



Enhancing the impact of conservation marketing using psychology: a research agenda

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Abstract

Conservation marketing draws upon social marketing and psychology to address the human dimensions of biodiversity loss. Behavioural scientists with expertise in conservation psychology can contribute to the design of research projects in this field that utilize a variety of methodologies (quantitative and qualitative), formal application for approval of methodology and procedure through relevant human and animal research ethics committees, and implementation and evaluation of projects or campaigns that are based on psychological principles of persuasion, attitude, and behavior change with the aim of protecting biodiversity. Interdisciplinary projects utilizing best practice in conservation psychology, community-based social marketing, and conservation marketing are likely to lead to improved outcomes, such as reductions in human consumption patterns and other unsustainable behaviors and increases in community engagement. A closer relationship between conservation psychology and conservation marketing will lead to publications of research in high-impact peer-reviewed journals, offering practical recommendations for conservation practitioners, as well as reaching laypeople. Importantly, communicating successes and failures of different approaches, projects or campaigns will help conservation practitioners, conservation educators, tourism operators, community groups, policy-makers, and other stakeholders make informed decisions and design effective conservation marketing campaigns based on evidence.

Keywords Conservation psychology · Conservation marketing · Social science · Biodiversity loss · Behavioral science · Conservation education

Introduction

Numerous terrestrial, aquatic, and insect species have been lost in the last few decades as part of the world's sixth major extinction event (Barnosky et al. 2011), as a result of human activities and our ever-growing population, which is expected to reach 9 billion people by 2050 (Kunzig 2011; Loboguerrero et al. 2019). The dramatic loss of insects globally due to pesticide use, changes in rural land use, and other human activities has been described as catastrophic (Sánchez-Bayo and

Wyckhuys 2019), as has the associated extinction of plants (Youngsteadt et al. 2019). Humans are literally eating megafauna to extinction—mammals, fish, amphibians, birds, and reptiles—for meat and body parts (Ripple et al. 2019). Urban areas continue to “sprawl,” rural land use patterns change, natural environments shrink and fragment, and protected areas are expected to both conserve biodiversity and help alleviate poverty (Locke and Dearden 2005; Manejar et al. 2019). Disruption of ecosystems through human activities, human intrusion into natural environments, intensive agricultural practices (Willett et al. 2019), human overpopulation, and overconsumption of resources are all contributing to climate change (Steffen et al. 2015). Given the anthropogenic (human-related) causes of this biodiversity crisis, mitigation strategies that address the human behavioural and psychosocial determinants of biodiversity loss are critical. This article will outline a research and practice agenda for the integration of psychological principles into conservation marketing efforts to enhance their impact.

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Addressing the human dimensions of biodiversity loss using conservation marketing and psychology

To achieve sustainability for our planet, we need people to change their behavior at both the individual and community level (Schultz 2014). Behavioral scientists have long known that raising awareness and changing people's attitudes do not always lead to behavior change, which is influenced by many factors, including the person's upbringing or social environment (peers, family, and culture) and his or her belief that he or she can make the change (Gifford and Nilsson 2014). There are now behavioral science specialty disciplines, including conservation psychology, that aim to discover how to change non-sustainable human behavior in order to protect the natural environment and conserve diminishing natural resources (Saunders 2003). Such specialties draw principles from all areas of psychology and behavioral science to facilitate collaboration with practitioners from other fields, including ecology, biology, and social science. To design successful conservation marketing campaigns that increase community engagement with biodiversity conservation, we need to focus on human psychology—how people feel, think about, or behave towards other species and the environment in general. In a nutshell, we need to form interdisciplinary teams of researchers who together can use their different areas of expertise to design methodologically sound and ethical research studies, conduct them in ecologically valid everyday settings, evaluate all studies/campaigns, and then publish the findings in high-impact peer-reviewed journals (Bennett et al. 2017).

