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What goes up must come down: an evaluation of a zoo conservation-education program for balloon litter on visitor understanding, attitudes, and behaviour

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ABSTRACT

Balloons used outdoors can fly away, posing ingestion and entanglement hazards to wildlife. "When Balloons Fly" (WBF) conservation-education program seeks to educate zoo visitors about these threats and encourage the use of wildlife-friendly bubbles at outdoor events. We examined the effect of WBF on visitor knowledge, attitudes, and behaviours (intentions and actions) over 6 months ($N = 624$). We compared outcomes among visitors who viewed a presentation and exhibit, to viewing the exhibit-only, and investigated the priming influence of completing a survey before entering the exhibit (pre-survey). Visitors had greater depth of understanding about the impact of balloons immediately following the visit, but post-visit message recall was low. General Linear Models revealed that over 6 months WBF significantly ($p < .05$) influenced positive attitudes concerning balloon use, increased likelihood to use bubbles, and reduced likelihood to use balloons. Completion of a pre-survey significantly influenced positive attitudes and reduced likelihood to use balloons. WBF is promoting conservation behaviour, with two-thirds of the follow-up sample reporting that behaviours they changed while hosting or attending an outdoor event since their visit were influenced by the zoo experience. Future work can investigate materials that might mimic a priming effect (e.g., worksheets).

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Global biodiversity is declining (Butchart et al., 2010), with experts estimating losses 100–1,000 times higher than what could be considered a natural extinction rate (Barnosky et al., 2011; Pimm et al., 2014). As one of the fastest-growing global economic sectors and contributor to 10% of the world's gross domestic product (World Travel and Tourism Council, 2018), it is critical for the travel and tourism industry to establish a leading involvement in worldwide biodiversity

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conservation (United Nations World Tourism Organization, 2017). Conservation education represents an important avenue for the tourism industry to make meaningful contributions to sustainable development, for example, to address Sustainable Development Goal 15 of the 2030 Sustainable Development Agenda: "*protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss*" (United Nations General Assembly, 2015). This article presents an evaluation of one such conservation-education initiative.

Nature-based tourism and wildlife tourism

Nature-based and wildlife tourism (viewing or interacting with nature and wildlife) are powerful tourism industry sub-sectors that can drive environmental stewardship (Higginbottom & Tribe, 2004). There is mounting evidence that such experiences can meaningfully influence people's affective reactions toward nature and wildlife, including increased empathy, sense of connectedness, and concern/care (Curtin, 2009; Curtin & Kragh, 2014; Luebke, 2018; Young, Khalil, & Wharton, 2018). Indeed, care is labelled a "fundamental starting point" for protecting the natural environment (Clayton & Myers, 2015, p. 7). Well-run modern zoos, that is, those "*conscious of the welfare of the animals in [their] care, dedicated to the conservation of animals in the wild, and committed to developing good citizens through education and empowerment of [their] visitors*" (Gray, 2017, p. 10), hereafter "zoos," have a unique capacity to inspire care, as they offer close encounters with animals, thus creating opportunities for people to connect with nature and non-human species and inspire conservation behaviour (Clayton, Fraser, & Burgess, 2011; Clayton, Fraser, & Saunders, 2009).

Although it is difficult to generalise the conservation involvement of tourism operators as diverse as zoos, conservation-education is becoming a prominent goal among zoo mission statements (Patrick, Matthews, Ayers, & Tunnicliffe, 2007). The structure of conservation-education programs or experiences vary, but typically they focus on a specific environmental issue, and promote a specific pro-environmental behaviour through multiple interpretive mediums, such as static signage displays, videos, and keeper/animal presentations. Examples include Zoos Victoria's "*Don't Palm Us Off*" which addresses the impact of unsustainable production of palm oil on orangutan habitat (see: https://www.zoo.org.au/get-involved/act-for-wildlife/dont-palm-us-off) and the Monterey Bay Aquarium Seafood Watch® program that seeks to support visitors to choose sustainably sourced seafood (see: http://www.montereybayaquarium.org/conservation-and-science/our-programs/seafood-watch). To develop a comprehensive understanding of the conservation impact of such programs, and to refine zoo-based conservation-education strategies moving forward, program outcome evaluations are necessary. Unfortunately, such evaluations are infrequently published in peer-reviewed journals, and of published work, outcomes are inconsistent, which could be attributed to the developmental needs present in evaluation methodology and reporting practices of related research (Mellish, Ryan, Pearson, & Tuckey, 2019).

Evaluation of conservation-education in zoos

Empirical outcome evaluations of zoo conservation-education programs can serve as important tools for understanding their effectiveness in creating change, and for tailoring the content of future initiatives (Shadish, Cook, & Leviton, 1991). Indeed, there is a growing research area that seeks to assess whether such programs are achieving their desired conservation goals (see review: Thomas, Teel, Bruyere, & Laurence, 2018). A large portion of this research applies theoretical frameworks of behaviour to quantify conservation impact, including the Theory of Planned Behaviour ([TPB]; Ajzen, 1991). TPB suggests that intention to perform behaviours is a key precursor to behavioural action, and that perceived behavioural control, attitudes toward the target

behaviour, subjective norms, and past behaviour, together, may predict intentions. Perhaps due in part to this TPB influence, there appears to be an overreliance on exploring self-report behavioural *intentions* within zoo-based conservation-education studies (Khalil & Ardoin, 2011; Mellish et al., 2019). Less so does literature investigate indicators of the effect of zoo conservation-education on visitor behaviour – in particular, self-reported or observed post-visit conservation behaviour (defined as actions relating to environmental sustainability; Ballantyne & Packer, 2005; Smith, Broad, & Weiler, 2008).

Within the published literature that has assessed self-reported uptake of conservation action, findings vary, which makes it difficult to draw reliable conclusions. For example, 6 months following a bird presentation, 23 out of 30 visitors who intended to increase their commitment to complete a prompted action did so, however, a large portion of these visitors further reported that influences other than the presentation shaped their commitment (e.g., media messaging, greater provision of recycling bins; Smith et al., 2008). In other studies, short-term changes in visitors' ($N = 100$) level of intended conservation action did not persist 2–3 months following a "Conservation Station" zoo experience (Dierking et al., 2004), and responses concerning uptake of conservation-related lifestyle changes 6–8 weeks following an aquarium visit most often included themes about increased respect for land and animals ($n = 37$) and being more informed/aware of an issue ($n = 26$), but did not detail specific daily behaviours (Adelman, Falk, & James, 2000). In contrast, follow-up interviews 6 weeks after viewing a presentation with messaging to keep cats inside at night indicated that 70% of visitors who pledged to perform the action had self-reported implementing the behaviour (MacDonald, 2015). Further, Mann, Ballantyne, and Packer (2018) reported that 49% of respondents gave an example of a conservation action (saved energy, eco-friendly purchasing) that they had performed that was attributed to uShaka Sea World's "Penguin Promises" program after 1-year post-visit.

There are likely several reasons for variations in the pattern of results across zoo-based conservation-education evaluation studies. Results may be attributed to the design and implementation of the program. Programs often contain different types of interpretive materials in different combinations and intensity, presenting challenges to identifying exactly what works and how. Another factor is the variety of target behaviours, which differ according to how demanding or effortful they are. The perceived difficulty of the targeted behaviour can influence uptake; simple behaviours requiring little effort (e.g., recycling) are more likely to be performed than complex behaviours that require more time or effort (e.g., volunteering; Smith, Curtis, & Van Dijk, 2010). Another example can be taken from Smith et al. (2008) who reported that participants who expressed the intent to remove road kill upon exiting the zoo but have since had the opportunity to do so and did not, explaining that this was because they felt too squeamish.

