VISITOR STUDIES
2023, VOL. 26, NO. 2, 125–142
https://doi.org/10.1080/10645578.2023.2168873

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Understanding Pro-Environmental Behaviors and Intentions in Visitors to a Zoo-Based Seal Encounter

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ABSTRACT

Increasing pro-environmental behavior may combat environmental deterioration and promote animal and human welfare. Using the Theory of Planned Behavior (TPB), we investigated how an Australian zoo-based seal encounter influenced participants' pro-environmental intentions and behavior at 1-month follow-up. Participants were 113 seal encounter visitors, with $n = 29$ providing 1-month post-encounter data. Pre-encounter, participants reported past and intended pro-environmental behaviors, and TPB constructs (attitudes, perceived behavioral control, subjective and moral norms). Post-encounter, participants rated their experience and future pro-environmental intentions. At 1-month follow-up, participants again reported their pro-environmental behaviors. The model explained past pro-environmental behaviors and future behavioral intentions (but not plastic use specifically), with subjective norms being the most important. Unlike past research, moral norms were not significant, perhaps due to the zoo-based research context. Importantly, participants reported a decrease in plastic use 1-month post-encounter. These findings provide suggestions for zoos to design encounters targeting subjective norms to promote pro-environmental behavior.

ARTICLE HISTORY
Received 24 June 2021
Revised 11 September 2022
Accepted 11 January 2023

KEYWORDS
Plastic use; pro-environmental behavior; seal encounter; theory of planned behavior; zoos

Introduction

The continued accumulation of human-created debris in the marine environment is of growing concern worldwide (Barboza et al., 2019; Gall & Thompson, 2015). The quantity of marine debris is increasing even in the most remote marine environments and a wide range of ocean habitats and fauna are threatened by its pervasive effects (Baulch & Perry, 2014). Globally, more than 320 million tonnes of plastics are produced annually and plastic debris constitutes roughly 70% of all marine debris due to its low degradability (Barboza et al., 2019; Butterworth, 2016). Consequently, the primary threats facing marine animals are plastic ingestion and entanglement (Butterworth et al., 2012). Ingestion may block an animal's digestive tract and cause starvation, and entanglement can result in physical trauma, restricted movement, reduced reproductive success, and death (Butterworth, 2016).

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The detrimental impacts of plastic debris are widespread within the marine ecosystem, with high rates in marine mammals (Baulch & Perry, 2014). An estimated 100,000 marine mammals die each year from plastic ingestion and entanglement (Laist, 1997; World Wildlife Fund, 2018). Less attention has been allocated to research on pinnipeds (hereafter seals), however, it is understood that due to their exploratory nature, seals are susceptible to entanglement in lost or discarded fishing gear and packaging straps and are at high risk of ingesting plastics (Butterworth, 2016; Jepsen & de Bruyn, 2019; Laist, 1997). Largely resulting from the harmful effects of extensive plastic debris, Australian Sea Lions (*Neophoca cinerea)* are now listed as Vulnerable and are one of the most endangered seals in the world, with over 146 individuals becoming entangled in marine debris each year (Page et al., 2004).

Alongside the adverse consequences for marine mammals, marine plastic debris threatens the health and safety of humans. Plastic debris in marine environments presents a hazard to marine vessels, facilitates the spread of bacterial contaminants, is esthetically detrimental for the tourist economy, and compromises the quality of seafood (Gall & Thompson, 2015; Smith et al., 2018). Therefore, human acts of pro-environmental behavior (PEB) such as minimizing plastic use are necessary to protect seals and their marine mammal counterparts, and ensure the safety and well-being of humans (Butterworth, 2016; Mellish et al., 2016).

Conservation psychology provides an understanding into the predictive determinants of sustainable behavior and hence how to mitigate unsustainable human behavior and the corresponding threats to both humans and the environment (Clayton & Myers, 2015; Pearson et al., 2013). Understanding the importance of the psychological predictors of PEB may enable behavioral components to be targeted within nature and wildlife-based tourism experiences (Ballantyne et al., 2018; Siemer et al., 2021). This information may be applied in zoos and aquariums (hereafter zoos) to encourage visitors to minimize their plastic use and engage in PEB.

Zoos represent an exclusive location for urban populations to connect with a diverse range of threatened species, adopt a sense of responsibility, evoke emotional connection, and build environmental knowledge which may result in PEB change (Bueddefeld & Van Winkle, 2018; Pearson et al., 2013). Given the imminent environmental threats faced by seals, their charismatic appeal, and their symbolism for broader conservation issues, seals are an influential zoo animal for environmental education (Sattler & Bogner, 2017). While various tours offer opportunities to view and/or swim with wild seals (e.g. Wild Ocean Tasmania), most people are unlikely to encounter seals in their everyday surroundings. Therefore, zoo-based seal encounters are important for introducing the public to the species and offering educational experiences (Clayton & Myers, 2015). To date, psychological research investigating the extent to which participants are adopting PEB after a seal encounter has not been explored, though preliminary research suggests zoos hold a vital role in pro-environmental learning and behavior up to six months after a zoo visit (Collins et al., 2020).