The dream team of collaborators would include academic researchers from the social and biological sciences, as well as conservation practitioners, social marketing companies, and a range of conservation stakeholders from government and non-government organizations (Clayton et al. 2013). As behavioral scientists, we suggest finding research collaborators with a psychology or allied behavioral science background, ideally graduates of a four-year program (e.g., honors) or holding a PhD. They would have expertise in the following: research methods and study design (qualitative, quantitative); selection of appropriate measurement tools (e.g., for knowledge, attitudes, behavior); preparation of ethics applications for review by Human Research Ethics Committees or Institutional Review Boards; recruitment of participants; and appropriate data analysis and interpretation. Importantly, these collaborators would be consulted before intervention or campaign development, to allow time for developing a methodologically sound project and time for applying for ethics approvals. The marketing experts on the team can focus on main parts of the conservation marketing campaign, such as selection of target audience(s), construction of key message(s), visual design strategies (e.g., use of imagery), and how to reach audiences (e.g., cinema advertisements, mass media coverage).

The great thing about conducting research in “real world” everyday settings is that the research is ecologically valid, but it is also challenging because conditions are unpredictable and less controlled than in a laboratory. If a conservation marketing intervention is a large community-wide campaign, then it is advisable to conduct a pilot study or trial with a small group of participants in a more controlled setting first to test the effect of individual elements of campaigns (e.g., text, images, or videos). Any evaluation published in the peer-reviewed literature should address and report both successes and failures, to help integrate human dimensions into conservation science in general (Bennett et al. 2017). Importantly, our publications should use standardized specific keywords, which include the words “conservation marketing” rather than general terms like “social marketing” or “communication campaigns.”

Persuading audiences to change their behavior: Lessons from the cognitive sciences

The human brain is incredibly efficient at making sense of the thousands, if not millions, of pieces of sensory information that it takes in every second, employing a number of learned *mental shortcuts* to do so. Understanding and leveraging these shortcuts is one way that conservation marketing can draw from psychological evidence to enhance the impact of conservation messages. Cognitive heuristics are robust decision rules that govern which sources of evidence or parts of a message or problem are attended to by individuals and which are ignored (Gigerenzer and Todd 1999). These heuristics are learned from our environments and past decision-making outcomes, and include, for example, the following:

- *Optimism bias*: the tendency to hold unrealistically positive expectations regarding the outcome of a threat or problem (Rittichainuwat et al. 2018),
- *Pessimism bias*: people can be unreasonably willing to accept highly pessimistic future outcomes (Gifford Jr 2009),
- *Availability heuristic*: the tendency to hold salient information which is “cognitively available,” that is, recently or commonly encountered (Clayton and Myers 2015), and
- *Affective heuristic*: the influence of affect or emotion on the perception of risk (Slovic et al. 2004). Specifically, favorable feelings about an event or hazard may lead to the perception that an event is low risk and vice versa.

Particularly relevant to biodiversity loss, these cognitive heuristics limit humans' ability to accurately perceive the level of risk posed by threats for which the consequences are potentially severe, but not immediately visible or proximal (Bazerman 2006; Gifford and Nilsson 2014). Understanding these cognitive heuristics and factoring them into the design of conservation messages is critical to maximizing positive message impact, particularly for general or disengaged audiences. Unfortunately, human

decision-making is not a rational process as we would like to think, and it is difficult (even counter-intuitive) for people to make evidence-based decisions, rather, it is much easier and more efficient for our brains to rely on experiential knowledge to inform decisions. Research has shown that cognitive heuristics consistently lead to people making inferior decisions in conservation even in the face of evidence to the contrary of their biases (McConnachie and Cowling 2013).

