Conservation Biology

Review

Effectiveness of biodiversity-conservation marketing

Jillian Ryan [1,2*] Sarah Mellish,[1] Jillian Dorrian,[3] Tony Winefield,[1] and Carla Litchfield[1]

[1]Conservation Psychology and Applied Animal Behaviour Research Group, University of South Australia, Magill Campus, St Bernards Road, GPO Box 2471, Magill, SA 5001, Australia
[2]Commonwealth Scientific and Industrial Research Organisation, Gate 13, Kintore Avenue, Adelaide, SA 5000, Australia
[3]Behaviour-Brain-Body Research Centre, University of South Australia, Magill Campus, St Bernards Road, GPO Box 2471, Magill, SA 5001, Australia

Abstract: Conservation marketing holds potential as a means to engage audiences with biodiversity conservation and help to address the human dimensions of biodiversity loss. Empirical evaluations of conservation marketing indicatives are growing, so we reviewed the literature on this research to inform future directions in the field. We used a systematic search strategy to identify studies that evaluated the effects of conservation marketing interventions (techniques and campaigns) on psychosocial outcomes, categorized as cognitive, affective, or behavioral. Six academic databases (Business Source Complete, Communication & Mass Media Complete, Greenfile, Proquest, Scopus, and Web of Science Core Collections), 3 gray-literature databases (BASE, Zenodo, and Google Scholar), and 2 websites (Rare and WildAid) were searched. Articles were subjected to critical appraisal to assess their methodological quality, and data were extracted from each article and analyzed using narrative synthesis. Altogether 28 studies from 26 articles were included in the review. Twenty-five studies were conducted from 2014 through 2016. Methodological quality of most studies was weak ($n = 16$, 57%) (moderate quality $n = 8$, 29%; high quality $n = 4$, 14%). The proportion of studies that evaluated a conservation-marketing technique (e.g., variants of texts, images, or videos) versus a campaign (e.g., community-based campaigns targeting locally relevant issues, such as unsustainable palm oil agriculture, light pollution, or wood fuel fire use) was relatively balanced. Although many studies reported statistically significant results in the intended direction, the utility of findings was limited by persistent methodological limitations, such as a lack of a comparator group, use of non-validated assessment tools, and a focus on self-reported data and subjective outcomes. Conservation marketing is clearly a nascent field of scientific enquiry that warrants further, high-quality research investigations.

Keywords: biodiversity, cognition, conservation psychology, human behavior, species conservation

Efectividad de la Mercadotecnia de la Conservación de la Biodiversidad

Resumen: La mercadotecnia de la conservación tiene potencial como un medio para involucrar a audiencias en la conservación y ayuda a atender la dimensión humana de la pérdida de la biodiversidad. Ha habido un incremento de las evaluaciones empíricas de indicadores de la mercadotecnia de la conservación, por lo que revisamos la literatura sobre esta línea de investigación para dar información a trabajos futuros en este campo. Utilizamos una estrategia de búsqueda sistemática para identificar, evaluar críticamente y sintetizar los resultados de estudios que evaluaron los efectos de las intervenciones de la mercadotecnia de la conservación (técnicas y campañas) sobre las consecuencias psicosociales y relacionadas con el involucramiento, categorizadas como cognitivas, afectivas o conductuales. Realizamos búsquedas en seis bases de datos académicas ((Business Source Complete, Communication & Mass Media Complete, Greenfile, Proquest, Scopus, y Web of Science Core Collections), tres bases de datos de literatura gris (BASE, Zenodo, y Google Scholar) y dos sitios web (Rare y WildAid). Los artículos fueron sujetos a una evaluación crítica para determinar su calidad metodológica, y los datos de cada artículo fueron extraídos y analizados por medio de síntesis narrativa. En total se incluyeron 28 estudios de 26 artículos en la revisión. Veinticinco estudios se llevaron a cabo de 2014 a 2016. La calidad metodológica de la mayoría de los estudios fue baja ($n = 16$, 57%) (calidad moderada $n = 8$, 29%; calidad alta $n = 4$, 14%). La proporción de estudios que evaluaron una técnica de mercadotecnia de la conservación (e. g., variaciones de textos, imágenes

*email jillian.ryan@csiro.au
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o videos) versus una campaña (e. g., campañas comunitarias enfocadas a temas relevantes localmente, como el cultivo no sustentable de palma de aceite, la contaminación lumínica y el uso de madera como combustible) fue relativamente equitativa. Aunque muchos estudios reportaron resultados significativos estadísticamente, la utilidad de los resultados fue limitada por las limitaciones metodológicas persistentes, como la falta de un grupo para comparar, el uso de herramientas de evaluación no validadas y el enfoque en datos auto reportados y resultados subjetivos. La mercadotecnia de la conservación es un campo de conocimiento claramente incipiente que garantiza investigaciones futuras de alta calidad.

Palabras Clave: biodiversidad, conducta, conocimiento, especies, psicología de la conservación

摘要: 保护宣传在吸引公众参与生物多样性保护和帮助解决人类导致的生物多样性丧失的方面具有很大潜力。目前, 关于保护推广宣传指标的经验评估越来越多, 因此, 我们综述了这方面研究的文献, 以指导该领域未来的发展方向。我们用系统检索策略来辨别、批判性评价和整合相关研究结果, 这些研究评估了保护宣传干预 (技术方法和宣传活动) 对公众的社会心理和参与情况的影响, 分为认知、情感和行为三个方面。我们检索了六个学术数据库 (Business Source Complete 、 Communication & Mass Media Complete 、 Greenfile 、 Proquest 、 Scopus 和 Web of Science Core Collections), 三个灰色文献数据库 (BASE 、 Zenodo 和 Google Scholar) 及两个网站 (Rare 和 WildAid), 对每篇文章的方法学质量进行了批判性地评估, 并从中提取数据加以综合分析。本综述共包含 26 篇论文中的 28 项研究, 其中 25 项研究于 2014-2016 年间完成。结果显示, 大部分研究的方法学质量较差 ($n = 16$, 占 57%) (中等质量的研究 $n = 8$, 占 29%; 高质量的研究 $n = 4$, 占 14%) 。这些研究中, 评估保护宣传技术方法 (如文本、图像和视频的应用) 与宣传活动 (如针对当地相关情况的社区活动, 包括不可持续的棕榈油农业、光污染和燃烧木柴等) 的研究比例相当。虽然许多研究在其预期方向上得到了统计学上的显著结果, 但由于方法学上缺少比较组、评估工具不可靠以及侧重自我报告数据及主观结果等普遍存在的问题, 这些研究得到的结论作用有限。显然, 保护宣传研究是一个新兴的学科领域, 还需要进一步高质量的研究调查。 **【翻译: 胡怡思; 审校: 聂永刚】**

关键词: 保护心理学, 物种, 生物多样性, 行为, 认知

Introduction

If the current biodiversity crisis (Hassan et al. 2005; Barnosky et al. 2011; Pimm et al. 2014) is not mitigated, it is expected to have catastrophic social and economic consequences for Earth's inhabitants (Johnson et al. 2017). It is now widely acknowledged that this crisis is anthropogenic, and scientists and policy makers have increased their efforts to promote sustainable lifestyles and behaviors as components of broader crisis-mitigation strategies (Novacek 2008; United Nations 2011; Johnson et al. 2017). Conservation marketing, which applies social-marketing strategies to conservation issues (Kotler & Zaltman 1971), is gaining recognition as a potentially powerful approach to increasing public awareness and concern for biodiversity loss and encouraging the human population to adopt more sustainable lifestyles (Wright et al. 2015).