The Theory of Planned Behavior (TPB) (Ajzen, 1991) is an empirically supported psychological framework shown to explain predictors of behavior across a wide range of contexts. Within conservation psychology, TPB has been applied to explain many areas, including the predictors of soil conservation practice (Wauters et al., 2010), intention to visit eco-friendly tourist destinations (Ahmad et al., 2020), and

consumption of environmentally friendly food and beverages (Wang & Wang, 2016). The TPB has also been applied to understanding the transport behaviors (private vehicle or shuttle bus) of visitors accessing varying sites within National Parks (Curtis et al., 2010). As discussed by Curtis et al. (2010), failure to target the variables predicting behavior in a specific population risks interventions lacking relevance to the behavior and population, hence becoming generic attempts at behavior change. As such, TPB provides a useful framework to understand the predictors of PEB, and in turn, can assist zoos to design targeted and influential animal experiences.

TPB assumes behavior is informed by behavioral intentions and grounded in rational thought. Behavioral intentions are the combined result of attitudes, perceived behavioral control, and subjective norms (Ajzen, 1991; Xu et al., 2017). Within conservation psychology, attitudes refer to an individual's positive or negative evaluation of performing a PEB; perceived behavioral control refers to an individual's perceived ability to successfully perform PEB; and subjective norms refers to the perceived importance placed on PEB by significant others (Ajzen, 1991; Clayton & Myers, 2015). The more favorably PEB is evaluated by oneself and significant others, the more an individual believes they are capable of performing pro-environmental actions, which in turn can create a stronger intention and possible chance of the behavior occurring (Tourangeau et al., 2021).

Research into conservation psychology has demonstrated variability regarding the importance of each TPB component in predicting PEB. A meta-analysis of 14 tourism studies employing the TPB has demonstrated that attitudes and perceived behavioral control have typically been reported as the strongest predictors of pro-environmental intentions and behavior (Lee & Hyelin, 2018). That is, positive attitudes toward the environment coupled with a belief that one has the capacity to change things, is an important predictor of a person's subsequent intentions and behaviors. However, research investigating individuals' pro-environmental intentions following a wild humpback whale experience found subjective norms may be a particularly important predictor of pro-environmental intentions when in a group setting (Clark et al., 2019). Potentially, the small group setting of a zoo-based seal encounter may enhance subjective norms and therefore increase participants' pro-environmental intentions and behavior, though this is yet to be empirically tested.

The variability of the influence of each TPB component suggests the importance of attitudes, perceived behavioral control, and subjective norms is heavily dependent on the characteristics of the behavior in question (Ho et al., 2015). Further, research suggests that more substantive variance in intention rather than actual behavior is explained by the theory, and integrating additional constructs and behavioral antecedents outside of the original theory is proposed as a modification to minimize this limitation (Clark et al., 2019; Hagger et al., 2020; Han et al., 2017; Yazdanpanah et al., 2014). One such influence is moral norms, or obligatory feelings toward the environment. Moral norms may be particularly relevant within conservation research as previous studies suggest they strengthen the explanation of pro-environmental intentions and behavior (Ballantyne, Packer, & Sutherland, 2011; Powell & Bullock, 2014; Yazdanpanah et al., 2014).

Moral norms are broadly related to emotive outcomes of pride or guilt following behavioral intention depending on congruence with an individual's belief system, and hence significantly explain pro-environmental intentions independently and within a

combined TPB model (Odou & Schill, 2020; Yazdanpanah et al., 2014). Notably, moral norms have been found to significantly influence or explain positive emotion, which in turn, significantly affects pro-environmental intentions (Han et al., 2015; Rezvani et al., 2017). In one study, recycling behavior using an extended TPB model including moral norms explained 71% of participants' pro-environmental intentions (de Leeuw et al., 2015). Similarly, in wild humpback whale encounters, moral norms explained up to 40% of the variance in participants' pro-environmental intentions when combined with attitudes, perceived behavioral control, and subjective norms (Clark et al., 2019). Consequently, moral norms may explain pro-environmental intentions and behaviors by enabling individuals to experience positive emotions, engagement, and reflection (Clayton & Myers, 2015; Pearson et al., 2013). However, whether these same relationships are evident in the context of other marine animal encounters (such as a zoo-based seal encounter) remains unclear.