Another pertinent feature of the human brain is its use of cognitive schemata to organize, cluster, and categorize information. Described as the “building blocks of cognition,” schemata therefore comprise our pre-conceived perception of any given topic or construct, which have considerable influence on how new information from the environment is interpreted and what information or aspects of a problem we attend to or ignore (Rumelhart 2017). Message recipients are more likely to attend to and be persuaded by information that is congruent with their existing cognitive schemata; however, in conservation marketing, we are often trying to shift or nudge audiences’ pre-conceptions of a problem or long-held habits and ways of doing things, which requires careful message framing. The elaboration likelihood model (Petty and Cacioppo 1986) is a psychological theory that can help us to develop more persuasive messages. According to this model, persuasion can occur through either the central route or the peripheral route. The attitudinal or behavioral shifts that occur via the central route arise when an individual genuinely considers and evaluates, or “elaborates on” the message presented to them and experiences a cognitive shift because of that communication (Petty and Cacioppo 1986). Persuasion through the central route necessitates either adaptation of existing schemata to incorporate the new information, or establishment of new cognitive schemata, and as a result of these processes may result in behavior change (Kitchen et al. 2014). Incorporating this principle into the development of conservation marketing messages involves making sure that relevant and interesting facts are presented within the campaign, but that the campaign explicitly connects those facts to concepts that the audience is already familiar with to encourage schemata shift rather than abrupt change, which is unlikely to stick.

Attitudinal or behavioral shift induced via the peripheral route occurs not because of a conscious evaluation of information presented or change to cognitive schemata, but due to exposure to simple cues regarding the merits of the position advocated (Petty and Cacioppo 1986). Persuasion occurring via the central route is generally more enduring than that which occurs via the peripheral route (Petty and Cacioppo 1986). A significant body of research has utilized the elaboration likelihood model to explain variance in the effectiveness of persuasive communication in achieving attitudinal or behavioral shift across a range of behaviors (Kitchen et al. 2014). In one example, researchers developed conservation messages that aimed to persuade zoo visitors to adopt biodiversity protective behaviors via the central route of

processing and then trained zookeepers to deliver these messages during a standard show, with 78 participants completing a survey following the presentation (MacDonald et al. 2016). Results indicated that visitor satisfaction and relevancy of message (two message characteristics that were theorized to promote elaboration) were significantly associated with recall of the conservation message, suggesting that efforts to promote elaboration contributed to visitor persuasion.

Disseminating persuasive messages via the media: beware the risks

Mass media sources in their online, print, and audio-visual formats offer enormous potential to disseminate conservation messages to broad audiences across geographical boundaries at low cost. Media reproductions of messages can help to increase the awareness and salience of conservation issues among the community, but it also comes with risks as these issues can be misinterpreted or exaggerated to the detriment of the conservation issue. The media has long been recognized to affect consumers’ purchasing habits (Duffett 2017) and attitudes towards public health issues (Flora et al. 1989). Using the media to encourage people to participate in conservation behavior has also been an area of interest for numerous years now, with conservation charity WildAid (<https://wildaid.org/about/>) being among the leaders in this area. WildAid harness about \$230 million in donated advertising space per year to disseminate species conservation campaigns that combat poaching and illegal wildlife hunting by driving down demand for products such as ivory and sea turtle meat. Success indicators for WildAid campaigns are currently captured in reach and dissemination statistics such as levels of social media engagement, numbers of signatures on a petition (Olmedo et al. 2018), and shifts in community awareness of and attitudes towards wildlife conservation issues before and after a campaign (WildAid 2017). There is a need for robust research evaluations of conservation marketing campaigns to establish conclusive evidence about their efficacy with matched area-controlled trials, for example. Media coverage often focusses on controversial, dangerous, or otherwise “exciting” topics, and an important consideration for conservation marketers is how the media’s portrayal might affect consumer or audience perception of the risk that a conservation issue may present. The media can influence peoples’ feelings about an event or hazard including through the use of emotive language, saturation, and imagery (Myrick and Evans 2014; Slovic et al. 2004). Risk perception theories that consider the way laypersons (non-experts) subjectively perceive how “risky” an event or a

hazard is, without relying on scientific risk data as a scientist or expert might do (Inouye 2014).