Other determining factors concern evaluation methodology and the inherent practical challenges that accompany zoo evaluation work. A review of zoo evaluation methods indicated that the most frequent intervention assessed within this body of work is an entire site or overall visit (Mellish et al., 2019). Assessing overall visit as opposed to isolated assessments of a specific interpretation element or an exhibit experience makes it difficult to determine what aspect of the experience may have contributed to study findings. Moreover, when often each program or experience is related to a specific conservation issue with a particular aim, there are typically tailored outcomes (e.g., to promote a shift in attitudes concerning a certain environmental issue), which often require the development of new measures to accurately assess program success (e.g., a custom-designed attitude scale for the specific environmental issue). Another inherent challenge is the difficulty in directly capturing post-visit conservation behaviours; subsequently, related research often draws upon indirect proxy measures including self-reported behaviour change, which, while largely unavoidable, can compromise methodological validity (i.e., social desirability bias; Arnold & Feldman, 1981).

A final consideration is the limited application of repeated measures designs (Mellish et al., 2019). There are multiple practical challenges here, including limited funding for more

comprehensive long-term evaluations within non-for-profit organisations, and the logistical burdens associated with surveying zoo visitors, that is, zoo visitors often participate in research voluntarily, and during recreational time, which poses challenges when recruiting for multiple survey completions across time points. Moreover, when seeking to establish a baseline measure against which the post-experience data can be compared, it is unknown to what extent completing the survey before being exposed to the exhibit or experience (hereafter refer to as the "pre-survey") might prime visits to engage or interact with the conservation-education material (e.g., signage, presentation). Priming theory asserts that exposure to a stimulus can unintentionally function as a filter or interpretive frame and influence how a person responds to subsequent stimuli (Bargh & Chartrand, 2000); as such, it is possible that a pre-survey could influence how visitors interpret and/or respond to intervention components.

Together, the inherent difficulties of comparing effects across interventions, the paucity of research evaluating post-visit conservation influences, and the presence of field-specific methodological gaps and practical challenges, signpost a critical need for more evaluations pertaining to the conservation impact of zoo experiences after visitors leave the zoo grounds. To address these gaps and to help move forward scientific understanding in the field, we evaluated the conservation effect of Zoos Victoria's "When Balloons Fly" (WBF) program. Guided by the TPB framework, we examined the impact on visitor understanding, attitudes, and behaviour (behavioural intentions and post-visit conservation behaviour) concerning balloon litter and the use of balloons outdoors, over a 6-month period. This study was guided by the following research questions:

1. How and to what extent does WBF influence visitor psychosocial outcomes over 6 months?
2. How and to what extent does the completion of a pre-survey impact visitor psychosocial outcomes immediately and 6 months posit-visit?

Connect-understand-act and when balloons fly

Balloons and their attachments pose "*considerable entanglement risk*" to marine wildlife (Wilcox, Mallos, Leonard, Rodriguez, & Hardesty, 2016, p. 111). Perhaps attributed to the visual similarity to typical prey items (e.g., jellyfish), balloon litter is commonly ingested too, with potential to block sections of the gastro-intestinal tract, affecting the victim's ability to breathe and threatening death by starvation (Acampora, Schuyler, Townsend, & Hardesty, 2014). Indeed, balloon litter and their attachments are one of the most common identifiable items found in the stomachs of flesh-footed shearwater chicks (*Puffinus carneipes*), a species whose population decline has been associated with high levels of plastic ingestion (Lavers, Bond, & Hutton, 2014). In response to these hazards, in February 2017, The Zoological Parks and Gardens Board (Zoos Victoria) launched their WBF conservation-education program which sought to (a) reduce the use of balloons outdoors and (b) promote the use of wildlife-friendly bubbles (hereafter "bubbles") as alternatives to balloons outdoors (McLeod, Sanders, & Wilson, 2018).

Zoos Victoria is the governing body of three zoos in the Australian state of Victoria: Healesville Sanctuary, Werribee Open Range Zoo, and Melbourne Zoo. Zoos Victoria utilise their Connect-Understand-Act (C-U-A) behaviour-change model to guide the development of programs (Zoos Victoria, 2010). Drawing upon Community-Based Social Marketing (CBSM; McKenzie-Mohr, 2000), theory of planned behaviour (Ajzen, 1991), and best-practice storytelling and engagement techniques to step visitors through a program "story," C-U-A highlights three key steps to promoting behaviour change within the zoo context: (1) *Connect* visitors and the broader public with species through emotionally engaging experiences; (2) facilitate *Understanding* of conservation issues through innovative and educational displays; and (3) encourage people to *Act* through education about specific, well-known behaviours, thus reducing threats to species and habitats (Lowry & Grey, 2009).

CBSM highlights the importance of choosing behaviours that have the largest "weight" in terms of impact, probably, and penetration among the target audience (McKenzie-Mohr, 2000). As such, Zoos Victoria conducted belief elicitation interviews (e.g., Johnson & Weller, 2002) with zoo visitors to inform the proposed program messaging. This analysis revealed that the most commonly identified benefits of the proposed behaviours was the avoidance of unnecessary plastic waste, benefits to the environment, and bubbles are a fun and interactive activity for children. The most commonly identified barriers to the behaviours were the perception that bubbles don't last as long as balloons, that they can be messier to use and require cleaning up, and that they are less impressive for party decorations; however, 30% of respondents reported that there was nothing to dislike about committing to wildlife-friendly bubbles over balloons (Zoos Victoria, unpublished data). Based on these results, the program messaging to use wildlife-friendly bubbles instead of balloons at outdoor events was developed to engage with children to highlight the fun and value of using bubbles outdoors (where the created mess would not matter) while also educating visitors about the impact balloons and their attachments have on our wildlife and the environment. Information about Zoos Victoria's approach to developing conservation-education programs and experiences can be found in Zoos Victoria Conservation Science Plan (see: https://www.zoo.org.au/sites/default/files/conservation-science-plan-zoos-victoria.pdf).

Melbourne Zoo is well-positioned to deliver a conservation-education program about marine debris (i.e., balloon litter) given its dedicated "Wild Sea" precinct, which describes an area of the zoo with multiple exhibits that showcase some of Victoria's iconic marine wildlife, including: Australian fur seals (*Arctocephalus pusillus doriferus*); Little penguins (*Eudyptula minor*); Australian pelicans (*Pelecanus conspicillatus*); Port Jackson sharks (*Heterodontus portusjacksoni*); and Fiddler rays (*Trygonorrhina*). At the time of data collection, there were multiple interpretive mediums installed in the Wild Sea precinct including static signage displays with information about balloon litter hazards (Figure 1), and a short (approximately 4 minutes) animation projected on a 20-m indoor screen, depicting the journey of a balloon that floated away from an outdoor party, entered the ocean, and entangled marine wildlife (Figure 2; a video of the projection can be viewed at: https://www.youtube.com/watch?v=9i41eW5TzxY).

Figure 1. A static signage display at the penguin tide pool located in Wild Sea that reads: "*Penguins can't fly but balloons can! When released outside, balloons can float on air currents and travel hundreds of kilometers. What goes up must come down and unfortunately for wildlife, balloons come down in all the wrong places. When balloons fly, seabirds die, but you can change that!*" Melbourne Zoo, Australia.

Figure 2. The 4-minute animation projected on a 20-m screen depicting the journey of a balloon that floated away from an outdoor event and entered the marine environment. Melbourne Zoo, Australia.