Education is a key mechanism used by zoos to teach and encourage sustainable behaviors in visitors. Although a relationship between knowledge, behavior, and intentions is often found (Hasan et al., 2015; Maki & Rothman, 2017; Pearson et al., 2013), the relationship is weak, with intentions influenced by a variety of factors (Moss, Jensen, & Gusset, 2017). Visitors' engagement with, and reflection on, the educational information is likely important. Engagement within environmental experiences can attract visitors' attention to the environmental information and interpretation provided during the experience, enhancing their knowledge, desire to take action, and pro-environmental intentions (Ballantyne et al., 2007; Ballantyne, Packer, & Sutherland, 2011). Similarly, environmental experiences that are engaging can stimulate positive emotions and reflection of one's own contribution to the environment (Packer & Ballantyne, 2010). Reflection can result in pro-environmental intentions and behavior by challenging an individual's unsustainable attitudes, moral norms, and perceived behavioral control (Ballantyne, Packer, & Sutherland, 2011). Thus, knowledge, engagement, and reflection may explain pro-environmental intentions and behavior and assist zoos to strategically design influential experiences for animal encounter participants. However, whether these constructs are associated with pro-environmental intentions following a marine species encounter is yet to be established.

The present research

Given the ongoing threats to marine ecosystems and to vulnerable marine species, it is particularly important to explore the psychological explanations of plastic use, pro-environmental intentions, and PEB associated with a seal encounter. More broadly, the behavioral changes after encountering a seal may positively impact other cohabitating marine species (Butterworth, 2016). Research specifically investigating the TPB and associated variables following a zoo-based seal encounter can contribute practical applications for the effective design of PEB interventions and advance knowledge within conservation psychology. Limited research exists to demonstrate the influence of psychological explanations to pro-environmental intentions, or how this converts to PEB.

Using the theoretical framework of TPB, this study tested whether a zoo-based seal encounter could positively impact participants' pro-environmental intentions and

behaviors, with an added focus on reducing plastic use. To the best of our knowledge, this is the first study to apply the TPB framework to understand PEB within the context of a seal encounter, and therefore provides a useful extension to the conservation psychology and visitor study fields. Participants completed pre-encounter measures of demographics, pro-environmental behavior over the past month, and TPB variables toward pro-environmental behavior. Immediately after the encounter, participants reported on their emotions, enjoyment, and reflection of the experience, and their pro-environmental behavioral intentions. PEB over the past month was evaluated again 1-month later. To address the research aims the following five hypotheses (H) were tested:

- H1 tested whether past PEB could be explained by attitudes, subjective norms, perceived behavioral control, and moral norms. This hypothesis extends the literature by examining the utility of the TPB within the context of visitors to a seal experience.
- H2 tested whether greater levels of reflection and engagement were correlated with a higher level of knowledge about seals after the encounter (controlling for individuals' level of seal knowledge prior to the encounter).
- H3 tested whether pro-environmental intentions were positively related to attitudes, perceived behavioral control, and subjective norms and if the inclusion of emotions, reflection, and engagement would significantly explain additional variance in the model. This model was also tested with plastic use specifically, rather than broader intentions, so test for specific effects stemming from the seal encounter.
- H4 tested whether individuals' past PEB (i.e., pre-encounter) was significantly related to pro-environmental intentions after a seal encounter.
- H5 tested whether a significant increase in individuals' PEB (specifically plastic use) had occurred 1-month after the seal encounter, relative to baseline.

Method

Participants

Data were gathered from 114 participants recruited as a convenience sample of zoo visitors participating in a seal encounter at a zoo in Queensland, Australia. Of this sample, one participant's dataset was discarded due to significant missing data, leaving 113 usable responses. Participants self-reported demographic information about age, gender, education, residential status, history with pets, and seal encounter experience. Participants were aged between 18 and 84 years ($M = 33.35$, $SD = 12.43$) and were predominantly female ($n = 70$, 61.9%). Approximately one third held a university qualification as their highest level of qualification ($n = 38$, 33.6%) with the remaining sample having a vocational certificate ($n = 29$, 25.7%), some university study ($n = 20$, 17.7%), or high school qualifications ($n = 26$, 23%). Participants resided across nine different countries, with the majority from Australia ($n = 96$, 85%) and New Zealand ($n = 7$, 6.2%). The most frequent residential location was urban ($n = 49$, 43.4).

For the majority of participants, this was their first seal encounter ($n = 105$, 92.9%). Over three quarters were not involved in conservation ($n = 90$, 79.6%), while most participants had owned a pet for most of their life ($n = 97$, 85.8%). Of these participants, 29 individuals (25.7%) provided follow-up survey data which was all usable. No incentives were offered for participation.

Materials

Demographics

Participants reported their gender, age, residential status, education, history with pets, and seal encounter experience. Participants indicated their involvement over the past 12-months with environmental organizations. Knowledge about seals and their environment was measured on a scale of 0 (*very little knowledge*) to 100 (*very knowledgeable*).