The practice of conservation marketing is not new to conservation organizations, many of which have long histories conducting outreach programs aiming to engage, educate, and inspire their audiences to act to protect biodiversity. Nonprofit organization, for example, WildAid (https://wildaid.org/) attracts more than US$200 million in donated media to disseminate large-scale campaigns aiming to reduce illegal wildlife trade. Ivory Free is an example of a WildAid campaign that aims to reduce demand for ivory products and therefore elephant poaching. It applies marketing techniques, such as celebrity endorsement from Prince William and David Beckham, and promotes the social-media hashtag #JoinTheHerd to encourage users to share their personal commitment to support elephant conservation (WildAid 2017). Consistent with behavior-change theory, sharing personal commitments may help to foster positive social norms around ivory avoidance (Azjen 1991).

Ivory Free is therefore expected to alleviate pressures on elephant populations by shifting community perceptions of ivory products from more to less desirable, leading to reduced demand for ivory and less illegal hunting and poaching (WildAid 2017) (Supporting Information).

In addition to dedicated conservation-marketing organizations, zoos, government departments, and nongovernmental organizations regularly undertake conservation-marketing initiatives to address local conservation problems. For example, Zoos Victoria's Love Your Locals project consists of a social-media campaign with celebrity endorsements that aim to raise awareness among Australians of endangered native species (https://www.zoo.org.au/get-involved/act-for-wildlife/love-your-locals). Conservation-marketing campaigns vary in scale, content, format, delivery mechanisms, and persuasion techniques (Duthie et al. 2017).

Due to the significant heterogeneity in approach and objectives effort, there is no single theory or framework for conservation marketing. Rather, different initatives draw on different behavior-change and persuasion techniques from psychology, marketing, and social-marketing domains. Wright et al. (2015) provide a detailed overview

Table 1. Examples of conservation-marketing techniques and their related theoretical principles.

Technique	*Theoretical principles (further reading)*
Human (e.g., celebrities) or animal (often flagship species) ambassadors act as figureheads or icons to represent and attract attention and funds to a conservation problem or ecosystem under threat	Endorsement from a well-liked and respected ambassador is likely to promote source and brand credibility, attract attention, and enhance likelihood of persuasion (Walpole & Leader-Williams 2002; Wheeler 2009).
Audience education through the provision of interesting and relevant facts (e.g., information about the extent or scale of a biodiversity problem, human contributions to biodiversity loss, and what individuals can do to minimize their personal impact)	Information that stimulates genuine cognitive elaboration (e.g., curiosity) is theorized to persuade via the central route of persuasion, which is more persuasive than information that persuades via the peripheral route of persuasion and relies on superficial cues (Petty & Cacioppo 1986; MacDonald et al. 2016).
Normative messages that convey social norms to promote desired behaviors or suppress undesired behaviors. Such messages might convey that the undesired behavior is uncommon (e.g., claiming that few people in the audiences' cultural or social group continue to purchase a product detrimental to biodiversity)	Humans tend to want to behave in ways that are compatible with the group they identify with; that is, humans are guided by unspoken rules and norms. This tendency can be leveraged to influence behavior toward conservation outcomes, or norms can be altered over time such that the biodiversity-protective behaviors become more acceptable (Azjen 1991; Pretty & Smith 2004).
Anthropomorphism or the attribution of human characteristics or behaviors to nonhuman species via written descriptions or images (e.g., in the description of birth, death, and extinction events)	Drawing attention to the similarities and commonalities between humans and other species via anthropomorphism may elicit greater empathy and combat indifference and inaction but can produce adverse effects and must be used appropriately (Root-Bernstein et al. 2013).

of conservation marketing theory and practice. Core conservation marketing methods include diverse psychosocial strategies or behavior-change techniques designed to nudge individuals toward desired behaviors, often by shifting levels of knowledge about the problem or what can be done to correct it (i.e., educational strategies) or by affecting shifts in attitudes and social norms relating to the problem (Wright et al. 2015; Lehner et al. 2016). Four common techniques include the use of human or animal ambassadors, audience education, social-norm messages, and anthropomorphism (Table 1).

In addition to these behavior-change techniques and theoretical principles, procedural frameworks exist to guide the development and evaluation of conservation marketing campaigns. Community-based social marketing is a 5-step process for developing and delivering behavioral interventions to target audiences: identify barriers to target behavior, design behavioral intervention, pilot the intervention, implement the intervention, and evaluate intervention effectiveness (McKenzie-Mohr 2000; McKenzie-Mohr & Schultz 2014). The conservation charity, Rare, has also developed the Pride approach to conservation marketing and behavior change. Pride campaigns share 12 core characteristics, including a locally relevant conservation ambassador or mascot, a focus on behavior change and understanding the audience, and an aim to encourage interpersonal communication among audience members (Butler et al. 2013). Rare has conducted over 450 Pride campaigns in more than 50 countries (Butler et al. 2013).

Conservation marketing has recently become the focus of growing empirical evaluations as practitioners and researchers strive to understand its underlying causal mechanisms and evaluate its overall effectiveness and the efficacy of specific techniques. Few efforts have been made to collate or summarize evidence, which is a barrier to the design of evidence-based campaigns. The quality and quantity of research on this topic is also unclear.

This study aimed to examine the body of research on evaluation of conservation marketing efforts to determine how many studies exist, when and where they took place, and what outcomes and interventions they evaluated; to summarize approaches taken and evaluate the methodological quality of studies and; to summarize evidence of the effect of conservation-marketing techniques and campaigns on psychosocial outcomes.

Methods

Eligibility Criteria

Eligibility was assessed on study population, intervention, control, outcomes, and study design (PICOS) (Moher et al. 2009) (details given in Table 2). Eligible studies included empirical evaluations of the impact of a conservation-marketing intervention (i.e., a technique or campaign) on participants' psychosocial engagement with a biodiversity conservation issue. Outcomes had to be categorizable as cognitive (e.g., awareness, understanding, knowledge), affective (e.g., attitudes, emotions), or behavioral (e.g., self-report intentions, action). Studies that had a general environmental focus but did not explicitly link to the conservation of a nonhuman (including plant) species or ecosystem fell outside of the

Table 2. Eligibility criteria for inclusion in the review of conservation-marketing effectiveness based on population, intervention, control or comparator, outcomes, and study design (PICOS).