The program also included a 15-minute zookeeper-led presentation at the seal enclosure. The presentation told the story of a seal that encountered a balloon floating in the ocean. To begin, the keeper guided the seal to demonstrate typical behaviours performed in the wild including aquaplaning and diving. In this time and unknown to the audience, a balloon-like prop was thrown into the water by the keeper. The keeper then "spotted" the balloon, and instructed the seal to retrieve it from the water. The seal presented the balloon to the keeper who held it up for audience viewing. The keeper identified the object as a balloon and explained to the audience the entanglement and ingestion threats that balloons pose to marine wildlife. The seal was then guided to place the balloon in a bin. To conclude, the keeper suggested bubbles as an alternative to balloons at outdoor events. To end, the seal leaped back into the water (with visitors invited to simultaneously shout "*bubbles not balloons*"). Consistent with research indicating sensory impressions can enhance the impact of an experience, and subsequently the uptake of environmental behaviours (Ballantyne, Packer, & Sutherland, 2011), a bubble machine was turned on as visitors exited the presentation arena. As the presentation area filled with bubbles, visitors were encouraged to make a pledge to use bubbles at their next outdoor event upon exiting Wild Sea, either by signing a pledge book (Figure 3) or by writing their name on a magnetised bubble and placing it on a pledge board (Figure 4). Asking visitors to make a public and durable commitment to use bubbles instead of balloons outdoors may increase the likelihood of post-visit behaviour change (McKenzie-Mohr, 2000).

Methods

This research was approved by the University of South Australia Human Research Ethics Committee (Application ID: 0000036359) and was conducted in compliance with the Zoos Victoria Code of Conduct for Scientific Research Practice.

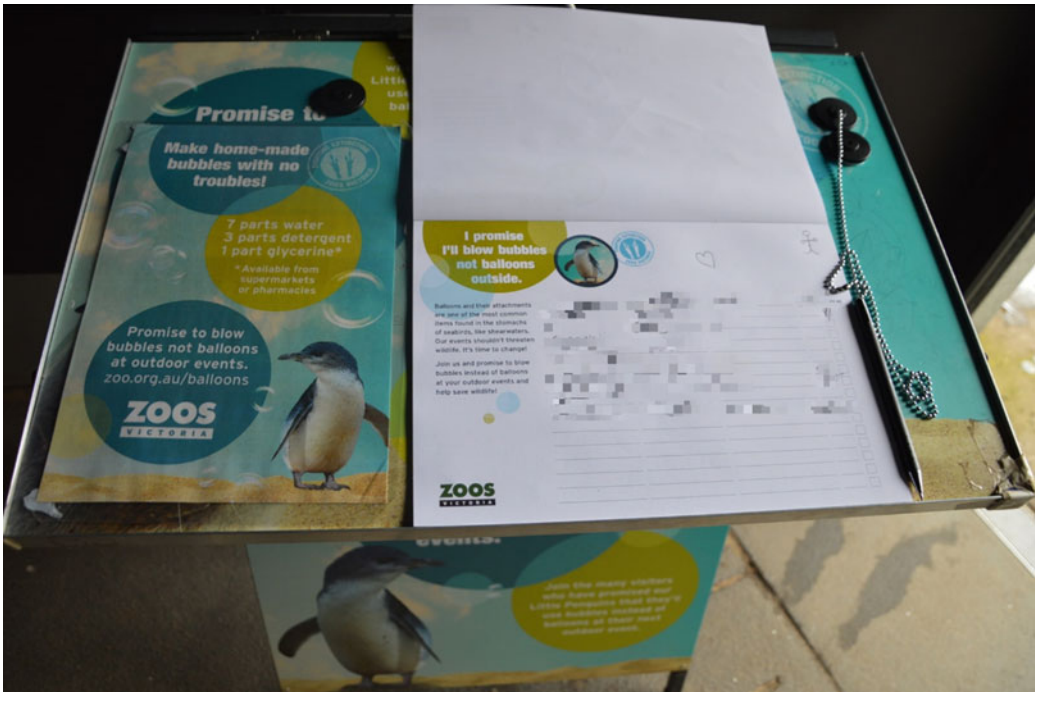

Figure 3. When Balloons Fly pledge book located in Wild Sea. Melbourne Zoo, Australia.

Figure 4. Bubble pledge board for visitors to place magnetised bubbles. At the time of this research, whiteboard markers were provided for visitors to write their name on the bubbles, which were wiped clear each day for reuse. Melbourne Zoo, Australia.

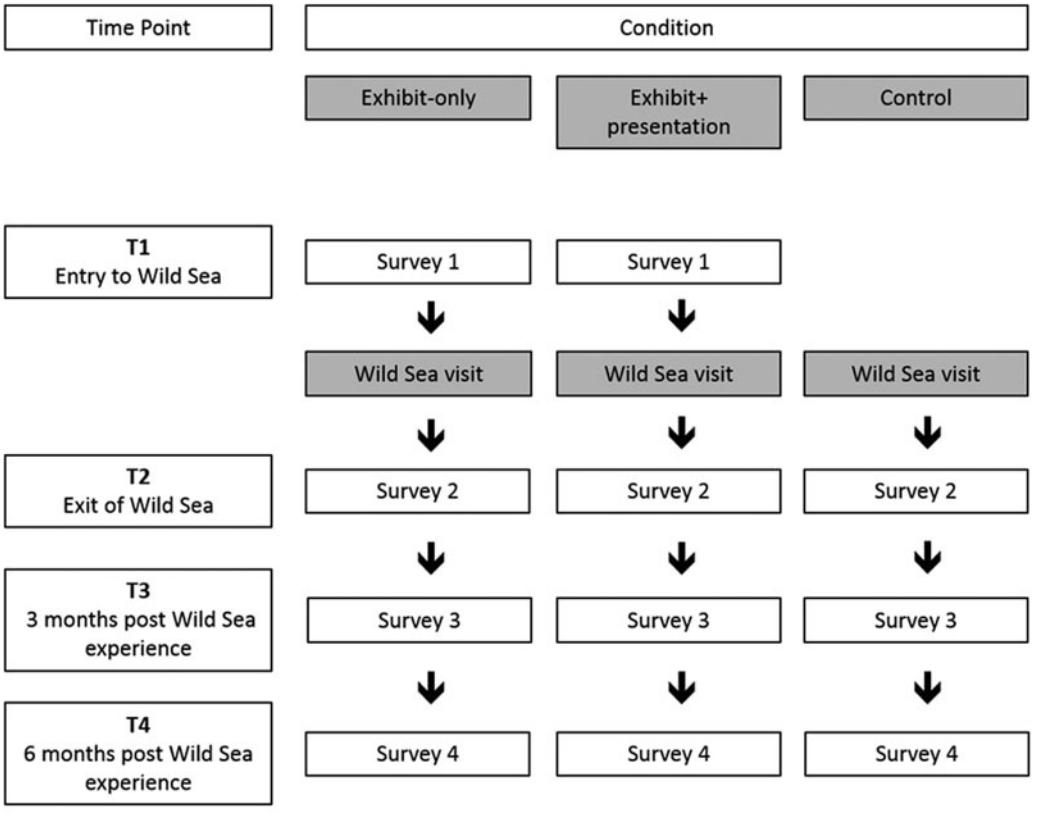

Figure 5. Study design with time points and visitor group conditions.

Study design

The Wild Sea precinct is structured such that the presentation area is located in the centre of the exhibit; visitors cannot reach the presentation area without first walking through a portion of the exhibit (thus viewing a portion of related program material). Given this layout, exhibit-only and exhibit + presentation experiences (and not a third presentation-only experience) were the two possible experiences available for visitors. Accordingly, comparisons were made between two groups: (1) exhibit-only (visitors who walked through Wild Sea, *did not* view the seal presentation, and completed a pre-survey); and (2) exhibit + presentation (visitors who walked through Wild Sea, *did* view the seal presentation, and completed a pre-survey). To account for how the completion of a pre-survey may influence visitor interaction/engagement with the exhibit, and thus influence visitor outcomes, we also collected data from an exhibit post-only group (visitors who walked through Wild Sea, *did not* view the seal presentation, and *did not* complete a pre-survey; hereafter referred to as "control"). Visitors could be surveyed before entering Wild Sea (T1), immediately exiting Wild Sea (T2), 3 months post-visit (T3), and 6 months post-visit (T4); Figure 5 depicts the study design.