Pro-environmental behavior

The Pro-Environmental Behavior Scale was adapted from previous work of Schultz and Zelezny (1998) and measured the frequency of past environmental behaviors. The original 12-item scale was tested across cultures, making it particularly applicable to a varied tourist demographic. The present study adjusted the timeframe of behavior frequency from the original 12-months to 1-month to enhance participants' response accuracy, as implemented by previous literature (Clark et al., 2019). Aligning with previous literature, one-item asking participants about their involvement in marine conservation was added (Clark et al., 2019). Similarly, one-item was added to measure the frequency of participants' plastic use.

The revised 14-items were responded to using a 5-point Likert scale from 1 (*never*) to 5 (*very often)*, with higher average scores representing higher PEB. Participants could also select "Not applicable" if there had been no perceived opportunity to perform a behavior. The Cronbach's alpha for the original scale was .72 (Schultz & Zelezny, 1998), and the new 14-item scale had high reliability, $\alpha = 84$.

This same scale was given to participants for the follow-up survey 1-month after their seal encounter. All items were identical to the past PEB measure in the pre-encounter survey. High reliability was also found for this scale at follow-up, $\alpha = .75$.

Pro-environmental intentions

A modified version of the PEB scale measured future pro-environmental intentions (Pfattheicher et al., 2016). Items were modified from "In the past I have" to "In the future I will look to". Higher average scores represented greater intentions to act pro-environmentally. This scale had a Cronbach's alpha of .83 in the original study and high reliability, $\alpha = .87$, in the present study. The marine conservation and plastic use items previously described were also added in this survey, and one-item was reverse scored.

Theory of planned behavior

The TPB subscales measuring attitudes, subjective norms, and perceived behavioral control were adapted from previous energy conservation research, therefore

demonstrating the validity of the scale to varying environmental contexts (Ajzen et al., 2011). The present research revised the wording of items from "conserving energy this semester" to "marine conservation" as validated by Clark et al. (2019). An additional subscale of moral norms was incorporated due to its validated importance in PEB (Clark et al., 2019; de Leeuw et al., 2015; Yazdanpanah et al., 2014). In previous research, Cronbach's alpha scores on subscales have ranged from .62 to .90 (Yazdanpanah et al., 2014), and ranged from .74 to .89 in the present study. Collectively, the present 16-item scale had high overall reliability, $\alpha = .92$. Each domain was measured via four items: attitudes toward marine conservation (e.g., "I think participating in marine conservation is wise"), subjective norms (e.g., "People I care about would encourage me to join in marine conservation"), perceived behavioral control toward participating in marine conservation (e.g., "If I wanted to, I could easily get involved in marine conservation"), and finally, moral norms (e.g., "Participating in marine conservation would make me feel like a better person"). Items were measured on a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher item scores represented stronger pro-environmental traits.

Visitor experience

Visitor experience was assessed in two subscales measuring experiential engagement and reflection (Ballantyne, Packer, & Falk, 2011). This questionnaire has been previously applied to zoo visitors and therefore demonstrates validity for the present study. Items were responded to on a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Collectively, the present 14-item scale had a high Cronbach's alpha of .91.

The seven-item Engagement subscale included questions such as "I was able to get a good view of the seals". This subscale originally had six-items, but previous research has highlighted the importance of eye-contact in visitor engagement (Powell & Bullock, 2014), so an item addressing the level of eye-contact participants made with a seal was added. This item, "I made eye contact with a seal", was tested for reliability with each subscale and included in the Engagement subscale as it improved the Cronbach's alpha from .87 for the original subscale to .91 in the present study. Higher average scores represented stronger engagement within the seal encounter.

The seven-item Reflection subscale included questions such as, "I felt an emotional connection with the seals I saw". This subscale was originally composed of six-items but previous research has emphasized the beneficial role of anthropomorphizing animals (Ballantyne, Packer, & Sutherland, 2011; Maguire et al., 2020), so an item addressing this was added, "The seals had human-like qualities". This item was grouped in the Reflection subscale after improving the Cronbach's alpha for Reflection from .71 for the original scale to .81 in the present study. Higher average scores represented more reflection on the seal encounter.

Emotion

The intensity of individuals' emotional responses toward the seal was measured using an adapted 10-item version of the scale developed and extensively tested with zoo visitors by Myers et al. (2004). The scale measured common emotions felt toward zoo animals such as "Wonder" and was measured on a 4-point Likert scale from 1 (*not*

at all) to 4 (*very much*). In the present study, only positive emotions were included and produced a Cronbach's alpha of .85. Higher average scores represented a more positively emotive zoo experience.

Research site

The zoo in question attracts an average of 10 million annual visitors, with the seal encounter being one of several optional additional experiences (also including a penguin encounter and shark dive) that can be purchased upon zoo entry. The seal encounter commences with an interactive behind the scenes tour where a group of up to six participants can view and learn about the animal's food preparation. This is followed by a live, brief education session (10 minutes) hosted by a seal trainer, featuring information about the Australian seal species and specific threats to their existence (including plastic pollution and unsustainable fishing practices). Participants are then introduced to a resident seal and encouraged to touch their fur and whiskers, look at their eyes, and complete husbandry activities with a seal trainer for 10 minutes. Depending on the package purchased, participants then have the option of entering the water with the seals for up to 20 minutes to engage in underwater viewing of the seal's activity.