Criteria	*Eligibility*	*Example of eligible studies*	*Example of ineligible studies*
Population	not limited	any sample containing human adults or children, including professionals (e.g., fishers) or members of the general public, for example, residents of a protected forest area, visitors to a particular beach, or consumers of a specific product	did not contain human participants or addressed a broader environmental problem not explicitly linked to a species conservation problem (e.g., climate change)
Intervention	conservation-marketing technique (specific aspect or component of conservation marketing) or campaign	conservation-marketing techniques (e.g., written texts, images, or videos) or conservation-marketing campaigns (e.g., community education and engagement initiatives distributed via various media)	evaluated the effect of nature reserves on residents' well-being
Control or comparator	all comparator groups accepted (e.g., separate control group or within- subjects pre- and postdesign), studies with no comparator group also accepted (e.g., one-off survey)	participants were allocated randomly to receive an intervention or not, participants self-reported whether they received an intervention (e.g., zoo visitors surveyed after they visited an exhibit), outcomes before and after an intervention were measured (e.g., zoo visit)	not limited
Outcomes	conservation-relevant cognitive, affective, and behavioral outcomes	knowledge, awareness, recognition, attitudes, feelings toward, level of concern, self-reported performance of behaviors (e.g., turning off lights at night time, uptake of fuel-efficient cooking methods)	initiative reach or number of audience members reached
Study design	primary, empirical research reports, or full-text conference papers written in English	peer-reviewed research studies, informal evaluations of programs	written in a language other than English, nonempirical evaluations (e.g., theoretical evaluations), literature, or systematic reviews

scope of this review. Eligibility was not limited based on participant population, research design, or date of publication. However, only articles written in or translated into English were considered eligible. Although we assessed methodological quality, we did not exclude studies based on these assessments because ours is the first synthesis of research on the subject and a primary aim was to describe the research scope and methodological quality. Methodological quality scores are described below in "Data Synthesis and Presentation." We reported results from studies with relatively higher methodological quality in more detail than studies of lower methodological quality.

Searches and Information Sources

The construct of conservation marketing was operationalized according to 2 search concepts: biodiversity conservation and marketing. Both search concepts were expanded with alternative search terms, spellings, wildcard truncations, and Boolean operators to maximize reach, and these expansions were adapted to suit each data source. The search strategy we used in Scopus, for example, was ("*threatened*" OR "*endangered*" OR "*conservation*") N/3 [meaning within 3 words of next term] ("*animal**" OR "*wildlife*" OR "*species*" OR "*science*" OR "*biodiversity*") AND ("*communicat**" OR "*market**" OR "*message fram**" OR "*portray**" OR "*campaign*" OR "*mass medi**").

Searches of the gray and academic literature had the same date range: no lower limit and up to 26 April 2016. Hand searches of included articles' reference lists were conducted following article screening.

Six academic journal databases were searched on 26 April 2016: Business Source Complete, Communication & Mass Media Complete, Greenfile, Proquest, Scopus, and Web of Science (Science Citation Index Expanded, 1975-; Social Sciences Citation Index, 1975-; Arts & Humanities Citation Index, 1975-; Conference Proceedings Citation

Index, Science, 1990-; Conference Proceedings Citation Index, Social Sciences & Humanities, 1990-).

Consistent with Collaboration for Environmental Evidence (CEE) (2018) guidelines, we searched the following gray-literature databases on 29 November 2018: BASE, Zenodo, Google Scholar, and resource lists published on websites of 2 dedicated conservation marketing organizations, Rare (https://www.rare.org/pride) and WildAid (https://wildaid.org/). Gray literature searches tend to return significantly greater numbers of search results than bibliographic databases, which can become unmanageable. Similar to previous reviews (e.g., Haddaway et al. 2014), we therefore limited gray literature search results to the first 150 results per database.

Following the initial search, all records were imported into reference-management software Endnote (version X7) and duplicates deleted. Two authors, J.R. and S.M., screened each article in duplicate. Article eligibility was assessed in 3 stages, first based on article titles, second, abstracts, and finally, full texts. We were able to retrieve all relevant abstracts and full texts we needed via the University of South Australia's comprehensive library subscriptions. Articles on which we disagreed on eligibility were automatically passed through to the next round until the final stages of screening, when all disagreements were discussed until consensus was reached.

Data Extraction

A standardized data-extraction form was developed to capture study author or authors and year of publication, sample characteristics, conservation problem addressed, campaign or technique evaluated, campaign delivery methods, primary outcomes, primary findings, statistical significance of findings, and effect sizes of change scores or mean change scores (data summarized in Table 3). This form was completed independently for each study by J.R. and S.M.

Where possible (i.e., for studies that had a comparator group and provided sufficient statistical data to enable effect-size calculation), effect sizes were calculated to indicate the magnitude of the effect of the conservation-marketing intervention on outcome variables. The magnitude of effect sizes was classified based on values of Cohen's d ($\geq$–0.15 to <0.40, small; $\geq$0.40–<0.75, medium; $\geq$0.75, large [Thalheimer & Cook 2002]) or based on odds ratios (OR) (0–<1.5, small; $\geq$1.5–<2.5, medium; $\geq$2.5, large [Rosenthal 1996]).

Critical Appraisal

Critical appraisal of studies was undertaken with the Quality Assessment Tool for Quantitative Studies (QATQS) (Effective Public Health Practice Project 2009). This tool assesses studies' methodological quality based on selection bias, design, confounders, blinding, data-collection methods, and withdrawals and dropouts. Studies receive a score of good, fair, or weak for each of the 6 categories and a global rating of strong (no weak ratings), moderate (a weak rating in 1 category), or weak (a weak rating in $\geq$2 categories).

Consistent with CEE (2018) recommendations to adapt quality appraisal tools to the objectives of the review, we made 1 adaptation to the QATQS: we removed the blinding category from consideration. Blinding indicates whether the researchers and participants are aware of participant intervention status and whether participants are aware of the purpose of the research; double-blind conditions are considered optimal. Blinding can be challenging in conservation settings because participants often take part in the intervention (e.g., watch a presentation at a zoo or view conservation-related advertisements) in the presence of researchers and are assessed by the researchers immediately after exposure, making it difficult to conceal participant intervention status. In addition, because most psychosocial conservation research assesses participants by asking direct questions about their conservation-related cognition, attitudes, and behavior, it is difficult to conceal the purpose of the research. Based on these characteristics of this research field, we elected to remove blinding from consideration in critical appraisal to avoid underestimating the global quality of included studies.

Critical appraisal was conducted in duplicate by J.R. and S.M. independently, and Cohen's kappa coefficient was calculated to determine inter-rater reliability. Across categories, inter-rater reliability ranged from good to excellent (κ range = 0.644–1.00, $p < 0.001$) (Table 4). Discrepancies were resolved through discussion until consensus was reached for 100% of items.

Data Synthesis and Presentation

Given the heterogeneity of research design, objectives, and outcomes studied, quantitative data synthesis was not feasible, and data were therefore analyzed using narrative synthesis (Popay et al. 2006; CEE 2018). An overview of the study characteristics based on the standardized data extraction sheet and methodological quality was initially established and used to identify similarities and differences between studies. Then, narrative synthesis was undertaken. We found that organizing or structuring this analysis based on a dominant characteristic, in this case, intervention type (technique or campaign) was most sensible. We also considered methodological quality of studies. Where possible, studies with a strong global score were described in greater detail in the synthesis.

Authors C.L. and J.D. coauthored 2 studies included in the review. To avoid potential author influences during screening and appraisal decision making, neither C.L. nor J.D. was involved in article screening, data extraction, or quality appraisal.