Procedure

Potential participants were approached on a "next-to-pass" basis, wherein on completion of approaching a visitor for recruitment, the next person to pass the survey point was approached to participate. Visitors were eligible if aged 18 years and over, and were proficient in English. Participants in the exhibit-only and exhibit + presentation groups were given a paper survey

pack as they entered Wild Sea, which included a take-home information sheet, a consent form to sign and return to the researchers on-site, a pre-experience survey (printed on green paper), and a post-experience survey (printed on blue paper). The control group was approached immediately upon exiting Wild Sea with the survey pack (minus the pre-survey). Data collectors were aware of the project objectives. Visitors were not told the specific purpose of the research, only that it was a study about knowledge and attitudes toward wildlife. Once given the pack, exhibit-only and exhibit + presentation visitor groups were instructed to complete the pre-survey at T1, and to complete the post-survey when they saw the second researcher, who was positioned at the exhibit exit waiting to accept completed surveys (T2). On the last page of the post-survey, participants were invited to provide contact information to be sent a short (5 minutea) online follow-up survey via SurveyMonkey at T3 and T4. Participants who completed assessments all four time points were eligible for a prize draw (3 × $100 Visa Prepaid gift cards); this incentive was specified in the post-survey and information sheet. At T1 and T2, data were collected over an equal number (8) of week and weekend days, and during non-school holiday periods, to reduce potential differences in visitor socio-demographic characteristics. Surveys were collected between 10:00 AM and 4:00 PM. Exhibit-only data collection ceased during exhibit + presentation data collection times (11:00 AM–11:25 AM daily). The keeper presentation was delivered once daily thus our capacity to recruit to the presentation condition was limited, yielding uneven condition sample sizes. During T3 and T4 data collection, respondents were emailed once a week for 3 weeks (one initial email to participate and then two reminder emails if they had not yet participated).

Piloting of measures

A pilot survey with $N = 82$ zoo visitors was conducted prior to the program launch. Connelly (2008) recommends that the pilot sample be 10% of the total project sample size. We initially sought to recruit 250 participants per group (i.e., intended total sample size 750) and therefore 75–80 was our target pilot sample. This pilot yielded an unacceptable ($\alpha = .58$) internal consistency parameter for our attitude scale specific to the issue of outdoor balloon use. Following modifications, a second pilot study (attitude scale only; $N = 80$) was conducted with a paid SurveyMonkey sample and yielded acceptable internal consistency ($\alpha = .72$). Each item of this revised scale is detailed in the "Materials" section.

Materials

Visitor sociodemographic characteristics

Drawing upon previous literature and contextual factors (e.g., location), we collected demographic information that may influence pro-wildlife attitudes and conservation behaviours (Driscoll, 1995; Lukas & Ross, 2005; Ross & Gillespie, 2009; Signal & Taylor, 2007). Items included: gender (male; female; interdeterminate/intersex/unspecified; prefer not to say); age (open-ended); vegetarian status (yes/no); pet ownership (yes/no); Zoo Victoria member (yes/no); mean social norm score concerning balloon use outdoors (agreement rated on a scale from 1- strongly disagree, 7- strongly agree regarding the statement "my friends and family consider using balloons outdoors not harmful to marine wildlife"); prior zoo visit in past 12 months (yes/no); level of education (high school; certificate/diploma/TAFE; undergraduate degree [i.e., bachelor]; post-graduate degree [i.e., honours, masters, PhD, graduate certificate]); prior outdoor balloon use (yes/no), and visit motivation including: learning and discovery; social interaction; passive enjoyment; self-fulfilment; and restoration (each coded as reported/not reported; Packer & Ballantyne, 2002; descriptions of each motivation are detailed in Table 2). Since WBF was

exclusive to the state of Victoria at the time of the research, visitors were asked to indicate if they were an international visitor (yes/no) or an interstate visitor (yes/no).

Understanding about impacts of using balloons outdoors

At T1 and T2, visitors were asked to describe any impacts that they were aware of concerning outdoor balloon use (open-ended).

Post-visit message recall

To assess post-visit recall of the primary conservation message (to use bubbles not balloons at outdoor events), at T3 and T4, visitors were asked to report any conservation behaviours they had learned about during their Wild Sea visit (open-ended).

Identification of bubbles as an alternative to balloons for outdoor events

At T1 and T2, visitors were asked to describe alternatives to balloons that could be used at outdoor events (open-ended); this item was coded as either reporting or not reporting bubbles as an alternative to balloons.

Attitudes toward the use of balloons outdoors

Attitudes toward the use of balloons outdoors was measured at all-time points (1- strongly disagree, 7- strongly agree). A 7-point scale (as opposed to a 5-point scale) was employed for all scale items since more categories can yield greater test–retest reliability and internal consistency (Preston & Colman, 2000; Lozano, García-Cueto, & Muñiz, 2008; Weng, 2004), and are rated more favourably in terms of respondent preference (Preston & Colman, 2000). The final attitude scale comprised six items: (1) Balloons are marine-wildlife friendly outdoor decorations; (2) I do not see anything wrong with using balloons outdoors; (3) I am concerned that balloons can be harmful to marine wildlife when used outdoors; (4) Bubbles provide a marine-wildlife friendly alternative to balloons for outdoor events; (5) I prefer that outdoor events I attend do not use balloons; (6) I care about marine wildlife and the impact of plastic pollution on marine wildlife. Item 1 and 2 were reverse-coded prior to data analysis. Possible total scores ranged from 6 to 42, with a higher score indicating a more positive attitude toward not using balloons outdoors.

Behaviour intentions

Likelihood to use balloons and likelihood to use bubbles at future outdoor events

Behaviour intentions were measures at all four time points. Visitors rated (a) how likely they were to use balloons at future outdoor events and (b) how likely they were to use bubbles at future outdoor events (1- extremely unlikely, 7- extremely likely).

Post-visit conservation behaviour

Post-visit conservation actions were measured at T3 and T4 and related to: discussions about the impact of using balloons at outdoor events; purchases of wildlife-friendly bubbles; and new behaviours that were engaged in while hosting or attending an outdoor event. Specifically, visitors were asked:

1. Since your visit to Wild Sea, have you discussed with anyone the impact of using balloons outdoors on marine environments (yes/no)?
   a. If yes, what was the discussion about (open-ended)?
2. Since your visit to Wild Sea, have you purchased wildlife-friendly bubbles (yes/no)?
3. Since your visit to Wild Sea, have you hosted or attended an outdoor celebration (yes/no)?
   a. If yes, did your zoo visit impact your behaviour at this event in any way (yes/no)?
   b. If yes, how? (open-ended)

At T4, visitors were asked to report behaviours *since the completion of the T3* survey, for example, "since completion of this survey three months ago, have you discussed with anyone the impact of using balloons on marine environments?").

Participants

All participants who participated in T1 also participated at T2, resulting in a total $N = 624$ visitors across T1 and T2. Of these, 67 respondents also participated at T3 and 42 at T4 (Table 1). The initial follow-up response rate of 11% at T3 is lower than previous research that has assessed post-visit impacts of zoo conservation programs with matched samples (16–24%; Adelman et al., 2000; Dierking et al., 2004; MacDonald, 2015). There was a relatively even proportion of males to females (female: 50–69%) and participants' mean age was 31 (SD = 12.4). Around two-thirds (57–64%) of the sample were prior balloon users; see Table 2 for participant demographic information.

