivScen ERA-Net COFUND Programme (FC); a research fellowship from the Biotechnology and Biological Sciences Research Council (BB/S009752/1) and funding from the Natural Environment Research Council (NE/S010335/1) (JAF); the Deutsche Forschungsgemeinschaft (German Research Foundation, HE 5893/8-1) (TH); the German–Israeli Foundation for Scientific Research and Development (I-2519-119.4/2019) (UR); the Oxford Martin School Oxford Martin Programme for the Illegal Wildlife Trade (DV); and the Japan Society for the Promotion of Science (20H04375) and the Toyota Foundation (D19-R-0102) (MS). This work contributes to the missions of the Alliance for Freshwater Life and the Conservation Culturomics Working Group of the Society of Conservation Biology.

Data Availability Statement

Data presented in figures were retrieved from the Google Trends platform (<https://trends.google.com>). Search query details are described in WebPanel 2.

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