Table 3. Characteristics of studies included in the review of conservation-marketing studies.

Article reference	*Subject population*	*Intervention type*		*Setting*	*Outcomes measured (C, cognitive; A, affective; B, behavioral)*			*Methodological design*	*Effects of intervention on cognitive (C), affective (A), or behavioral (B) outcome*					
									statistical significance[a]			*effect size*[b]		
		campaign	*technique*		*C*	*A*	*B*		*C*	*A*	*B*	*C*	*A*	*B*
Alfaro-Shigueto et al. 2012	fishers	√		Peru, South America			√	interviews (1 time point)	not applicable: no comparator group					
Andriamalala et al. 2013	adults (or residents)	√[c]		southwestern Madagascar	√	√	√	pre- and postsurvey with different participants				NR		
Curti & Valdez 2009 - traditional evaluation sample	fishers & leaders	√		Panama Canal	√	√		pre- and postsurvey with same participants		NR		OR: 5.76, large	OR: 3.45, large	
Day et al. 2014	local fishers and community members	√[c]		Cortes, Philippines	√	√	√	pre- and postsurvey; unclear if same participants	√	√	NR	insufficient data to calculate		
DeWan et al. 2013	residents, Yuhe Nature Reserve	√[c]		Gansu Province, China	√	√	√	controlled clinical trial	√	√	√	insufficient data to calculate		
Dikou & Dionysopoulou 2011	residents of (NMPANS)[d]		√	Greece	√	√	√	survey (1 time point)	not applicable: no comparator group					
Douglas & Winkel 2014	adults	√[c]	√	Dominica		√		interviews (1 time point)		√		insufficient data to calculate		
Draheim et al. 2011	undergraduate university students		√	Washington D.C., U.S.A.		√		pre- and postsurvey with same participants		√			$d = 0.24$ small	
Green et al. 2013	landowners	√[c]		Actopan municipality, Mexico	√	√	√	pre- and postsurvey with same participants	NR, insufficient data to calculate					

Continued

Table 3. Continued.

Article reference	Subject population	Intervention type: campaign	Intervention type: technique	Setting	Outcomes measured (C, cognitive; A, affective; B, behavioral): C	A	B	Methodological design	Effects of intervention on cognitive (C), affective (A), or behavioral (B) outcome: statistical significance[a] C	A	B	effect size[b] C	A	B
Hart and Larson 2014	undergraduate university students		√	northeastern U.S.A.	√	√	√	randomized controlled trial	√	√	√	$d = 1.15$, large	$d = 1.71$, large	$d = 1.71$, large
Howe et al. 2012	residents in or near Chernye Zemli Reserve	√		Southern Russia	√	√	√	controlled clinical trial	√			insufficient data to calculate		
Kamrowski et al. 2014	residents of town	√		Bargara, Australia		√	√	survey (1 time point)		not applicable: no comparator group				
Kamrowski et al. 2015	residents of town	√		Bargara, Australia	√	√	√	survey (1 time point)		not applicable: no comparator group				
Landers et al. 2006	homeowners with yards	√		Washington D.C., U.S.A.	√		√	pre- and postsurvey with different participants	✗		√	insufficient data to calculate		
Martinez et al. 2013	landowners, electricity consumers	√[c]		Peru	√	√	√	cohort analytic	√	√	√	insufficient data to calculate		
Opermanis et al. 2015	nature hall event attendees	√		Latvia	√		√	survey (1 time point)	not applicable: no comparator group					
Padua 1994	primary school students (grades 5–8)	√		São Paulo State, Brazil	√	√		randomized controlled trial	√	√		$d = 1.65$ large		
Pearson et al. 2011	undergraduate university students		√	Adelaide, South Australia	√	√	√	randomized controlled trial	√	√		insufficient data to calculate		

Continued

Table 3. Continued.

Article reference	Subject population	Intervention type: campaign	Intervention type: technique	Setting	Outcomes measured (C, cognitive; A, affective; B, behavioral): C	A	B	Methodological design	Effects of intervention on cognitive (C), affective (A), or behavioral (B) outcome: statistical significance[a] C	A	B	effect size[b] C	A	B
Pearson et al. 2014	adult visitors to Melbourne Zoo		√	Melbourne, Victoria, Australia	√	√	√	interrupted time series	√	√	√	OR: 2.5, med.	OR: 1.13, small	OR: 3.35, med.
Ross et al. 2011	members of public		√	U.S.A.	√	√		randomized controlled trial	√	√		$d = 0.20$, Small	$d = 0.18$, Small	
Saypanya et al. 2013	residents of in or near protected zones	√[c]		Laos	√	√	√	controlled clinical trial	√	√	√	insufficient data to calculate		
Schaffner et al. 2015	community members		√	Switzerland		√		interviews (1 time point)	not applicable: no comparator group					
Schroepfer et al. 2011, experiment 1	university students		√	Durham, North Carolina, U.S.A.	√	√	√	randomized controlled trial	√	√	✗	insufficient data to calculate		
Schroepfer et al. 2011, experiment 2	university students		√	Durham, North Carolina, U.S.A.	√	√	√	randomized controlled trial	√	√	✗	insufficient data to calculate		
Shaw et al. 2014	cinema attendees		√	Rothschild, U.S.A.	√			one-off interview	not applicable: no comparator group					
van der Ploeg et al. 2011	residents		√	San Mariano, Philippines	√	√		controlled clinical trial	NR			OR: 9.25, large	OR: 90, large	
Weinstein et al. 2015, experiment 1	psychology students, members of the public		√	U.K.			√	randomized controlled trial			√	insufficient data to calculate		
Weinstein et al. 2015, experiment 2	psychology students, members of the public		√	U.K.			√	randomized controlled trial			√	insufficient data to calculate		

[a]*We calculated all effect sizes with data provided in articles; no studies reported effect sizes.*
[b]*Abbreviations: NR, not reported; OR, odds ratio;* d, *Cohen's* d.
[c]*RARE Pride campaign*
[d]*National Marine Park of Alonissos, Northern Sporades*

Table 4. Critical appraisal scores for studies included in the review of conservation-marketing studies.