Analysis of quantitative data

Statistical analyses were performed with IBM SPSS Statistics (v25). To identify and control for possible demographic between-group differences, One-Way Analysis of Variance (ANOVA) and Chi-Square Test of Independence (or Fisher's Exact Test of Independence) were performed. Analyses revealed significant between-group differences on eight demographic variables ($p < .05$; Table 2). We used the univariate general linear model (GLM) procedure to analyse the quantitative repeated-measures variables assessed across all time points including: (1) attitudes toward the use of balloons outdoors (2) likelihood to use balloons at future outdoor events; and (3) likelihood to use bubbles at future outdoor events. The univariate GLM procedure provides regression analysis and analysis of variance for one dependent variable on one or more predictor variables. This procedure is the most appropriate method for our repeated-measures items because it allows for the accommodation of analysing non-normal data, prevents listwise deletion due to missing data or dropouts (i.e., retains the people who have data for only some time points as opposed to deleting the entire case), and accounts for unbalanced sample sizes (Cnaan, Laird, & Slasor, 1997; Gelman & Hill, 2007; Krueger & Tian, 2004; Pinheiro & Bates, 2000).

To identify and account for only significant predictor variables and thus optimise model fit, a purposive selection method was applied during data analysis (Bursac, Gauss, Williams, & Hosmer, 2008). Prior to generating the final model, we first ran the models with all eight significant demographic variables and then excluded those that did not significantly contribute to the model and/or influence other variables. The final models included time point, completion of pre-survey (yes), viewed a presentation (yes), and all significant covariates relative to each outcome variable,

Table 1. Total sample numbers for each visitor group, by time point.

	T1	T2	T3	T4
Exhibit-only	249	249	29	23
Exhibit + presentation	125	125	23	10
Control		250	15	9
Total Sample *n*	374	624	67	42

Table 2. Visitor demographic characteristics, by visitor group.

	Exhibit-only valid (%)	Exhibit + presentation valid (%)	Control valid (%)	Significant?*
Total *n*	249	125	250	
Gender (Female)	50	69	50	Yes
Mean Age in Years (SD)	31 (11.9)	32 (12.8)	30 (12.5)	No
Vegetarian Status (Yes)	8	7	7	No
Pet Ownership (Yes)	60	67	67	No
Zoos Victoria Member (Yes)	17	33	14	Yes
Prior Visit in Past 12 months (Yes)	31	40	22	Yes
International Visitor (Yes)	24	15	22	No
Interstate Visitor (Yes)	22	23	27	No
Highest Level of Education				
High School	22	2	25	No
Certificate/Diploma/TAFE	23	21	21	
Undergraduate Degree (e.g., Bachelor)	38	34	40	
Post-graduate Degree (e.g., Honours, Masters, PhD, Graduate Certificate)	17	22	14	
Prior Balloon Use (Yes)	63	64	57	No
Mean Social Norm Score (SD)	4	3	4	No
Motivation for Visit				
Learning and Discovery (Yes) *(to expand understanding, desire to discover new things)*	32	46	4	Yes
Social Interaction (Yes) *(to spend time with friends/family)*	53	65	61	Yes
Passive Enjoyment (Yes) *(to enjoy oneself, be pleasantly occupied)*	47	40	54	Yes
Self-Fulfilment (Yes) *(to make things more meaningful, feel a sense of achievement)*	13	11	21	Yes
Restoration (Yes) *(to relax, have a change from routine)*	19	23	34	Yes

Due to missing data, *n* varies between 243 and 250 for the exhibit-only and control groups, and between 123 and 125 for the exhibit + presenation group.
*Significant at $p < .05$ level.

as fixed effects. Due to insufficient cases for between-group comparisons, gender was recoded as reporting or not reporting female for these analyses. The maximum likelihood method was used to estimate variance components. We used an alpha level of .05 for all statistical tests.

Analysis of qualitative data

We employed thematic analysis (Braun & Clarke, 2006) to identify and organise patterns in our qualitative data, and adopted a complete coding method to account for visitor responses that contained multiple themes (and therefore, the valid item *n* may exceed the total sample *n*). We included 100% of cases in our inter-rater reliability (Cohen's Kappa [κ]) assessments. Cases were independently coded by two coders. Kappa is reported for each outcome variable individually in the "Results" section. In this research, κ ranges from 0.62 to 1.0. Based on guidelines by Landis and Koch (1977), Kappa values of 0.0–0.20 = "slight agreement," 0.21–0.40 = "fair agreement," 0.41–0.60 = "moderate agreement," 0.61–0.80 = "substantial agreement," and 0.81–1.0 = "almost perfect" or "perfect" agreement.

Results

Due to the low follow-up response rate on open-ended knowledge and behaviour items at T3 and T4, below we report the *total* most frequently reported themes (i.e., across both follow-up time points [T3–T4] and all three visitor groups; total valid $n = 109$). A table of response themes

and proportions itemised by visitor group and time-point for each relevant outcome variable is provided in the Supplementary Material. We report a range % instead of the mean % to represent the percentage range across the three condition groups (exhibit-only, exhibit + presentation, control).

Understanding about impacts of using balloons outdoors

Analyses of the open-ended question about impacts of using balloons outdoors at the T1 pre-survey revealed three main themes: balloons becoming general litter (26–27%); balloons becoming marine litter (27–32%); balloons posing a general/non-specified hazard to wildlife (20–21%). At T2, of visitors who reported additional understandings, exhibit-only and exhibit + presentation groups reported impacts that most commonly included: balloons posing a general/non-specified hazard to wildlife (21–30%); and balloons posing an entanglement hazard to wildlife (13–22%). The exhibit + presentation group were nearly twice more likely to report the specific entanglement threat than exhibit-only visitors (22% vs. 13%). Only 3% of control group responses contained this theme ($\kappa = 0.68$). See Table 3 for response themes and proportions.

Post-visit message recall

When asked in an open-ended question to describe any conservation behaviours they had learned about during their Wild Sea visit, participant responses most frequently contained a do not litter/reduce/recycle theme (20 of 74 total valid responses; 27%). Using bubbles/using bubbles instead of balloons was the second most frequently reported theme (identified 19 times out of 74 valid responses; 26%; $\kappa = 0.62$). See Supplementary Material for a table displaying response themes and proportions by condition and time point.

Identification of bubbles as an alternative to balloons for outdoor events

Figure 6 displays the percentage of each visitor group that reported bubbles as an alternative to using balloons at outdoor events at T1 and T2. The identification of bubbles as an alternative to balloons for outdoor events increased from T1 to T2 for the exhibit-only and exhibit + presentation groups. Further, visitors groups who completed a pre-survey were almost twice as likely to have reported bubbles as an alternative at T2 than visitors in the control condition who did not complete a pre-survey. Notably, the difference in the identification of bubbles at T1 between the exhibit-only and exhibit + presentation groups (21%) became smaller at T2 (4%; $\kappa = 1.0$).

