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Drivers of pro-environmental behaviours among outdoor recreationists: The case of a recreational fishery in Western Canada

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ABSTRACT

Pro-environmental behaviours (PEBs) are important for mitigation and restoration efforts in the Anthropocene. As recreationists are motivated to engage in leisure activities to increase their own personal wellbeing, we submit that threats to wellbeing (an egocentric motivator) predict engagement in PEBs amongst recreationists. We also predict that differences in experiences across groups of recreationists leads to differences in PEB engagement. Using an online survey, we test our two hypotheses (if recreationists perceive there is a threat to their wellbeing and that their behaviours can yield environmental successes, then they will be more likely to engage in PEBs, and if recreationists differ in recreational experiences then they will demonstrate differences in PEB engagement) amongst outdoor recreationists, specifically Canadian rainbow trout and steelhead anglers in British Columbia (n = 894 respondents). We define 'threat to wellbeing' as the interaction of environmental threat-perceptions of used environments for fishing, and level of centrality fishing has to one's lifestyle. To test our first hypothesis, we conducted three linear regressions corresponding to three different PEBs related to catch-and-release (C&R) fishing. Our egocentric predictor 'threat to wellbeing' was only significant for one out of the three PEBs tested, showing mixed support for our first hypothesis. It is of note that 'environmental threat perceptions' and one's belief in successes resulting from PEB engagement were found to be significant predictors for all three PEBs tested. These results suggest that predictors of PEB may not always be transferable across PEBs relating to recreational activities, and environmental threat perception and one's belief in successes resulting from PEB engagement are strong predictors of PEBs amongst recreationists. To test our second hypothesis, we conducted a Kruskal Wallis test to determine if there were significant differences across angler groups in PEB predictor scores and PEB engagement and conducted pairwise population Z-tests to determine proportional participation rates across angler groups for the three PEBs and PEB predictors investigated. Experiences were found to shape predictors of PEBs, as well as likelihood to engage in PEBs, as different angler groups targeting different fish (i.e., rainbow trout vs steelhead) and using different aquatic habitats (i.e., rivers vs. lakes) demonstrated significantly different scores for PEB predictors, as well as significantly different likelihood to engage in two of the three PEBs tested. These findings support the notion that recreationists are not a homogenous group, and that their beliefs and resulting behaviours during recreational activities are determined by their experiences in nature and can be influenced by the species with which they interact, and the habitats they use for recreation.

1. Introduction

The concept of the 'Anthropocene', in which human actions are responsible for substantial environmental changes (Crutzen and Stoermer, 2000) is a poignant realization of the degree of impact human behaviours are having on the Earth (Keys et al., 2019). Human behaviours and actions directly dictate the fate of ecosystems, meaning that adoption of pro-environmental behaviours (PEBs) and other human actions can translate into positive benefits for the environment. Definitions of PEB vary throughout the literature, but for the purposes of this article we use Stern (2000), who defines them as all individual behaviours enacted with the intent of generating benefits for the environment.

PEBs amongst outdoor recreationists are of specific interest because when they are enacted in recreationally used ecosystems, they hold the

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potential to offset anthropogenic stressors. By providing individuals with opportunities to relieve psycho-social stress, relax, socialize, and connect with nature, outdoor recreation has been shown to increase wellbeing and generate positive emotions, whilst lowering obesity rates amongst those who participate (Vella et al., 2013; Korpela et al., 2014; Outdoor Industry Association, 2017; Eigenschenk et al., 2019). Outdoor recreation also supports a wide range of economic activities (e.g., recreational fishing, snorkeling, bird watching, kayaking) and creates jobs in rural regions. In the USA alone, the outdoor recreation industry generates $887 billion USD in consumer spending annually as of 2017, supporting approximately 7.6 million American jobs (Outdoor Industry Association, 2017). As a result, PEBs not only lead to ecological benefits, but also social and economic gains for society. Although recreationists are important potential enactors of PEBs (Chang and Martens, 2010), little research has looked to identify predictors of PEBs within this segment of society.

Although research has not heavily focused on predicting specific acts of PEBs during recreation like we do here, a body of work exists looking at the drivers and determinants of PEBs more generally. One indirect yet significant pro-social motivator of PEBs is 'problem awareness', also referred to as 'perceived levels of environmental threat', or 'environmental threat perceptions' (Bamberg and Moser, 2007). Several empirical studies conducted in the social sciences have uncovered links between environmental threat perceptions and PEBs. For example, Hartmann et al. (2015), studied the linkage between threat perceptions and intent to engage in PEBs amongst US citizens and Australians subjected to 'threat appeal based green advertising'. Using online surveys, the authors found that increased cognitive levels of threat perceptions and fear arousal in response to climate change significantly increased intent to engage in PEBs. In a study conducted by Johnson and Frickel (2011), long term ecological and social data were used to identify the correlation between ecological threat and PEBs via longitudinal data on bird and amphibian population numbers, and the number of founded environmental movement organizations. Johnson and Frickel (2011) found that population declines correlated with the establishment of such organizations, suggesting that threat perception can be linked to environmental activism.