Social amplification of risk

Social amplification of risk theory explains the social, psychological, institutional, and cultural processes that impact upon how individuals perceive risks associated with difference hazards, leading to either risk amplification (the audience misinterprets low-risk events as high risk) or risk attenuation (the audience misinterprets high-risk events as low risk). Media coverage, namely media saturation, can lead to risk amplification (Coppola 2005) and attenuation to the detriment of biodiversity conservation. Risk amplification has been demonstrated to adversely affect species' conservation, particularly in cases where animals pose a threat to humans, such as sharks biting humans (Neff and Hueter 2013) or primates destroying farming crops (Lee and Priston 2005). When people believe that such risks are high, it can impact their support of conservation initiatives for such species (Karanth and Chellam 2009), which has been documented in relation to coyotes in Canada (Alexander and Quinn 2011).

On the flipside of the coin, complex environmental issues with higher risks (e.g. biodiversity crisis, climate change) are reported on less frequently than needed or reported on in ways that contribute to the public's confusion and uncertainties about the topic (Happer and Philo 2016). Further, the media does not present an exact “photocopy” of the event. Instead, it often simplifies and sensationalizes the event, through emotion-provoking language (Joffe 2003). Combined with audiences' cognitive heuristics, this type of language and the media saturation of rare events may increase audience fear of such interactions and lead them to believe these interactions occur often (risk amplification). Perception of risk impacts supports conservation initiatives and needs to continue to be included in human dimensions of conservation research. Research has shown that the media can influence perception of risk, in ways that either aid or hinder support of conservation behaviors and the media is therefore a potentially powerful tool or hindrance to biodiversity conservation that requires careful consideration.

Looking to the future: rigorous evaluations to secure continual improvements

Rigorous evaluations of conservation marketing efforts are essential to the establishment of evidence about which conservation marketing techniques work and for which organizations. Conservation organizations including zoos, aquariums, and NGOs, have an important role to play to promote community

engagement in conservation-related behaviors (Conde et al. 2011; Tribe and Booth 2003) and are leading the way in their efforts to undertake conservation marketing campaigns, evaluate them, and share the results. With hundreds of millions of annual visitors worldwide (Smith 2013), zoos and aquariums in particular provide unique social environments whereby large numbers of people can connect to, and develop care for, the natural environment, which is often necessary for pro-environmental behavior (Clayton and Myers 2015). Conservation organizations alike must fully embrace behavioral science theories and psychological principles as they typically seek to progress visitor cognitive (understanding, knowledge, awareness), affective (attitudes, social norms, emotions, motivations, values), and behavioral (action and intent to act) domains pertaining to environmental problems — all concepts of which are focal to psychology and can be appropriately measured by behavioral scientists.

Behavioral science and psychological principles should be integrated into all stages of the conservation marketing campaign life cycle to maximize rigor and ensure validity and reliability of findings. As an example of how this goal could be achieved, we outline in Table 1 some existing and potential future roles of social science at different stages of a campaign life cycle. At the earliest stage of *initiation*, behavioral scientists should be approached and integrated into the project team. This could be achieved either by forming a university-industry partnership (which has an additional benefit of access to an accredited human research ethics committee) and/or building internal behavioral science research capacity. Behavioral scientists will offer valuable input to program *definition* too, principally to the project scope. For instance, defining theoretically grounded psychosocial outcomes (e.g., What do we want to educate visitors about? What attitudes, social norms, values, emotions, and motivations do we need to measure, promote, and/or foster? What non-divisible end-state behavior(s) are we seeking to encourage?). To accurately address and measure these outcomes at evaluation, behavioral scientists can further assist with the *design* of activities with the psychosocial outcomes in mind, which requires an understanding of their “make up,” so to speak. As an example, attitudes comprise cognitive, affective, and behavioral (conative) components, which should be integrated into educational components. Behavioral scientists can offer important insights about how to integrate these components of attitudes (among other affective concepts, e.g., emotion) into persuasive signage, multimedia, and keeper-led presentations, and subsequently enrich the potential for conservation education to have meaningful impacts.