Attitudes concerning the use of balloons outdoors

In this study, our attitude scale yielded an internal consistency estimate of $\alpha = .76$. As depicted in Figure 7, mean attitude scores were already high at T1 for visitor groups (34–35 on a 42-point scale), and these scores increased to 38–39 by T4; exhibit + presentation visitors consistently reported higher attitude means than both the exhibit-only and control groups. A univariate GLM revealed that WBF significantly impacted visitor attitudes toward not using balloons outdoors, $F[11,\ 9.63] = 9.63$, $p = .000$, adjusted $R^2 = 0.65$. Time point was a significant predictor of more positive attitudes ($p = .000$). Attitudes were significantly more positive among visitors who: completed a pre-survey ($p = .000$); viewed a presentation ($p = .001$); reported a learning and discovery motivation ($p = .000$); and reported self-fulfilment motivation ($p = .039$), than those who did not. There were no significant differences concerning zoo membership ($p = .061$). There was a significant interaction effect between time-point and viewing the presentation on attitudes ($p = .000$), indicating that for people who viewed a presentation, as time progressed, attitudes become

Table 3. Response themes and proportions for visitor understanding about impacts of using balloons outdoors at T1 and T2, by visitor group.

		T1		T2		
Response theme	Example response	Exhibit-only % (*n*)	Exhibit + presentation % (*n*)	Exhibit-only % (*n*)	Exhibit + presentation % (*n*)	Control % (*n*)
		Valid item $n = 252$	Valid item $n = 168$	Valid item $n = 262$	Valid item $n = 142$	Valid item $n = 316$
Balloons become general litter	"pollution," "waste that negatively impacts the environment"	27 (68)	26 (44)	6 (15)	6 (8)	23 (72)
Balloons become marine litter	"ends up in the water," "blows away into water"	27 (67)	32 (53)	9 (24)	8 (11)	22 (68)
Balloons pose a hazard to marine life: general/non-specified	"animals could be affected," "danger to wildlife"	20 (51)	21 (35)	21 (55)	30 (42)	13 (40)
Balloons pose a choking/ingestion hazard to animals	"balloon string is a choking hazard," "animals swallow them"	4 (11)	5 (8)	6 (16)	45 (7)	21 (66)
Balloons pose entanglement hazard to animals	"seals become entangled," "string can trap and entangle penguins"	7 (17)	5 (9)	13 (33)	22 (31)	3 (9)
Balloons are non-biodegradable	"don't break down," "doesn't decompose"	4 (10)	3 (5)	1 (3)	–	5 (16)
Don't know/None	"not sure," "don't know," "none"	7 (17)	7 (11)	3 (7)	6 (8)	13 (40)
Nothing additional (for T2 pre-post groups only)	"nothing additional," "no more than I already knew"			41 (108)	25 (35)	
Other	"get caught on electricity line," "choking hazard for humans," "visually unattractive," "invade air space," "scare animals," "helium is a finite resource"	4 (11)	2 (3)	0.4 (1)	–	2 (5)

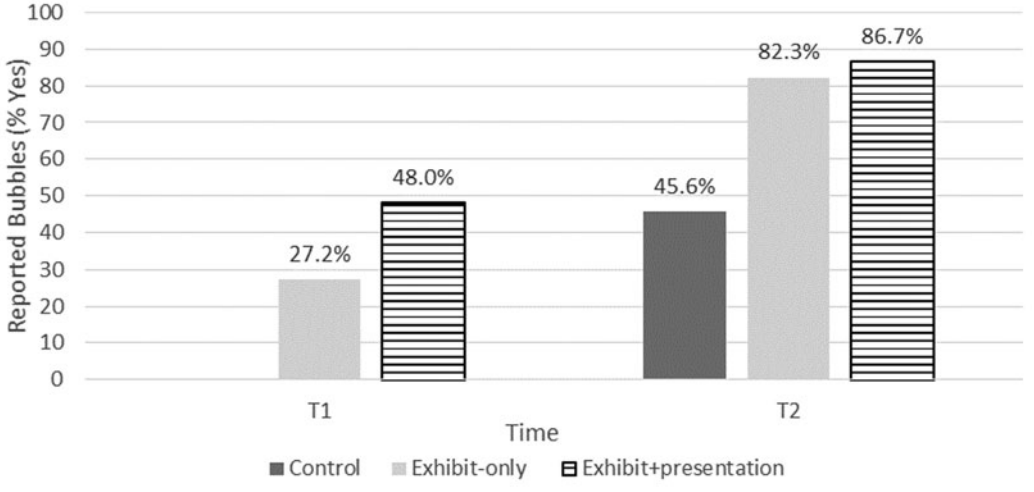

Figure 6. Clustered column chart displaying the percentage of each visitor group that reported bubbles as an alternative to using balloons at outdoor events at T1 and T2.

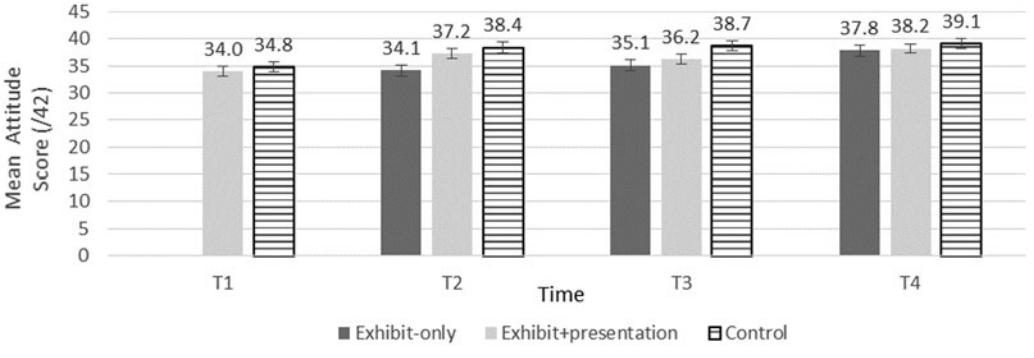

Figure 7. Clustered column chart with standard error bars displaying mean scores for attitudes concerning the use of balloons outdoors, across time.

more positive. The full univariate GLM outputs for each outcome variable can be found in the Supplementary Material.

Likelihood to use balloons and likelihood to use bubbles at future outdoor events

As displayed in Figure 8a, mean likelihood to use balloons scores were already low at T1 for all visitor groups (2.4–2.5 out of 7), and this decreased further across time (1.5–1.7 at T4). Analyses revealed WBF significantly impacted visitor likelihood to use balloons $F[10, 16.8] = 7.81$, $p = .000$, adjusted $R^2 = 0.59$. Mean likelihood scores overall reduced significantly across time ($p = .000$); compared to mean scores at T1, significant differences were observed at T2 ($p = .000$) and T4 ($p = .000$). Likelihood to use balloons scores were significantly lower among visitors who: completed a pre-survey ($p = .000$); reported a learning and discovery motivation ($p = .000$); and reported a social interaction motivation ($p = .022$). Scores did not differ significantly on viewing a presentation ($p = .476$), and there was no significant interaction between time and viewing a presentation on likelihood to use balloons scores ($p = .232$).