	Selection bias	*Study design*	*Confounders*	*Data collection*	*Withdrawals and dropouts*	*Global score*
Alfaro-Shigueto et al. 2012	fair	weak	weak	fair	N/A	weak
Andriamalala et al. 2013	fair	fair	weak	weak	N/A	weak
Curti & Valdez 2009	fair	fair	weak	weak	weak	weak
Day et al. 2014	weak	weak	fair	weak	weak	weak
DeWan et al. 2013	fair	fair	fair	weak	N/A	moderate
Dikou & Dionysopoulou 2011	weak	weak	n/a	good	N/A	weak
Douglas & Winkel 2014	weak	weak	n/a	weak	N/A	weak
Draheim et al. 2011	weak	weak	weak	good	weak	weak
Green et al. 2013	good	fair	good	weak	N/A	moderate
Hart & Larson 2014	fair	good	good	good	N/A	strong
Howe et al. 2012	fair	good	good	fair	N/A	strong
Kamrowski et al. 2014	fair	weak	n/a	good	N/A	moderate
Kamrowski et al. 2015	fair	weak	n/a	good	N/A	moderate
Landers et al. 2006	fair	fair	weak	weak	N/A	weak
Martinez et al. 2013	fair	fair	good	weak	N/A	moderate
Opermanis et al. 2015	fair	weak	n/a	weak	N/A	weak
Padua 1994	weak	good	weak	good	good	weak
Pearson et al. 2011	weak	good	good	good	weak	moderate
Pearson et al. 2014	good	fair	good	good	N/A	strong
Ross et al. 2011	fair	good	weak	weak	N/A	weak
Saypanya et al. 2013	fair	good	good	fair	N/A	strong
Schaffner et al. 2015	weak	weak	n/a	fair	N/A	weak
Schroepfer et al. 2011, experiment 1	weak	good	weak	fair	N/A	weak
Schroepfer et al. 2011, experiment 2	weak	good	weak	fair	N/A	weak
Shaw et al. 2014	weak	weak	n/a	weak	N/A	weak
van der Ploeg et al. 2011	good	fair	weak	weak	N/A	weak
Weinstein et al. 2015, experiment 1	weak	good	good	good	N/A	moderate
Weinstein et al. 2015, experiment 2	weak	good	good	good	N/A	moderate

Results

The preliminary search located 7142 unique records, and the screening process identified 28 eligible studies published in 26 articles that evaluated the impact of a conservation-marketing intervention on individuals' cognitive, affective, or behavioral engagement with biodiversity conservation (Fig. 1).

Characteristics of Included Studies

There was a relatively equal balance of studies evaluating techniques and campaigns ($n = 14$ and $n = 15$, respectively; 1 study investigated both [Douglas & Winkel 2014]) (Table 3). Studies originated from diverse regions around the world. Most occurred in Europe, North America, and South or Central America. All but 3 studies (Padua 1994; Landers et al. 2006; Curti & Valdez 2009) were conducted from 2011 to 2016. Most studies included ≥ 2 outcome variables, typically spread across 2 or 3 domains (i.e., cognitive, affective, and behavioral). Samples typically consisted of residents of a specific area (often a protected area, e.g., residents living near the National Marine Park of Alonissos, Northern Sporades in Greece [Dikou & Dionysopoulou 2011]), although university student samples were also common (e.g., Schroepfer et al. 2011), as were attendees of specific events, such as Nature Hall art and science events (Opermanis et al. 2015), zoo visitors (Pearson et al. 2014), and cinema attendees (Shaw et al. 2014).

Methodological Quality

Over half of all included studies were assigned a weak global methodological score (16 studies, 57.1%). Eight studies (28.6%) were assigned a moderate global score, and 4 studies (14.3%) received a strong global score (Table 4). Studies assigned a strong global score included 2 controlled clinical trials (trials with nonrandom allocation between conditions [Howe et al. 2012; Saypanya et al. 2013]), 1 randomized controlled trial (Hart & Larson 2014), and 1 interrupted time series study (different groups of self-selected participants were sampled and assessed across a longitudinal series of time points [Pearson et al. 2014]).

The specific methodological components most commonly assessed as weak included selection bias (i.e., participants were not selected at random and response or acceptance rate was poor or not reported; 12 studies, 42.9%), confounders (i.e., important differences in demographics, such as sex or age, or other characteristics between groups prior to intervention or differences between groups were not reported and differences were not controlled for in data analysis; 10 studies, 35.7%), and

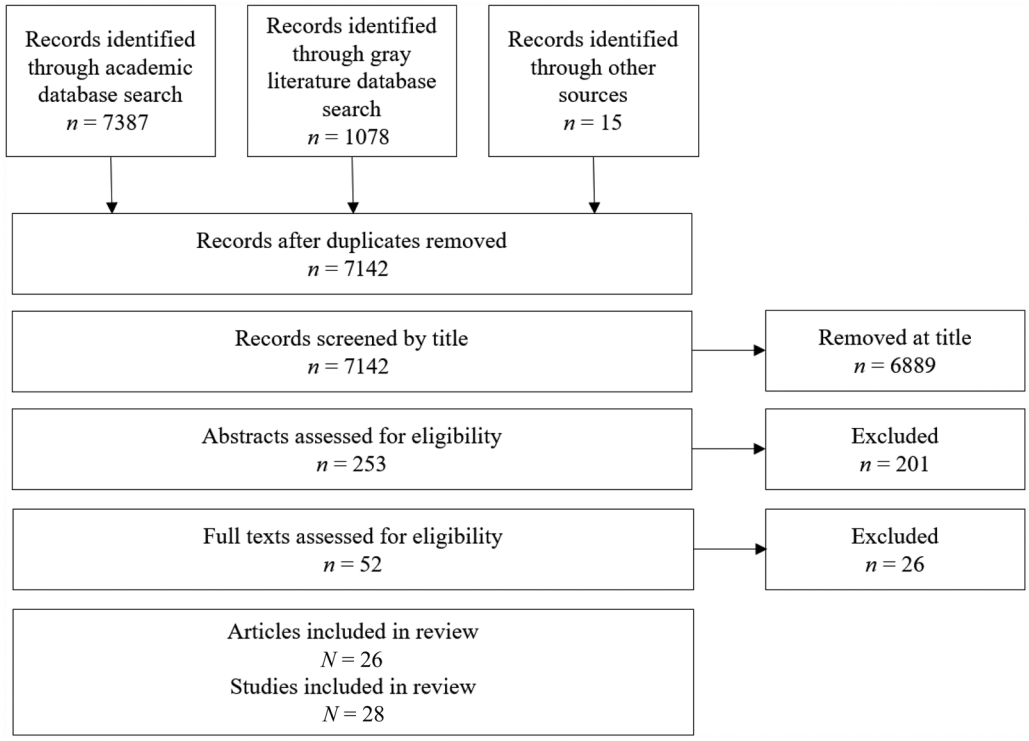

Figure 1. Data-collection flow chart applied in the review of conservation-marketing studies.

data collection (i.e., assessment tools were not shown to be reliable or valid; 12 studies, 42.9%). Rigorous study designs (i.e., those with a control condition, including randomized controlled trials and clinical controlled trials) did not always equate to strong global methodological scores. A number of randomized controlled trials scored weak for global methodological quality (e.g., Padua 1994; Ross et al. 2011; Schroepfer et al. 2011) due to other limitations in how the studies were conducted or reported, such as the use of unvalidated measurement tools or poor response rates (Table 4).

Narrative Synthesis of Findings

Conservation marketing techniques evaluated in this body of research included written text or messages (Hart & Larson 2014; Schaffner et al. 2015), still images (Ross et al. 2011), videos (Weinstein et al. 2015 [studies 1 & 2]; Pearson et al. 2011; Schroepfer et al. 2011; Shaw et al. 2014), or a combination of these (Draheim et al. 2011). None of these studies scored strong for global methodological quality; however, Pearson et al. (2011) and Weinstein et al. 2015 (studies 1 & 2) scored moderate. Each of these studies were randomized controlled trials, whereby university students were randomly allocated to view different video presentations and then complete assessments of their behavior (Weinstein et al. 2015) or cognition, affect, and behavior (Pearson et al. 2011). Both studies found statistically significant differences in outcome scores depending on which video was viewed; however, it was not possible to calculate effect sizes due to the provision of insufficient detail except for 1 outcome in Pearson et al. (2011) in which students reported increases in target behaviors from 23% to 85% (OR of 1.35 or small effect). It was not possible to conduct further synthesis of findings from the 14 studies that evaluated conservation-marketing techniques because of the poor methodological quality of these studies (e.g., 3 did not include a comparator group [Dikou & Dionysopoulou 2011; Shaw et al. 2014; Schaffner et al. 2015]).