The latter two stages—implementation and evaluation—can further be advanced by integrating the social and behavioral sciences. *Implementation* brings with it a set of unique challenges that can inhibit conservation education success; yet

Table 1 Roles of the social sciences and actions to consider at different stages of zoo and aquarium conservation education

Phase/task	Role/action	Resources and additional reading
Initiation	Establish an interdisciplinary team involving social scientists with strong knowledge of psychological theory and research methodology, either by forming a university-industry partnership and/or building internal social science research capacity (employ social scientists, upskill existing employees).	
Definition	Social scientists can apply theories of behavior change, theories of attitude, theories within social psychology, and existing application tools based on some of these principles (e.g., community-based social marketing; CBSM, McKenzie-Mohr 2000) to identify target behaviors, and the relevant environmental (social) and personal (psychological) barriers and facilitators of the behavior.	<i>Theory:</i> theory of planned behaviour (Ajzen 1985, 2002); social learning and social cognitive theory (Bandura and Walters 1977); elaboration likelihood theory (Petty and Cacioppo 1986). <i>Application tools, frameworks, and models:</i> CBSM process for change (McKenzie-Mohr 2000); Behaviour Change Toolkit (People in Need 2017).
Design	Using theories of persuasion embedded within social psychology, social scientists can help to create materials and experiences to promote environmental behaviors that are grounded in well-established psychological frameworks including: attribution theory; cognitive dissonance theory; classical conditioning; elaboration likelihood theory; narrative transportation theory; and social judgment theory.	<i>Relevant literature:</i> Review of personal and social factors that influence pro-environmental concern and behaviour (Gifford and Nilsson 2014); application of the elaboration likelihood model to the zoo context (MacDonald et al. 2016).
Implementation	Social scientists can draw upon the diffusion of innovation theory (DIT) to explore and understand the (un) helpful processes to conservation-education implementation. Such knowledge could help move forward implementation practices that shape program success.	<i>Theory:</i> Diffusion of innovation theory (Rogers 2010). <i>Application model:</i> model of diffusion in service organisations ((Greenhalgh et al. 2004). <i>Relevant literature:</i> the diffusion of innovative biodiversity conservation policies and practices (Mascia and Mills 2018).
Evaluation	A primary goal of conservation education is to promote engagement in conservation-related behaviors. Evaluations pertaining to the efficacy of these efforts would therefore greatly benefit from mainstreaming the application of social science theories. Such frameworks will offer robust guidance and justification for choosing and correctly measuring outcome variables.	<i>Application tool:</i> My Environmental Education Evaluation Resources Assistant (Zint 2017)

seldom do zoos or aquariums conduct process evaluations of their conservation-education efforts. Implementation can be best explored with insights from one of the social sciences most established theoretical frameworks—the diffusion of innovation theory (Rogers 2010). The diffusion of innovation theory explains that the spread of ideas during innovation is influenced by features of the innovation itself (e.g., nature and complexity of the chosen conservation issue and conservation behavior); features of the implementers (e.g., implementer motives, values, specific skills); features of the organization (e.g., structure and culture, time and resources, capacity to evaluate, support and advocacy for the program); and external influences (grants/external funding; political directives). Using this framework as a lens to understand how, and to what extent, these factors impact the implementation of zoo and aquarium conservation education could help pinpoint implementation strengths and developmental needs. Last, the validity of conservation-education *evaluation* efforts will be enhanced if the outcomes of interest are properly integrated at the program design stage, and if evaluations are designed and delivered in collaboration with social scientists who have specialized training in behavioral research methodology and statistics.

Concluding remarks

Demonstrating improved biodiversity outcomes remains one of the greatest challenges for evaluation of any conservation program (Baylis et al. 2016), and increased interdisciplinary collaboration will be needed to address this challenge. Whereas biological scientists are trained to measure biological outcomes, this is not a realistic or achievable goal for most conservation campaigns aimed at changing human behavior, whether it is large or small, short term or long term, and local or global. Behavioral scientists are trained to avoid making cause-effect claims when interpreting their data. Many biodiversity conservation problems are “wicked” in nature, which means that they are so complex that they are potentially unsolvable—with multiple anthropogenic threats and activities and multiple stakeholders with different agendas (Game et al. 2014). By contrast, a “tame” problem is one that can be solved, by applying laws of physics, mathematics, or chemistry. That is, there is a specific answer to the problem that can be reached by following a series of known rules or laws. Conservation problems or issues are typically related to the management of human behavior and humans are complicated,