Figure 8b shows moderately high mean likelihood to use bubble scores at T1 (4.8–5.4/7), and these scores increase over time. Analyses indicate WBF significantly impacted mean likelihood to

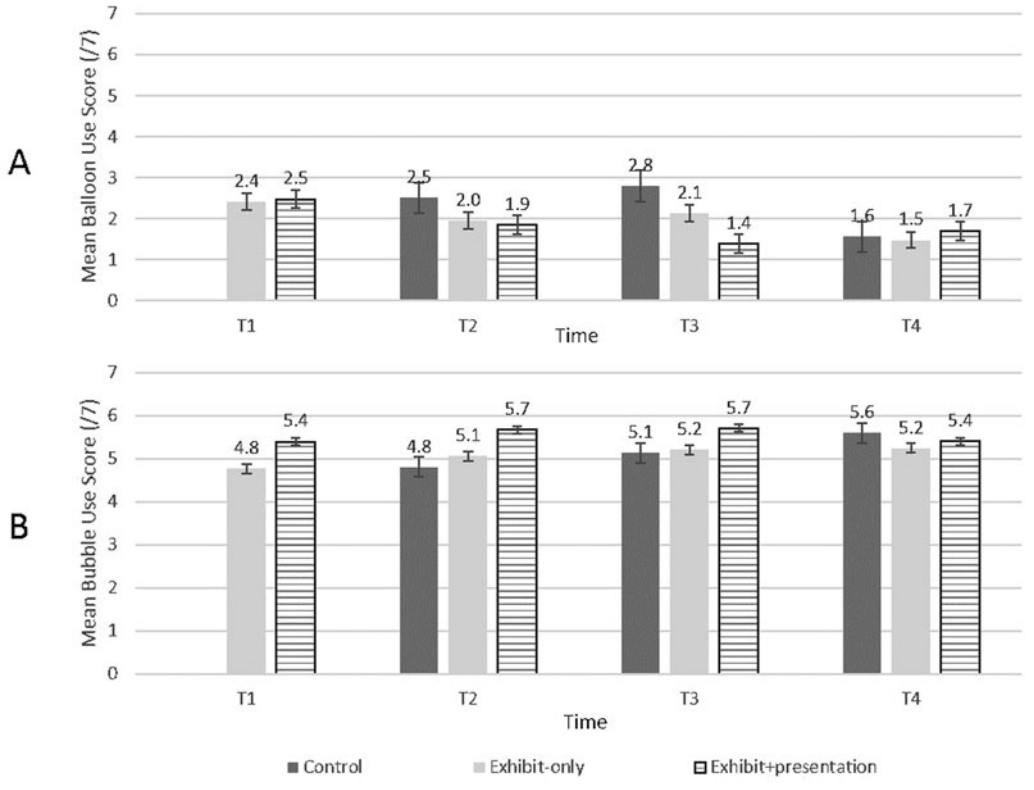

Figure 8. Clustered column charts with standard error bars displaying mean scores for each visitor group on (A) likelihood to use balloons at future outdoor events and (B) likelihood to use bubbles at future outdoor events, across time.

use bubbles scores, $F[10, 20.42] = 5.10$, $p = .000$, adjusted $R^2 = 0.47$. Likelihood to use bubbles scores were significantly higher among visitors who reported being a zoo member ($p = .000$) and reported being female ($p = .001$). Scores did not differ significantly on viewing a presentation ($p = .177$), completing a pre-urvey ($p = .157$), reporting a learning and discovery motivation ($p = .080$) or time ($p = .145$), and there was no significant interaction between time and viewing a presentation on likelihood to use bubbles scores ($p = .874$).

Post-visit conservation behaviour

At T3, 50 participants (of 67; 75%) reported having discussed a topic related to the impact of using balloons outdoors on marine environments; 26 participants (of 46; 57%) reported having done so at T4 (see Table 5 for response proportions by visitor group). Of those who provided further detail about what they talked about in an open-ended question, the most common response themes included discussions about general/non-specified hazards of balloons (e.g., "how harmful they can be"; 52%, 32 of 62 follow-up responses), discussions about balloon use ("avoiding balloons," "using balloons responsibly," "using balloons irresponsibly"; 27%, 17 of 62); and discussions about balloon alternatives (26%; 16 of 62). Few participant responses detailed discussing the specific ingestion or entanglement hazards that balloons pose to marine wildlife (8%; 5 of 62). Please refer to Supplementary Material for a table of response themes and proportions itemised by time point and visitor group ($\kappa = 0.67$).

Purchase of bubbles was reported by 24 participants (of 67; 36%) at T3, and by 8 visitors (of 31; 26%) at T4 (Table 4).

Table 4. Response frequencies and percentages for quantitative behavioural outcome measures at T3 and T4, itemised by time point and visitor group.

Post-visit behaviour change measure	T3			T4		
	Exhibit-only $n = 29$ % (n)	Exhibit + presentation $n = 23$ % (n)	Control $n = 15$ % (n)	Exhibit-only $n = 23$ % (n)	Exhibit + presentation $n = 10$ % (n)	Control $n = 9$ % (n)
Discussed impact of using balloons outdoors on marine environments (Yes)	79 (23)	83 (19)	53 (8)	64 (14)[h]	80 (8)	44 (4)
Purchased bubbles since visit (Yes)	41 (12)	35 (8)	27 (4)	23 (5)[h]	33 (3)[l]	–
Hosted or attended an outdoor celebration since zoo visit (Yes)	44 (12)[a]	52 (12)	57 (8)[c]	50 (10)[i]	56 (5)[l]	33 (3)
Changed behaviour while hosting/ attending an outdoor event (Yes)	50 (5)[b]	73 (8)[d]	86 (6)[f]	67 (4)[j]	75 (3)[g]	67 (2)[m]
Changed behaviour while hosting/ attending an outdoor event was influenced by visit to Wild Sea (Yes)	86 (12)[c]	69 (11)[e]	75 (3)[g]	83 (10)[k]	50 (2)[g]	44 (4)

Due to missing data: the valid n for groups at T3 ranges from 11 to 27; and the valid n for groups at T4 ranges from 3 to 22.

Attending or hosting an outdoor event was reported by 32 participants (of 64; 50%) at T3, and by 18 (of 38; 47%) participants at T4 (Table 5). Of these, 19 participants (of 28; 68%) at T3 and 9 participants (of 13; 69%) at T4 further reported that their visit to Wild Sea influenced their behaviour at the outdoor event. Of those who additionally described in an open-ended response how their behaviour was influenced, the total most frequently reported themes included: did not use/purchase balloons (10 of 25; 40%) and encouraged others not to use balloons/use alternatives (8 of 25; 32%). Four of 25 (16%) responses specifically identified using bubbles as a way their visit influenced their behaviour. See Supplementary Material for a table of response themes and proportions itemised by time point and visitor group; $\kappa = 0.67$.

Discussion

This outcome evaluation found preliminary evidence that WBF is promoting greater depth of knowledge concerning impacts of balloon use outdoors, is encouraging more positive attitudes post-visit, and more favourable social norms toward not using balloons immediately following the exhibit experience. The program is inspiring intent to act, with visitors overall reporting increased likelihood to use bubbles, and reduced likelihood to use balloons. In terms of post-visit conservation behaviour, Melbourne Zoo visitors reported talking about the issue of outdoor balloon use, as well as modifying their behaviours at outdoor events, with 66–69% of the follow up sample specifying that the behaviours they changed at an outdoor event after their visit were influence by their Wild Sea experience. A final major finding from this evaluation is the likely influence of a pre-survey on visitor psychosocial outcomes. For example, visitors who completed a pre-survey reported significantly more favourable subjective norm scores, more positive attitudes, and significantly lower likelihood to use balloons, than visitors who did not complete a pre-survey. These results may indicate that the completion of a pre-survey influenced visitors to look for or more fully engage in the WBF program material.

Understanding about impacts of using balloons outdoors

WBF is facilitating greater depth of knowledge about the threats of balloon use outdoors in the short-term, with responses at T2 containing more detailed aspects of hazards than at T1 (e.g., balloons harm wildlife vs. balloons pose entanglement hazards to wildlife). This is an important first step for WBF, given knowledge is a necessary (albeit not sufficient) precondition for pro-environmental behaviour (Kaiser & Fuhrer, 2003; McKenzie-Mohr, Lee, Kotler, & Schultz, 2011). Visitors who did not complete a pre-survey did not demonstrate the same depth of understanding at T2 than those who did, indicating that the pre-survey likely influenced how visitors interacted with educational material and/or absorbed information. Is it possible that that exposure to the pre-survey encouraged participants to seek out or be more likely to focus on WBF materials (Bargh & Chartrand, 2000).