Of the studies that evaluated campaigns, there was an equal number of community-based education, public awareness, and action campaigns (Curti & Valdez 2009; Alfaro-Shigueto et al. 2012; Howe et al. 2012; Kamrowski et al. 2014 [studies 1 & 2]; Padua 1994; Landers et al. 2006; Pearson et al. 2014; Opermanis et al. 2015) and Pride campaigns (Andriamalala et al. 2013; DeWan et al. 2013; Green et al. 2013; Martinez et al. 2013; Saypanya et al. 2013; Day et al. 2014; Douglas & Winkel 2014). Of the community-based campaigns, Howe et al. (2012) and Pearson et al. (2014) both were assessed as having strong global methodological quality. Of the remaining 7 studies, 5 yielded a weak methodological score and 2 were assigned moderate ratings.

Howe et al. (2012) conducted a controlled clinical trial with residents near the Chernya Zemli Reserve in Southern Russia to evaluate whether a media-driven public awareness campaign promoted greater awareness, more favorable attitudes, and intentions to act toward

saiga antelope (*Saiga tatarica*) conservation. Results showed a significant interaction effect of knowledge about saiga antelopes and exposure to the intervention on knowledge of saiga conservation efforts, and 82% of participants pledged to donate to saiga conservation (mean pledge amount = US$5.26–23.52). Findings suggested that reinforcement of existing knowledge and exposure to the campaign via multiple media contributed to changes in audience awareness and behavioral intentions. Pearson et al. (2014), in contrast, demonstrated positive effects of a zoo-based education campaign (Don't Palm Us Off), which aimed to educate Melbourne Zoo visitors in Victoria, Australia, about the adverse effects of palm oil agriculture on orangutans (*Pongo*) and to encourage visitors to take action to support mandatory palm oil labeling. Different groups of zoo visitors were surveyed prior to campaign launch, throughout the campaign, and after the campaign ended. Results indicated that palm oil awareness, attitudes toward orangutans, and support for palm-oil labeling increased at all time points relative to baseline ($p < 0.01$). It was possible to calculate odds ratios for the main findings; results suggested effect sizes ranging from small (for attitude change over time, OR = 1.13) to medium (willingness to change behavior over time OR = 3.35).

Pride campaigns are a specific type of conservation-marketing campaign conducted by conservation organization, Rare. Of the studies evaluating a Pride campaign, equal numbers were assessed as methodologically weak and moderate (3 of each), and 1 study was assessed as methodologically strong (Saypanya et al. 2013). Saypanya et al. evaluated the effects of a Pride campaign on community awareness of, attitudes toward, and self-reported interpersonal communications about illegal hunting of ungulates (primary source of prey for *Panthera tigris*) among residents of a protected area in Laos. Knowledge increased over the course of the campaign among residents who lived in the intervention area and residents of a control site, whereas attitudes and self-reported behavior improved only in the intervention site, suggesting that these shifts were initiated as a result of the campaign. Other studies evaluating Pride campaigns similarly showed positive effects, although some studies reported limited statistical information, making it difficult to interpret the findings. For example, Day et al. (2014) failed to report a sample size and reported increases in behavior as "31.1 percentage points" without further explanation. In general, it was common for Pride evaluations to report basic descriptive statistics (e.g., report changes in percentages [Andriamalala et al. 2013; DeWan et al. 2013; Martinez et al. 2013; Day et al. 2014]) as opposed to employing inferential statistical analyses to draw conclusions from the data (e.g., chi square [Green et al. 2013; Day et al. 2014], general linear models [Douglas & Winkel 2014]).

None of the included studies reported effect sizes for change scores or differences in mean scores between control and intervention participants, but it was possible to calculate effect scores for 7 of the 28 included studies. Large effects in the intended directions were seen in Curti and Valdez (OR 3.45–5.76; 2009) and Hart and Larson (Cohen's d 1.15–1.71; 2014), for example, whereas other studies demonstrated small effect sizes (Ross et al. 2011, Cohen's $d = 0.18$–0.20; 2011). Dewan et al. (2013) reported an increase in purchases of habitat-saving gas fires (which resulted in a 40% reduction in fuelwood consumption per household) from 12% of households using gas fires at baseline to 43% of households 2.5 years after the campaign was executed (OR = 5.53, large effect).

Discussion

We identified 28 studies published in 26 peer-reviewed journal articles that evaluated the psychosocial impacts of conservation marketing initiatives. Conservation organization Rare was overrepresented in this data set because they consistently evaluate their campaigns and disseminate their findings. Our notable findings were that all but 3 studies were conducted in the 5 years prior to our review; focus was typically broad; the majority were beset with methodological shortcomings; and although many demonstrated statistically significant change in the intended direction, few demonstrated impact as measurable behavior change.

Over 90% of studies were conducted from 2011 to 2016, which underscores the fact that this is a nascent field of research. Although methodological limitations affected the reliability of findings for most studies reviewed, it is encouraging to note the diversity of study objectives, geographic locations, issues addressed, and techniques used in this body of research because these highlight the utility and adaptability of conservation marketing as an audience engagement strategy. Furthermore, statistically significant findings in the intended directions were reported across the range of studies regardless of methodological quality, which hints at converging evidence about conservation marketing's efficacy as a biodiversity tool.

Strengths and Limitations

This is the first study to identify, critically appraise, and synthesize research findings in the emerging field of conservation marketing. Significant efforts were made to capture all potentially influential studies, including the development of a comprehensive search strategy in consultation with an academic librarian. We used standardized critical appraisal tools to ensure the reliability and validity of findings, and all stages of data collection, data analysis, and critical appraisal were conducted in duplicate. Even so, designing a search strategy based

on appropriate search terms was a major challenge, and some eligible articles may have been missed (type 1 error) and others that were not conservation marketing initiatives may have been included (type 2 error). To minimize these errors in future, we encourage the use of standardized terms and keywords, such as conservation-marketing initiatives, instead of broader teams, such as social marketing or communication campaigns. Specific limitations of our review include a lack of a systematic review protocol and failure to maintain records of the reasons that studies were excluded at various stages of the screening process, which made it impossible to comment on the reasons studies were deemed ineligible (e.g., outside scope).

Since we conducted this review, Verissimo and his colleagues have published at least 3 evaluations of social-marketing campaigns aimed at conservation. They addressed measurement of qualitative impacts (Salazar et al. 2019), challenges of evaluating social-marketing campaigns aimed at biodiversity conservation (Veríssimo et al. 2018), and demand-reduction campaigns for illegal wildlife products (Greenfield & Veríssimo 2019).