Another motivator of PEB with strong implications for recreationists is 'specialization' (often referred to as 'commitment' or 'centrality', an index of psychological commitment). The theory of recreational specialization (Bryan, 1977; Scott and Shafer, 2001; Harshaw et al., 2020) suggests that skill, equipment preference and chosen location used for outdoor recreation contribute to one's level of specialization in a given activity. Specialization levels occur on a continuum and directly influence values and attitudes (i.e. importance of an activity to self-identity) as well as behaviours (i.e. use of preferred gear). For example, birdwatchers in Hong Kong (n = 318) reported a positive relationship between specialization and environmentally responsible behaviour on questionnaires (Cheung et al., 2017). As specialization increases, recreationists may become less consumptive of resources following a turn towards preservation. There is no consensus in the literature on how best to measure recreational specialization as researchers have identified it using different behavioural or value/attitude metrics, or some combinations thereof; however, there remains support for the use of 'centrality-to-lifestyle' as a viable indicator of specialization (Scott and Shafer, 2001; Sorice et al., 2009).

Existing behavioural psychology literature suggests self-interest is a significant driver of behaviour (Ajzen, 1985). As outdoor recreation can be harmful to ecosystems (Boyle and Samson, 1985; Larson et al., 2016), we assume that recreationists are likely not engaging in outdoor recreation with eco-centric goals, and that motivators to engage in pro-environmental behaviours during outdoor recreation are likely to predominantly result from a desire to maintain benefits – specifically levels of wellbeing – that are achieved through recreation. Our work looks to find support for this claim amongst recreationists based on our knowledge of past work in this space. A study conducted by Schmitt et al. (2018) found that recreationists who devote more of their personal resources towards pro-environmental behaviours reported higher levels of life-satisfaction (i.e. wellbeing). However, Schmitt et al. (2018) also found that the relationship between pro-environmental behaviour and wellbeing is not linear and can be influenced by perceptions of threat. Specifically, they found that levels of participation in 32 different PEBs correlate with increased perceptions of ecological threat, as well as decreases in life-satisfaction amongst a representative sample of Canadians and Americans. These findings suggest that threat perceptions negatively correlate with life-satisfaction, but positively correlate with increased engagement in PEBs (which negates to some degree decreases in life-satisfaction).

In a meta-analysis on the presence and strength of PEB determinants conducted by Hines et al. (1987) and then replicated by Bamberg and Moser (2007), PEBs are found to be both pro-socially motivated, and self-interest driven. Pro-social motivations are often defined in the literature using Schwartz's (1997) Norm-Activation-Model, which suggests that behaviours are the result of moral or personal norms built off of cognitive, emotional, and social factors. The most prominent factors influencing moral norms are problem awareness and causal attribution (example: feelings of guilt leading to moral obligations to act), in that order. Ajzen's (1985) Theory of Planned Behaviour (TPB) is often used in the literature when investigating behaviours driven by self-interest (egocentric behaviours). The TPB suggests that humans act with the goal of avoiding punishment and gaining rewards. Under this theory, behaviours are governed first by one's goal of avoiding losses; second, one's belief in their ability to avoid losses and obtain gains; and third, social norms (i.e. fear of social exclusion). As PEBs are found to be driven by pro-social and egocentric psycho-social factors, models looking to predict PEB should look to incorporate both (Bamberg and Moser, 2007).

Several psycho-social factors were repeatedly identified and included in integrated PEB models, most notably Stern's (2000) Value-Beliefs-Norm theory (Klöckner and Blöbaum, 2010; Klöckner, 2013; Fritsche et al., 2018). Such models suggest that intentions to engage in PEB form in response to personal environmental threat perceptions, and norms and goals (Fritsche et al., 2018). Although intention to act is recognized as the biggest determinant of PEB (Bamberg and Moser, 2007), realizations of PEBs are limited by subjective norms and perceptions of our capability to cause positive change through PEBs (Verplanken and Wood, 2006; Bamberg and Moser, 2007). Stern's (2000) 'value-belief-norm theory (VBN) of environmentally significant behaviour' is often considered to be the best model for gauging the likelihood of support for environmental movements and is often used in the literature when identifying determinants of pro-environmental behaviours (Stern, 2000; Ibtissem, 2010). The theory considers both pro-social and self-interest driven motivations for PEBs and has been used to define PEBs in both private and public spheres (i.e. green transport, biodiversity conservation, energy conservation, eco-friendly consumerism, etc.; Liu et al., 2018). The theory suggests that values dictate beliefs, which in turn leads to the creation of personal/social norms, which motivate intentions, and ultimately drive behaviours.