Procedure

Ethical approval was granted by the Research Ethics Committee of the home institution. Potential participants were approached in the zoo's allocated seal encounter meeting area. Participants completed the pre-encounter questionnaire pack (consisting of demographics, knowledge of seals, pro-environmental behaviors over the previous month, and Theory of Planned Behavior scales) which took approximately 10 minutes. After the seal encounter, previously consenting participants were invited to complete the next surveys (measuring seal knowledge, pro-environmental intentions, visitor experience, and emotion scales) which took approximately 5 minutes. Consenting participants were emailed 1-month after the encounter to complete the final survey (consisting of the pro-environmental behavior scale) which also took 5 minutes to complete. A non-identifiable code was used to link the surveys across the three time points.

Results

Data were analyzed using the Statistical Program for Social Science (SPSS) version 24. All analyses were two-tailed. To determine the necessary participant size for multiple regression, a statistical recommendation is to sample at least 10 times as many participants as predictor/independent variables, meaning the current study was sufficiently powered in every test (Brace et al., 2012).

Before interpreting the data, assumption testing was conducted and assumptions were met. Individual surveys with less than 10% missing data were retained. The

sample mean was used to replace the data for individual items. One case was deleted due to significant levels of missing data allowing analyses to be conducted on 113 on-site surveys, and 29 follow-up surveys. A small number of outliers (extreme total scores more than 3 standard deviations from the sample mean) were noted on the emotion, engagement, reflection, attitudes, perceived behavioral control, moral norms, and post-encounter PEB scales. These outliers were removed and replaced with the next highest or lowest value (as appropriate) so the position of the score was retained but their influence was reduced (Brace et al., 2012).

Main analyses

Descriptive statistics are consistent with previous research conducted with a similar population by Clark et al. (2019) and are displayed in Table 1.

Hypothesis 1. A hierarchical multiple regression was performed to assess variability in past PEB from attitudes, subjective norms, and perceived behavioral control in Step 1, and moral norms in Step 2. At Step 1, the model accounted for significant variability in past PEB $F(3, 109) = 23.13$, $p < .01$ and explained 37.2% (Adjusted R^2) of the variance in past PEB. In terms of individual contributions, subjective norms was significant, whereas attitudes and perceived behavioral control *did not* contribute significantly to the variance in past PEB. Table 2 displays variance in past PEB for the variables within the model.

Step 2, including moral norms, *did not* add significance to the collective model in explaining past PEB, $F_{change}(1, 108) = 3.24$, $p = .08$. However, as an independent model, these variables were significant in explaining past PEB, $F(4, 112) = 18.52$, $p < .01$. Moral norms trended toward significance in independently explaining past PEB. Subjective norms remained significant, whilst attitudes and perceived behavioral control *did not* add significant unique contributions to the explanation. Therefore, greater subjective norms were related to greater past PEB.

Hypothesis 2. Partial correlations assessed the relationship between level of engagement and reflection and post-encounter seal knowledge, with baseline knowledge used as a covariate. Post-encounter knowledge was significantly positively correlated with engagement ($r = .31$, $p = .01$) and reflection ($r = .31$, $p = .01$).

Hypothesis 3. A hierarchical multiple regression was performed to explain pro-environmental intentions from attitudes, perceived behavioral control, and subjective

Table 1. Descriptive statistics and intercorrelation matrix for the regression variables.

Variable	*1*	*2*	*3*	*4*	*5*	*6*	*M*	*SD*
1. TPB attitude	–						4.47	0.62
2. TPB perceived behavioral control	.46**	–					3.75	0.72
3. TPB subjective norms	.66**	.52**	–				4.02	0.84
4. TPB moral norms	.76**	.52**	.74**	–			4.03	0.71
5. Experience engagement	.43**	.19*	.30**	.32**	–		4.73	0.39
6. Experience reflection	.46**	.30**	.39**	.46**	.70**		4.20	0.62
7. Emotion	.44**	.31**	.40**	.40**	.64**	.67**	3.61	0.40

Note. TPB = Subscale from the Theory of Planned Behavior Scale. Experience = Subscale from the Visitor Experience Scale.
*$p < .05$. **$p < .01$.

Table 2. Hierarchical multiple regression analyses explaining past PEB from the extended TPB model (*N* = 113).