It is promising to see the diversity of conservation-marketing applications; however, this body of research is characterized by significant methodological flaws that affect the validity and reliability of findings. Of the 28 studies included in our review, just 4 were of strong methodological quality; the remainder had 2 or more major methodological limitations. Common limitations included selection biases, confounders, and the use of unvalidated assessment tools. Some of these limitations likely stem from the fact that conservation marketing is in its infancy as a scientific field and thus standardized approaches to the evaluation of campaigns and operationalization of outcome variables are yet to be established or taken up (Bennett et al. 2017). A number of articles have been published recently that call for increased integration of the social sciences into conservation, and they provide detailed plans for how conservation practitioners can improve the methodological quality of their evaluations (e.g., Bennett et al. 2017; Teel et al. 2018). Building research teams that are multidisciplinary and experienced in designing methodologically sound and ethical research studies, carrying them out in ecologically valid settings, and publishing the findings in peer-reviewed journals is an important step toward these objectives.

Future Directions

An important function of the discussion surrounding conservation marketing's effectiveness is to propose methodological recommendations and identify areas for future research. In terms of addressing methodological issues and limitations, we propose 4 core recommendations that future studies should address (at a minimum) to achieve sufficient methodological rigor and support direct comparison of study findings in experimental research: first, describe research design and procedure in detail to ensure replicability of studies, including survey response rates, dropout and acceptance rates, sample sizes, mean scores and standard deviations, data-analysis plans, and effect sizes; second, prioritize the inclusion of a comparator group, such as a control group or site, to help establish causal explanations (between group comparisons) or if that is not possible, prepost intervention assessments with the same group of participants; third, control for effects of potential covariates (e.g., gender and age) in statistical analyses; and fourth, conduct a pilot study or trial with a small group of participants in a more controlled setting to test the effect of individual elements of the campaign (e.g., text, images, and videos). The field will also benefit from high-quality case studies and qualitative reflections that provide context and in-depth understanding, as well as generating further hypotheses.

In terms of research directions, operationalizing and quantifying the magnitude of impact on biodiversity outcomes remains a difficult challenge for this field. Of the psychosocial outcomes assessed (cognitive, affective, and behavioral), conservation-protective behavior has the most direct link to biodiversity outcomes, but in reality it remains difficult and, in many cases, unethical to observe and measure what people do in their private lives, at home, or work. Furthermore, few validated scales for measuring conservation-related behavior exist and those that do have not been validated against objective criteria; hence, the relationship between self-reported conservation behavior and actual behavior is unclear. Still, the small body of research included in this review contains some innovative examples of how objective behaviors or consequences of behaviors can be measured in conservation marketing research. DeWan et al. (2013), for example, recorded purchases of fuel-efficient stoves and estimated reductions in fuelwood use, which averaged at 40% per household. Creative ways to assess actual behavior change or results of behavior change should be encouraged. Where this is not possible, it is essential that validated self-reported measures are used rather than purpose-designed or ad hoc assessment tools. Conservation marketing holds promise and appeal as a means to reach and influence audiences to benefit biodiversity conservation.

Supporting Information

Illustration of theoretical conservation marketing process applied to Ivory Free campaign (WildAid 2017) (Appendix S1) is available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

Literature Cited

Ajzen I. 1991. The theory of planned behavior. Organizational Behavior and Human Decision Processes **50:**179–211.

Alfaro-Shigueto J, Mangel JC, Dutton PH, Seminoff JA, Godley BJ. 2012. Trading information for conservation: a novel use of radio broadcasting to reduce sea turtle bycatch. Oryx **46:**332–339.

Andriamalala G, Peabody S, Gardner CJ, Westerman K. 2013. Using social marketing to foster sustainable behaviour in traditional fishing communities of southwest Madagascar. Conservation Evidence **10:**37–41.

Barnosky AD, Matzke N, Tomiya S, Wogan GO, Swartz B, Quental TB, Marshall C, McGuire JL, Lindsey EL, Maguire KC. 2011. Has the Earth's sixth mass extinction already arrived? Nature **471:**51–57.

Bennett NJ, Roth R, Klain SC, Chan K, Christie P, Clark DA, Cullman G, Curran D, Durbin TJ, Epstein G. 2017. Conservation social science: understanding and integrating human dimensions to improve conservation. Biological Conservation **205:**93–108.

Butler P, Green K, Galvin D. 2013. The principles of pride. Rare, Arlington, Virginia.

Collaboration for Environmental Evidence (CEE). 2018. Guidelines and standards for evidence synthesis in environmental management. Collaboration for Environmental Evidence, Penmaenmawr, United Kingdom. Available from http://www.environmentalevidence.org (accessed July 2019).

Curti M, Valdez U. 2009. Incorporating community education in the strategy for harpy eagle conservation in Panama. Journal of Environmental Education **40:**3–16.

Day BA, DeWan A, Cadiz FC, Jakosalem-Balane J, Dueñas V, Trinidad Jr PM. 2014. Rare social marketing for sustainable fishing in Cortes, Surigao del Sur, Philippines. Applied Environmental Education & Communication **13:**56–65.

DeWan A, Green K, Li X, Hayden D. 2013. Using social marketing tools to increase fuel-efficient stove adoption for conservation of the golden snub-nosed monkey, Gansu Province, China. Conservation Evidence **10:**32–36.

Dikou A, Dionysopoulou N. 2011. Communicating a marine protected area through the local press: the case of the National Marine Park of Alonissos, Northern Sporades, Greece. Environmental Management **47:**777–788.

Douglas LR, Winkel G. 2014. The flipside of the flagship. Biodiversity and Conservation **23:**979–997.

Draheim MM, Rockwood LL, Guagnano G, Parsons E. 2011. The impact of information on students' beliefs and attitudes toward coyotes. Human Dimensions of Wildlife **16:**67–72.

Duthie E, Veríssimo D, Keane A, Knight AT. 2017. The effectiveness of celebrities in conservation marketing. PLOS ONE **12** (e0180027) https://doi.org/10.1371/journal.pone.0180027.

Effective Public Health Practice Project. 2009. Quality assessment tool for quantitative studies. National Collaborating Centre for Methods and Tools, McMaster University Hamilton, Ontario. Available from https://www.nccmt.ca/knowledge-repositories/search/14 (accessed January 2017).

Green KM, DeWan A, Arias AB, Hayden D. 2013. Driving adoption of payments for ecosystem services through social marketing, Veracruz, Mexico. Conservation Evidence **10:**48–52.

Greenfield S, Veríssimo D. 2019. To what extent is social marketing used in demand reduction campaigns for illegal wildlife products? Insights from elephant ivory and rhino horn. Social Marketing Quarterly **25:**1.

Haddaway NR, Styles D, Pullin AS. 2014. Evidence on the environmental impacts of farm land abandonment in high altitude/mountain regions: a systematic map. Environmental Evidence **3:**1.

Hart P, Larson BM. 2014. Communicating about invasive species: how "driver" and "passenger" models influence public willingness to take action. Conservation Letters **7:**545–552.

Hassan R, Scholes R, Ash N. 2005. Ecosystems and human well-being: current state and trends. Island Press, Washington, D.C.

Howe C, Obgenova O, Milner-Gulland EJ. 2012. Evaluating the effectiveness of a public awareness campaign as a conservation intervention: the saiga antelope *Saiga tatarica* in Kalmykia, Russia. Oryx **46:**269–277.