Post-visit message recall

Three to six months following their visit, only 25% of visitors recalled the primary conservation message to use bubbles not balloons at outdoor events. Since familiar concepts are easier to recall because of their long-term associative links (Deese, 1960), it is possible that the novelty of bubble use at outdoor events impacted participants' abilities to recall this behaviour. Another explanation for this outcome could be communication 'noise' created by the multiple conservation-education programs that encompass different educational components and are delivered concurrently.

Identification of bubbles as an alternative to using balloons outdoors

Results indicate that WBF is educating people about bubbles as a wildlife-friendly alternative to balloons short-term. Consistent with group differences on understanding of impacts of using balloons outdoors (above), both exhibit-only and exhibit + presentation groups were twice more likely than the control group to report bubbles as an alternative. In contrast to previous research that has generally demonstrated enhanced conservation impacts for presentations when compared with traditional exhibit experiences (Mellish, Pearson, Sanders, & Litchfield, 2016; Miller et al., 2013), in this study there was no marked difference between exhibit-only and exhibit + presentation groups on identification of bubbles as an alternative at T2. This outcome, again, may be attributed to a pre-survey priming effect, or alternatively may reflect the persuasiveness of the exhibit as a whole, including the indoor animation experienced by all visitors.

Attitudes concerning use of balloons outdoors

Consistent with previous research measuring post-visit attitudes following a zoo visit (e.g., Miller et al., 2013), increases in mean attitude scores concerning balloon use outdoors persisted over time (T2–T4). This is an important result for WBF as is represents a possible success in changing in how people think or feel about outdoor balloon use, which is a difficult task because the behaviour is typically symbolic of celebration and festivity (when used at birthday parties and weddings) and spiritual output (when released at funerals), and less so has a negative connotation to harming wildlife. Given knowledge about an environmental problem can influence pro-environmental concern (Gifford & Nilsson, 2014), one possible explanation for this rise in mean attitude scores might be the aforesaid increased understanding about the impact of balloons on marine wildlife, which may have inspired concern for animals affected by balloon debris.

Likelihood to use balloons and likelihood to use bubbles at future outdoor events

Greater knowledge is associated with intention to act through increasing positive attitudes (e.g., in the context of zoo-based orang-utan conservation education; Pearson, Dorrian, & Litchfield, 2013). This information coupled with the aforesaid increases in depth of understanding, more positive attitudes, and more favourable subjective norm scores, makes the overall rise in likelihood to use bubbles and decrease in likelihood to use balloons among visitor groups unsurprising. It is interesting to note that the rise in likelihood to use bubbles is inconsistent with the low number of follow-up participants who actually reported using bubbles at outdoor events post-visit. There are several factors to consider when interpreting this outcome (discussed further in the post-visit conservation action section below), including for example, the possible limited opportunity to use bubbles for those who may not have planned a party or memorial.

Post-visit conservation behaviour

Many visitors reported to have discussed the topics of balloons becoming marine litter and posing hazards to marine wildlife, as well the matters of avoiding balloons, using balloons responsibly, and using alternatives to balloons, with their friends and family after their visit. This finding lends some support to existing work indicating zoo experiences can influence interest in and commitment to talking to others about the target conservation issue (Dierking et al., 2004), which may also perpetuate social norms around balloon use or spread the impact of the campaign to a wider audience than the zoo visitors themselves.

Our results suggest that WBF created some post-visit behaviour change at outdoor events, with 68% (T3)–69% (T4) of the follow-up sample reporting that their visit to Wild Sea impacted their behaviour at an outdoor event in some way. However, when asked how their behaviour was influenced, few responses containing the theme of using alternatives to balloons specifically mentioned bubbles. This is consistent with the limited number of follow-up participants who specifically reported purchasing bubbles post-visit. In addition to the explanation that the novelty of bubble use at outdoor events could have contributed to this outcome, as well as possible limited opportunities to use bubbles, contextual factors or personal preference may also explain the low uptake of bubble use. Costs associated with purchasing bubble equipment, limited knowledge or resources to make homemade equipment/bubble mix, and/or the variety of other wildlife-friendly alternatives available (e.g., paper streamers, biodegradable confetti), offer some further explanations for this result. Regardless, not using balloons and the uptake of using wildlife-friendly alternatives (bubbles or otherwise) represents an overall reduced potential for balloon litter to enter the marine environment, and thus is a positive end.

Strengths and limitations

This research addressed several methodological problems identified in reviews of related research (Khalil & Ardoin, 2011; Mellish et al., 2019). The use of a pilot study revealed reliability issues with our custom-designed attitude scale for balloon use outdoors, which enabled us to modify and re-pilot the scale prior to conducting the full-scale research. Further, by adopting a repeated-measures design over 6 months, we were able to assess if changes at T2 persisted over time, and if behaviour modification occurred post-visit, thus allowing for a more comprehensive assessment of the impacts of WBF. Finally, by controlling for the completion of a pre-survey, we were able to factor in to our analyses the influence that completing a pre-survey likely has on visitor interaction with and/or interpretation of the program material. Consistent with limitations of other post-visit evaluations (Smith et al., 2008), a key limitation to this research is the low follow-up response rate, which subsequently restricts our capacity to more thoroughly assess lasting impacts. Further, it is possible that follow-up outcomes over-represent the broader visitor

population, as those who provided contact information and completed the follow-up surveys may be more environmentally oriented than those who did not. Social desirability bias (i.e., participants providing socially favourable survey responses; King & Bruner, 2000) should additionally be considered when interpreting our results. According to this type of response bias, it is possible that respondents over-stated rather than under-stated their post-visit behaviours. Moreover, while our research was informed by TPB, we acknowledge that it does not measure all sub-constructs that make up the theory.

Conclusions and directions for future research

Findings build upon existing work that indicates zoo-based conservation-education programs have potential to inspire visitors to modify their behaviour after the zoo visit (MacDonald, 2015; Mann et al., 2018; Miller et al., 2013). Research outcomes have further yielded direct on-the-ground implications for the WBF program, including modifications to the keeper-led seal presentation. In response to T2 findings which indicate a generally low proportion of visitors who reported a specific entanglement threat of balloon litter (13–22% across exhibit-only and exhibit + presentation groups), Zoos Victoria introduced into their presentation more discussion around the risk of entanglement with balloon string and the subsequent impact on marine wildlife. This work also offers important methodological contributions for future zoo program evaluations that utilise repeated-measures designs. A key learning from this research is that inviting visitors to complete a survey prior to the intervention under evaluation likely influences how visitors interpret and engage with educational material and/or experiences. This is a useful discovery for: (a) refining evaluation methodology, as it highlights the need to control for or consider pre-survey influences (or test for priming influences at the pilot study stage; Weiler, Moyle, Wolf, de Bie, & Torland, 2017) when exploring if evaluation outcomes are attributable to program material, and; (b) implementing and empirically testing conservation-education resources that mimic the potential educational effect of a pre-survey. One possible suggestion is worksheets containing questions related to exhibit interpretation, available to visitors at the entry of an exhibit (or available to download prior to visit). For the portion of visitors who visit zoos with a learning and discovery motivation (31–46% across groups in this study), a worksheet may additionally increase visitor enjoyment (i.e., learning for fun; Packer, 2006).

Future work could seek to empirically explore why balloons represent celebration and festivity (when used at birthday parties and weddings) and spiritual output (when released at funerals). A scholarly understand of the underlying benefits and human values of balloon use could help to create interventions that might more comprehensively discourage the behaviour. Finally, given that participants' post-visit message recall was low, a future direction for the program might include offering visitors a post-visit reinforcement (Hughes, Packer, & Ballantyne, 2011), as a way to extend the potential impact of the program.

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