	Predictor	*B*	95% CI	*SE B*	β	R^2	ΔR
Step 1	Constant	0.58	[−0.18, 1.33]	0.38		.39**	
	Attitude	0.18	[−0.34, 0.40]	0.11	.17		
	Subjective norm	0.40	[0.23, 0.57]	0.08	.50**		
	Perceived behavioral control	−0.01	[−0.17, 0.16]	0.08	−.01		
Step 2	Constant	0.58	[−0.17, 1.33]	0.38		.41	.08
	Attitude	0.06	[−0.19, 0.31]	0.13	.06		
	Subjective norm	0.33	[0.14, 0.51]	0.09	.41**		
	Perceived behavioral control	−0.03	[−0.19, 0.14]	0.08	−.03		
	Moral norm	0.23	[−0.02, 0.48]	0.13	.24		

Note. PEB = Pro-environmental behavior. TPB = Theory of planned behavior.
*$p < .05$. **$p < .01$.

Table 3. Hierarchical multiple regression analyses explaining PEB intentions from the TPB model and emotions, reflection, and engagement (*N* = 113).

	Predictor	*B*	95% CI	*SE B*	β	R^2	ΔR^2
Step 1	Constant	1.15	[0.46, 1.84]	0.35		.43**	
	Attitude	0.29	[0.09, 0.47]	0.10	.28**		
	Subjective norm	0.24	[0.09, 0.40]	0.08	.32**		
	Perceived behavioral control	0.14	[−0.01, 0.29]	0.08	.16		
Step 2	Constant	0.05	[−1.08, 1.18]	0.57		.50**	.08**
	Attitude	0.17	[−0.03, 0.37]	0.10	.17		
	Subjective norm	0.21	[0.06, 0.35]	0.07	.27**		
	Perceived behavioral control	0.12	[−0.03, 0.26]	0.07	.13		
	Emotions	0.26	[−0.05, 0.57]	0.16	.17		
	Experience engagement	0.04	[−0.29, 0.37]	0.17	.02		
	Experience reflection	0.18	[−0.04, 0.39]	0 .11	.17		

Note. PEB = Pro-environmental behavior. TPB = Theory of planned behavior.
*$p < .05$. **$p < .01$.

norms in Step 1 and emotion, reflection, and engagement in Step 2. At Step 1, the model was significant in explaining pro-environmental intentions $F(3, 109) = 27.01$, $p < .01$. This collection of variables explained 41.1% (Adjusted R^2) of the variance in pro-environmental intentions. Attitudes and subjective norms were significant with perceived behavioral control trending toward being a significant as well. Table 3 displays variance in pro-environmental intentions for the variables entered into the model.

Step 2, where emotion, reflection, and engagement were entered, explained significantly more variance in pro-environmental intentions $F_{change}(3, 106) = 5.57$, $p = .01$. The collective model explains 47.6% (Adjusted R^2) of the variance in pro-environmental intentions. Subjective norms were the only significant independent variable. Thus, greater pro-environmental intentions are significantly associated with higher subjective norms.

The same analysis was repeated but with plastic use intentions as the outcome measure, rather than the composite intentions variable. Neither Step 1 ($F(3, 109) = 0.50$, $p > .05$) nor Step 2 ($F(6, 106) = 0.78$, $p > .05$) were significant, the Fc_{hange} was not significant, and none of the individual variables contributed significant variance to the model. In a post-hoc exploratory analysis, plastic use in the lead up to the encounter was weakly but significantly correlated with plastic use intentions after the encounter, $r = .27$, $p < .01$, but neither variable was associated with plastic use behavior at the one-month follow-up (*p*s> .05).

Hypothesis 4. A bivariate (linear) correlation revealed that past PEB (i.e., pre-encounter; $M = 2.98$) was significantly related to pro-environmental intentions ($M = 3.94$) after the seal encounter, $r = .75$, $p < .01$

Hypothesis 5. A paired samples t test showed no significant change to PEB from prior the seal encounter ($M = 2.90$, $SD = 0.59$) to 1-month follow-up ($M = 2.96$, $SD = 0.51$), $t(28) = -0.81$, $p = .42$, 95% CI [-.20, .09].

On average, participants used less plastic (a reverse scored item) at the 1-month follow-up ($M = 3.24$, $SD = 0.83$), than before their encounter ($M = 2.72$, $SD = 1.13$). This difference was significant $t(28) = -2.24$, $p = .03$, and represented a large effect, $d = -0.85$, 95% CI [-.99, −.04].

Discussion

This study examined psychological factors which help to understand PEB and intentions after a zoo-based seal encounter. Specifically, we tested whether the TPB and associated variables could significantly explain participants' plastic use, pro-environmental intentions, and PEB. The key finding was that subjective norms explained past PEB and future pro-environmental intentions, although not plastic use intentions specifically. Furthermore, the seal encounter resulted in a decrease in plastic use over the following month, suggesting the importance of these zoo-based encounters on PEB.