do not always behave in “rational” or predictable ways, and have a “dark side”—as evidenced by anti-social and criminal behavior (Litchfield 2013). Indeed, the illegal trade in wildlife is the perfect example of the “dark side” of humans who want to collect or consume any animal that is rare (Nijman et al. 2019). It will rarely be possible to link clearly and directly specific conservation campaigns or psychological theories to improve biodiversity outcomes. Increases in population size may not always be achievable especially in the short term, whereas maintaining populations or even slowing their decline may be a more realistic or achievable outcome. For example, evaluations of Marine Protected Areas may overemphasize “increase” of shark/ray populations (MacKeracher et al. 2019), although in some cases, increases in fish biomass may be viewed as a biological outcome (e.g., RARE campaign evaluation by Verissimo et al. 2018). It would be unrealistic to consider that a mobile phone recycling campaign resulting in 100,000+ phones being donated to Zoos Victoria in Australia would show a direct effect on gorilla population numbers in the Democratic Republic of Congo (Litchfield et al. 2018). Ideally, conservation organizations should partner with behavioral scientists to measure social outcomes and biologists to measure biological outcomes of campaigns designed to change unsustainable human behavior. One thing we can all agree on is that biodiversity conservation cannot be achieved without changing unsustainable human behavior (Schultz 2011), which is best achieved by integrating behavioral and social sciences into all stages of conservation education. We have offered some ideas for ways that this goal might be accomplished in the context of conservation marketing programs.