Johnson CN, Balmford A, Brook BW, Buettel JC, Galetti M, Guangchun L, Wilmshurst JM. 2017. Biodiversity losses and conservation responses in the Anthropocene. Science **356:**270–275.

Kamrowski R, Sutton S, Tobin R, Hamann M. 2014. Potential applicability of persuasive communication to light-glow reduction efforts: a case study of marine turtle conservation. Environmental Management **54:**583–595.

Kamrowski RL, Sutton SG, Tobin RC, Hamann M. 2015. Balancing artificial light at night with turtle conservation? Coastal community engagement with light-glow reduction. Environmental Conservation **42:**171–181.

Kotler P, Zaltman G. 1971. Social marketing: an approach to planned social change. Journal of Marketing **35:**3–12.

Landers J, Mitchell P, Smith B, Lehman T, Conner C. 2006. "Save the crabs, then eat 'em": a culinary approach to saving the Chesapeake Bay. Social Marketing Quarterly **12:**15–28.

Lehner M, Mont O, Heiskanen E. 2016. Nudging–a promising tool for sustainable consumption behaviour? Journal of Cleaner Production **134:**166–177.

MacDonald E, Milfont T, Gavin M. 2016. Applying the Elaboration Likelihood Model to increase recall of conservation messages and elaboration by zoo visitors. Journal of Sustainable Tourism **24:**866–881.

Martinez R, Green KM, DeWan A. 2013. Establishing reciprocal agreements for water and biodiversity conservation through a social marketing campaign in Quanda Watershed, Peru. Conservation Evidence **10:**42–47.

McKenzie-Mohr D. 2000. Fostering sustainable behaviour through community-based social marketing. American Psychologist **55:**531–537.

McKenzie-Mohr D, Schultz W. 2014. Choosing effective behavior change tools. Social Marketing Quarterly **20:**35–46.

Moher D, Liberati A, Tetzlaff J, Altman DG. 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Annals of Internal Medicine **151:**264–269.

Novacek MJ. 2008. Engaging the public in biodiversity issues. Proceedings of the National Academy of Sciences of the United States of America **105:**11571–11578.

Opermanis O, Kalnins SN, Aunins A. 2015. Merging science and arts to communicate nature conservation. Journal for Nature Conservation **28:**67–77.

Padua SM. 1994. Conservation awareness through an environmental education programme in the Atlantic forest of Brazil. Environmental Conservation **21:**145–151.

Pearson E, Dorrian J, Litchfield C. 2011. Harnessing visual media in environmental education: increasing knowledge of orangutan conservation issues and facilitating sustainable behaviour through video presentations. Environmental Education Research **17:**751–767.

Pearson E, Lowry R, Dorrian J, Litchfield CA. 2014. Evaluating the conservation impact of an innovative zoo-based educational campaign: 'Don't Palm Us Off' for orang-utan conservation. Zoo Biology **33:**184–196.

Petty RE, Cacioppo JT. 1986. The elaboration likelihood model of persuasion. Pages 1–24 in Communication and persuasion. Springer.

Pimm SL, Jenkins CN, Abell R, Brooks TM, Gittleman JL, Joppa LN, Raven PH, Roberts CM, Sexton JO. 2014. The biodiversity of species and their rates of extinction, distribution, and protection. Science **344:**1246752.

Popay J, et al. 2006. Guidance on the conduct of narrative synthesis in systematic reviews. A product from the ESRC methods programme. Version 1, b92. Economic and Social Research Council, Swindon.

Pretty J, Smith D. 2004. Social capital in biodiversity conservation and management. Conservation Biology **18:**631–638.

Root-Bernstein M, Douglas L, Smith A, Verissimo D. 2013. Anthropomorphized species as tools for conservation: utility beyond prosocial, intelligent and suffering species. Biodiversity and Conservation **22:**1577–1589.

Rosenthal JA. 1996. Qualitative descriptors of strength of association and effect size. Journal of Social Service Research **21:**37–59.

Ross SR, Vreeman VM, Lonsdorf EV. 2011. Specific image characteristics influence attitudes about Chimpanzee conservation and use as pets. PLOS ONE **6** (e22050) https://doi.org/10.1371/journal.pone.0022050.

Salazar G, Mills M, Veríssimo D. 2019. Qualitative impact evaluation of a social marketing campaign for conservation. Conservation Biology **33:**634–644.

Saypanya S, Hansel T, Johnson A, Bianchessi A, Sadowsky B. 2013. Effectiveness of a social marketing strategy, coupled with law enforcement, to conserve tigers and their prey in Nam Et Phou Louey National Protected Area, Lao People's Democratic Republic. Conservation Evidence **10:**57–66.

Schaffner D, Demarmels S, Juettner U. 2015. Promoting biodiversity: Do consumers prefer feelings, facts, advice or appeals? Journal of Consumer Marketing **32:**266–277.

Schroepfer KK, Rosati AG, Chartrand T, Hare B. 2011. Use of "entertainment" chimpanzees in commercials distorts public perception regarding their conservation status. PLOS ONE **6** (e26048) https://doi.org/10.1371/journal.pone.0026048.

Shaw BR, Howell A, Genskow K. 2014. Evaluation of a movie theater advertisement campaign to promote behaviors that prevent spread of aquatic invasive species. Society and Natural Resources **27:**768–776.

Teel TL, et al. 2018. Publishing social science research in *Conservation Biology* to move beyond biology. Conservation Biology **32:**6–8.

Thalheimer W, Cook S. 2002. How to calculate effect sizes from published research: A simplified methodology. Work-Learning Research, pp. 1–9.

United Nations. 2011. Aichi biodiversity targets. Convention on Biological Diversity.

van der Ploeg J, Cauilan-Cureg M, van Weerd M, De Groot WT. 2011. Assessing the effectiveness of environmental education: mobilizing public support for Philippine crocodile conservation. Conservation Letters **4:**313–323.

Veríssimo D, Bianchessi A, Arrivillaga A, Cadiz FC, Mancao R, Green K. 2018. Does it work for biodiversity? Experiences and challenges in the evaluation of social marketing campaigns. Social Marketing Quarterly **24:**18–34.

Walpole MJ, Leader-Williams N. 2002. Tourism and flagship species in conservation. Biodiversity and Conservation **11:**543–547.

Weinstein N, Rogerson M, Moreton J, Balmford A, Bradbury RB. 2015. Conserving nature out of fear or knowledge? Using threatening versus connecting messages to generate support for environmental causes. Journal for Nature Conservation **26:**49–55.

Wheeler RT. 2009. Nonprofit advertising: impact of celebrity connection, involvement and gender on source credibility and intention to volunteer time or donate money. Journal of Nonprofit & Public Sector Marketing **21:**80–107.

WildAid. 2017. Ivory Free. WildAid, San Francisco. Available from http://www.wildaid.org/about-wildaid (accessed February 2017).

Wright AJ, Veríssimo D, Pilfold K, Parsons ECM, Ventre K, Cousins J, Jefferson R, Koldewey H, Llewellyn F, McKinley E. 2015. Competitive outreach in the 21st century: why we need conservation marketing. Ocean & Coastal Management **115:**41–48.