H1 tested whether the TPB, including moral norms, could significantly explain participants' past PEB. Collectively, the model significantly accounted for 37% of the variability in a person's PEB. Subjective norms were the most important variable in the model in explaining past PEB. However, contrary to previous environmental research (Clark et al., 2019; Yazdanpanah et al., 2014), moral norms did not add further significance to the original TPB model which included only attitudes, perceived behavioral control, and subjective norms.

The difference in findings between this and previous studies may be explained by the context of the animal encounter. Within a zoo-based environment, damaging environmental impacts are discussed but are not immediately observed given the staged setting, potentially reducing an individuals' sense of responsibility, pro-environmental attitudes, and moral norms. Wild settings on the other hand, may influence moral norms differently as individuals may be able to visualize how human behaviors impact the animal's natural environment, leading to a stronger connection with the animal and their habitat (Clark et al., 2019). In contrast, zoos use waste management processes such as rubbish bins and the animal's environment is kept clean and hygienic, hence reducing visual cues to the impact of litter such as plastics.

Extensive environmental degradation may inhibit one's perceived behavioral control to independently improve environmental problems through pro-environmental behavior. However, consistent with predictions of subjective norms in the TPB, being a member of a group may enhance an individual's accountability for environmental deterioration. Subjective norms may also change what pro-environmental goals individuals perceive to be achievable. Whilst an individual behaving environmentally may not significantly benefit the environment, within a group, the influence of PEB can achieve more significant change (Reese & Junge, 2017). Therefore, environmental interventions should increase the role of subjective norms to further encourage PEB.

Hypothesis 2 tested whether reflection and engagement during the seal encounter was correlated with post-encounter knowledge about seals. This hypothesis was supported. Participants are more engaged and pay greater attention to animals that are active and attentive to humans, which is highly possible in zoo-based animal encounters where the animals perform behaviors as directed by trainers (Powell & Bullock, 2014). Consistent with previous research, engagement may increase participants' feelings of connection, motivate their willingness to learn about the species, and encourage reflection on their role in the species' survival (Clark et al., 2019; Myers et al., 2004; Powell & Bullock, 2014). In this way, reflection is useful for challenging unsustainable attitudes toward the environment and encouraging PEB (Ballantyne, Packer, & Falk, 2011).

Knowledge about seals was not significantly associated with pro-environmental intentions, contrary to previous literature that recognized the influence of knowledge on attitudes (e.g. Hasan et al., 2015). This research challenges the findings of Maki and Rothman (2017) and Pearson et al. (2013), who emphasized the importance of knowledge in contributing to predictions of pro-environmental intentions. However, the relationship between knowledge, intentions, and behaviors is weak (Moss et al., 2017) and therefore may have been difficult to detect within our small sample. Animal encounters that provide knowledge on an individual species and potential threats, but do not offer clear steps for pro-environmental action, may decrease perceived behavioral control to influence the environment and PEB intentions (Ballantyne et al., 2007). Therefore, it is important for zoos to provide clear and actionable steps that visitors can implement in their home lives.

Hypothesis 3 examined whether stable TPB variables and components of the seal encounter could significantly account for participants' future pro-environmental intentions. The combination of attitudes, perceived behavioral control, subjective norms, emotions, reflection, and engagement significantly accounted for 48% of the variance in participants' intentions to behave pro-environmentally. Subjective norms were the only significant unique contributor though, suggesting the importance of this construct. Zoos are recognized for creating an engaging social setting and supporting positive social reflection on environmental experiences. It is common for participants to arrive with their significant social groups which may strongly influence participants' pro-environmental intentions based on the perceived support for PEB (Reese & Junge, 2017). Pro-environmental intentions can be strengthened within a group context by enhancing participants' beliefs of what pro-environmental actions are possible to achieve and their significance compared to PEB at an individual level. These results emphasize the importance of discussions *after* an animal encounter to enhance pro-environmental intentions (Reese & Junge, 2017). Subjective norms are a significant predictor of pro-environmental intentions, as is consistent with predictions of subjective norms in the TPB and previous environmental research (Clark et al., 2019; Reese & Junge, 2017).

Although the collection of variables were important in understanding pro-environmental intentions *generally*, they were not able to significantly explain plastic use intentions *specifically*. We conducted further correlations to explain this finding and found that plastic use in the past month (i.e., the stand-alone item from the pre seal encounter PEB scale) was weakly but significant correlated with post-encounter plastic use intention. That is, previous use of plastic was related to future plastic use intention, while trait TPB variables and response to the seal encounter were not related. It is worth

considering these findings in the context of the findings relating to hypothesis 4: past (pre-encounter) PEB was significantly associated with pro-environmental intentions following a seal encounter. Collectively, these findings suggest that understanding the factors contributing to the specific behavior of plastic use is more challenging than understanding PEB generally. Previous work in other contexts has generally found support for TPB to predict plastic use or intentions. For example, Raimondo et al. (2022) found that attitudes, social norms, and perceived behavioral control predicted intentions to reduce use of plastic drinking containers, with past behaviors being related to future intentions. Further, Sun et al. (2017) found that TPB variables were able to predict intentions to use plastic bags. The reason for the differences between previous findings and our results is not immediately clear, although issues with specificity of the sample (zoo patrons vs general sample), context, and type of behavior (general vs specific plastic use) are likely to be important. The ability to positively influence zoo visitors' plastic use intentions will be an important area for future research.