References

- Ajzen I (1985) From intentions to actions: a theory of planned behavior. *Action control*. Springer, pp 11–39
- Ajzen I (2002) Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior I. *J Appl Soc Psychol* 32(4): 665–683
- Alexander SM, Quinn MS (2011) Coyote (*Canis latrans*) interactions with humans and pets reported in the Canadian print media (1995–2010). *Hum Dimens Wildl* 16(5):345–359
- Bandura A, Walters RH (1977) *Social learning theory*. Prentice-hall, Englewood Cliffs
- Barnosky AD, Matzke N, Tomiya S, Wogan GO, Swartz B, Quental TB et al (2011) Has the Earth’s sixth mass extinction already arrived? *Nature* 471(7336):51–57
- Baylis K, Honey-Rosés J, Bömer J, Corbera E, Ezzine-de-Blas D, Ferraro PJ, Lapeyre R, Persson UM, Pfaff A, Wunder S (2016) Mainstreaming impact evaluation in nature conservation. *Conserv Lett* 9(1):58–64
- Bazerman MH (2006) Climate change as a predictable surprise. *Clim Chang* 77(1–2):179–193
- Bennett NJ, Roth R, Klain SC, Chan KM, Clark DA, Cullman G et al (2017) Mainstreaming the social sciences in conservation. *Conserv Biol* 31(1):56–66
- Clayton S, Myers G (2015) *Conservation psychology: understanding and promoting human care for nature*. Wiley
- Clayton S, Litchfield C, Geller ES (2013) Psychological science, conservation, and environmental sustainability. *Front Ecol Environ* 11(7): 377–382
- Conde DA, Flesness N, Colchero F, Jones OR, Scheuerlein A (2011) An emerging role of zoos to conserve biodiversity. *Science* 331(6023): 1390–1391
- Coppola DP (2005) “Gripped by fear” Public risk (mis) perception and the Washington, DC sniper. *Disaster Prev Manag* 14(1):32–54
- Duffett RG (2017) Influence of social media marketing communications on young consumers’ attitudes. *Young Consum* 18(1):19–39
- Flora JA, Maibach EW, Maccoby N (1989) The role of media across four levels of health promotion intervention. *Annu Rev Public Health* 10(1):181–201
- Game ET, Meijaard E, Sheil D, McDonald-Madden E (2014) Conservation in a wicked complex world; challenges and solutions. *Conserv Lett* 7(3):271–277
- Gifford A Jr (2009) Cultural, cognition and human action. *J Socio-Econ* 38(1):13–24
- Gifford R, Nilsson A (2014) Personal and social factors that influence pro-environmental concern and behaviour: a review. *Int J Psychol* 49(3):141–157
- Gigerenzer G, Todd PM (1999) Simple heuristics that make us smart. *Evolution and cognition* (paper)
- Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O (2004) Diffusion of innovations in service organizations: systematic review and recommendations. *Milbank Q* 82(4):581–629
- Happer C, Philo G (2016) New approaches to understanding the role of the news media in the formation of public attitudes and behaviours on climate change. *Eur J Commun* 31(2):136–151
- Inouye J (2014) Risk perception: theories, strategies, and next steps. Campbell Institute National Safety Council, Itasca
- Joffe H (2003) Risk: from perception to social representation. *Br J Soc Psychol* 42(1):55–73
- Karanth KU, Chellam R (2009) Carnivore conservation at the crossroads. *Oryx* 43(1):1–2
- Kitchen P, Kerr G, Schultz DE, McColl R, Pals H (2014) The elaboration likelihood model: review, critique and research agenda. *Eur J Mark* 48(11/12):2033–2050
- Kunzig R (2011) Population 7 billion. *Natl Geogr* 219(1):32–63
- Lee PC, Priston NE (2005) Human attitudes to primates: perceptions of pests, conflict and consequences for primate conservation. *Commensalism and Conflict: The Human-Primate Interface* 4:1–23
- Litchfield CA (2013) Rhino poaching: apply conservation psychology. *Science* 340(6137):1168–1168
- Litchfield CA, Lowry R, Dorrian J (2018) Recycling 115,369 mobile phones for gorilla conservation over a six-year period (2009–2014) at Zoos Victoria: a case study of ‘points of influence’ and mobile phone donations. *PLoS One* 13(12):e0206890
- Loboguerrero AM, Campbell BM, Cooper PJ, Hansen JW, Rosenstock T, Wollenberg E (2019) Food and earth systems: priorities for climate change adaptation and mitigation for agriculture and food systems. *Sustainability* 11(5):1372
- Locke H, Dearden P (2005) Rethinking protected area categories and the new paradigm. *Environ Conserv* 32(1):1–10
- MacDonald E, Milfont T, Gavin M (2016) Applying the elaboration likelihood model to increase recall of conservation messages and elaboration by zoo visitors. *J Sustain Tour* 24(6):866–881
- MacKeracher T, Diedrich A, Simpfendorfer CA (2019) Sharks, rays and marine protected areas: a critical evaluation of current perspectives. *Fish Fish* 20(2):255–267