There were no changes to participants' overall PEB 1-month after a seal encounter (Hypothesis 5). Perhaps participants who have engaged in zoo-based animal experiences need longer than 1-month to complete the experiential learning cycle and reflectively process their encounter. Individuals may take time to trial new concepts in their everyday life and develop pro-environmental attitudes and perceived behavioral control (Bueddefeld & Van Winkle, 2018). This hypothesis builds upon previous research into the gap between pro-environmental intentions and behavior (Bueddefeld & Van Winkle, 2018), and provides initial research into the effect of zoo-based seal encounters upon PEB.

Finally, a significant decrease was found in participants' plastic use at the 1-month follow up. As opposed to general PEB, using plastic involves discrete steps that can be clearly avoided or minimized. The acceptance, or use, of plastic was specifically targeted throughout the seal presentation, and the behavior is generally visibly observable (i.e. purchasing a plastic water bottle); therefore allowing for participants to clearly recognize their plastic use and consider alternative, more sustainable behaviors. Although not supported here, there may be capacity to reduce visitor's plastic use by increasing perceived behavioral control or subjective norms, as zoos may prime visitors to become attracted to conservation information (Jensen et al., 2017). Many external sources are currently promoting achievable management solutions specifically for reducing plastic use (such as government policies to eliminate single use plastics), likely reinforcing participants' positive emotions and encouraging positive reflection upon their environmental experience.

Limitations

The present research findings should be interpreted within the context of several limitations. The convenience sampling method implemented resulted in a relatively small sample size, especially at the follow-up, likely impacted by completing the study over the quieter tourist season in Winter months. Further, the sample underrepresents international participants, and those who consented to participate may be more pro-environmentally inclined than those who declined participation. Due to the correlational nature of this study, and the lack of a control group, the findings may be embedded in a preexisting desire to support conservation rather than an influence of

the seal encounter. Before generalizing to all seal encounter participants, the results of the present study need to be established within diverse population samples with control groups.

The measure of experiential engagement demonstrated sensitivity to participants' euphoria after encountering a seal and may therefore need alterations to accommodate for heightened responses and negative skew. Further, the measure of motivations for the zoo visit did not accommodate for a broad range (e.g., we only asked for the primary reason). We added an additional item to both the engagement and reflection sub scales, which improved the Cronbach's alpha, but unfortunately our sample size was too low to confidently conduct a factor analysis (Field, 2005) to ensure these items were suitable. Demand characteristics may have influenced participants' responses due to the unavoidable researcher presence during data collection. The results of the present study may provide preliminary data within conservation psychology that can be further tested and refined in future studies.

Future research directions

The present research suggests that zoo-based seal encounter participants' plastic use significantly decreases after their encounter. This is perhaps due to public post-visit action resources specifically urging the community's prevention of plastic use and reinforcing participants' subjective norms and perceived behavioral control. Future research testing whether implementing post-visit action resources assists participants to translate their pro-environmental intentions into PEB is required (Ballantyne et al., 2018; Ballantyne & Packer, 2016). Given the importance of subjective norms within the present research, post-visit action resources may be most effective if they discuss the importance of protecting loved ones and maintaining the environment for future generations (Ballantyne et al., 2018). Moral obligations may also be useful, and more work is needed to understand why it was not an important predictor in our study yet has been in other similar studies (e.g., Clark et al., 2019; Yazdanpanah et al., 2014).

Implications and conclusion

PEB is expected to positively impact all species sharing the marine environment and the broader ecosystem. Zoo-based seal encounters provide an accessible opportunity for a large percentage of the population to engage with seals where they may not have the opportunity in wild settings. The present research indicates these zoo-based encounters may promote visitor experiences with knowledge, positive emotion, and pro-environmental messages. Understanding the psychological factors contributing to PEB following a zoo-based seal encounter may assist zoos to design meaningful animal experiences and encourage behavior change. Based on the present research, animal experiences may be most influential upon participants' plastic use, pro-environmental intentions, and PEB, if they promote pro-environmental subjective norms. This study extends the literature by encouraging the integration of targeted subjective norms into zoo-based animal encounters to achieve necessary PEB change. The present study may contribute to the growing research within conservation psychology by applying the

TPB to a zoo-based seal encounter, and provides a basis from which zoos can further refine and improve their animal encounters to influence the psychological predictors of PEB.

Disclosure statement

No potential conflict of interest was reported by the authors.

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