- Manejar AJA, Sandoy LMH, Subade RF (2019) Linking marine biodiversity conservation and poverty alleviation: a case study in selected rural communities of Sagay Marine Reserve, Negros Occidental. *Mar Policy* 104:12–18
- Mascia MB, Mills M (2018) When conservation goes viral: the diffusion of innovative biodiversity conservation policies and practices. *Conserv Lett* 11(3):e12442
- McConnachie MM, Cowling RM (2013) On the accuracy of conservation managers' beliefs and if they learn from evidence-based knowledge: a preliminary investigation. *J Environ Manag* 128:7–14
- McKenzie-Mohr D (2000) Fostering sustainable behavior through community-based social marketing. *Am Psychol* 55(5):531–537
- Myrick JG, Evans SD (2014) Do PSAs take a bite out of shark week? The effects of juxtaposing environmental messages with violent images of shark attacks. *Sci Commun* 36(5):544–569
- Neff C, Hueter R (2013) Science, policy, and the public discourse of shark "attack": a proposal for reclassifying human–shark interactions. *J Environ Stud Sci* 3(1):65–73
- Nijman V, Morcatty T, Smith JH, Atoussi S, Shepherd CR, Siriwat P, Nekaris KAI, Bergin D (2019) Illegal wildlife trade – surveying open animal markets and online platforms to understand the poaching of wild cats. *Biodiversity* 20(1):58–61. <https://doi.org/10.1080/14888386.2019.1568915>
- Olmedo A, Sharif V, Milner-Gulland EJ (2018) Evaluating the design of behavior change interventions: a case study of rhino horn in Vietnam. *Conservation Letters*, 11(1), e12365
- People in Need (2017) 'Behaviour Change Toolkit'. Available at: <https://www.behaviourchange.net/document/33-behaviour-change-toolkit>. Accessed 19 June 2019
- Petty RE, Cacioppo JT (1986) The elaboration likelihood model of persuasion. *Communication and persuasion*. Springer, pp 1–24
- Ripple WJ, Wolf C, Newsome TM, Betts MG, Ceballos G, Courchamp F et al (2019) Are we eating the world's megafauna to extinction? *Conserv Lett*:e12627
- Rittichainuwat B, Nelson R, Rahmafritra F (2018) Applying the perceived probability of risk and bias toward optimism: implications for travel decisions in the face of natural disasters. *Tour Manag* 66: 221–232
- Rogers EM (2010) *Diffusion of innovations*. Simon and Schuster
- Rumelhart DE (2017) *Schemata: the building blocks of cognition*. Theoretical issues in reading comprehension. Routledge, pp 33–58
- Sánchez-Bayo F, Wyckhuys KA (2019) Worldwide decline of the entomofauna: a review of its drivers. *Biol Conserv* 232:8–27
- Saunders CD (2003) The emerging field of conservation psychology. *Hum Ecol Rev*:137–149
- Schultz PW (2011) Conservation means behavior. *Conserv Biol* 25(6): 1080–1083
- Schultz PW (2014) Strategies for promoting proenvironmental behavior. *Eur Psychol* 19:107–117
- Slovic P, Finucane ML, Peters E, MacGregor DG (2004) Risk as analysis and risk as feelings: some thoughts about affect, reason, risk, and rationality. *Risk Analysis: An International Journal* 24(2):311–322. <https://doi.org/10.1111/j.0272-4332.2004.00433.x>
- Smith L (2013) Visitors or visits? An examination of zoo visitor numbers using the case study of Australia. *Zoo Biol* 32(1):37–44
- Steffen W, Richardson K, Rockström J, Cornell SE, Fetzer I, Bennett EM et al (2015) Planetary boundaries: guiding human development on a changing planet. *Science* 347(6223):1259855
- Tribe A, Booth R (2003) Assessing the role of zoos in wildlife conservation. *Hum Dimens Wildl* 8(1):65–74
- Verissimo D, Bianchessi A, Arrivillaga A, Cadiz FC, Mancao RK (2018) Does it work for biodiversity? Experiences and challenges in the evaluation of social marketing campaigns. *Social Marketing Quarterly*, 24(1):18–34
- WildAid (2017) Rhino Horn Demand. <https://wildaid.org/wp-content/uploads/2018/05/Rhino-Horn-Demand-in-Vietnam-2017.pdf>. Accessed 3 July 2019
- Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, Garnett T, Tilman D, DeClerck F, Wood A, Jonell M, Clark M, Gordon LJ, Fanzo J, Hawkes C, Zurayk R, Rivera JA, de Vries W, Majele Sibanda L, Afshin A, Chaudhary A, Herrero M, Agustina R, Branca F, Lartey A, Fan S, Crona B, Fox E, Bignet V, Troell M, Lindahl T, Singh S, Cornell SE, Srinath Reddy K, Narain S, Nishtar S, Murray CJL (2019) Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *Lancet* 393(10170):447–492
- Youngsteadt E, López-Urbe MM, Sorenson CE (2019) Ecology in the sixth mass extinction: detecting and understanding rare biotic interactions. *Ann Entomol Soc Am* 112:119–121
- Zint M (2017) 'My Environmental Education Evaluation Resource Assistant'. Available at: <http://meera.snre.umich.edu/about-meera>. Accessed 19 June 2019

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