The goal of this study is to apply what is known about predictors and theories of PEB from the literature discussed above to specific acts of PEBs using data collected through an online angler survey. The study is twofold. First, we investigate the hypothesis that engagement in PEBs is egocentric in nature amongst recreationists by investigating 'threat to wellbeing' as an indicator of engagement in PEBs. We then investigate the hypothesis that differences in experiences amongst recreationists (here we specifically look at anglers) lead to differences in engagement in PEBs. Anglers are recreationists who use aquatic landscapes such as rivers, lakes, and oceans, for the purpose of catching fish, predominantly with hook and line, for leisure and/or social purposes as opposed to collecting a primary source of protein (Arlinghaus and Cooke, 2009). Anglers and other recreationists are sometimes overlooked in conservation and management due to the belief that they are part of the

problem. For example, anglers are often blamed for increased mortality in fish through harvest and post-release mortality through catch-and-release fishing (Granek et al., 2008; Arlinghaus and Cooke, 2009). This being said, through PEBs, anglers and other recreationists have the opportunity to offset their impacts on the environment and contribute to conservation efforts. This work looks to motivate others to continue to research PEBs within this demographic, and to encourage environmental decision-makers to account for such behaviours when considering conservation strategies.

2. Theoretical framework

In this study, we used a non-random online survey of rainbow trout and steelhead (*Oncorhynchus mykiss*) anglers (n = 894) in British Columbia, Canada. Based on existing studies that link psychological wellbeing with PEBs (Schmitt et al., 2018; Corral-Verdugo et al., 2011), we predict that PEBs are pursued to offset potential losses in wellbeing resulting from decreases in recreational opportunities (See Fig. 1). As the belief thatactions can result in successes has been found to predict engagement in such actions (Verplanken and Wood, 2006), belief in the resulting successes of PEBs is included in our framework.

Our first hypothesis (H1) is: if recreationists perceive there is a threat to their wellbeing and that their behaviours can yield environmental successes, then they will be more likely to engage in PEBs. Thus, we predict that 'environmental threat perception', 'centrality-to-lifestyle', and their interaction we refer to as 'threat to wellbeing', will be predictors of likelihood to engage in PEBs. Here, 'centrality-to-lifestyle' represents how important/central the activity of fishing is to each individual, and 'environmental threat perception' represents how much an environmental threat is perceived to be present on utilized landscapes. We propose that the interaction of these factors threaten one's ability to engage in the recreational activity of fishing, and thus promote egocentric motives to engage in PEBs. For the context of this work, we use the 'belief in [the effectiveness of] catch-and-release (C&R) [as a conservation tool]' as an indicator of belief successes resulting from 'action' (i.e., engagement in PEBs), as the PEBs explored here all look to limit the impact of catching fish on hook and line prior to their release (i.e., taking an online fish handling course, minimizing fish air exposure, and using a tool backed by science to reduce harm to fishes).

Our second hypothesis (H2) is: if recreationists have different experiences as a result of interacting with different environments and/or species, then they will demonstrate differences in their beliefs and in their likelihood to engage in PEBs. Based on the literature, we predict that predictors of PEBs are shaped by lived experiences, which change based on targeted species and used environments. We predict such differences will be apparent in observed disparities across groups of like-minded anglers in their likeliness to engage in PEBs. Specifically, we predict anglers fishing in rivers are more likely to engage in PEBs over lake anglers, due to observed differences in ecosystems, and the lower levels of fish stocking that takes place in BC rivers vs. lakes (FFSBC, 2019), and that steelhead anglers are more likely to engage in PEBs as a result of concern for steelhead population numbers in BC (COSEWIC, 2018).

3. Method

3.1. Survey development and distribution

An online survey entitled *Threats to Rainbow Trout and Steelhead in British Columbia* was designed and reviewed by a team of four academics, three rainbow trout anglers, and five rainbow trout fisheries experts and policy makers to ensure its validity and integrity, and was approved by the Carleton University Research Ethics Board (#10733). Participants were required to give informed consent via the online consent form at the beginning of the survey. The survey consisted of multiple choice, Likert, and free-answer questions. The survey mechanism was built and operated using the online Qualtrics software. The survey was pre-tested by three anglers with experience fishing for rainbow trout in BC. Pre-testing indicated a completion time of approximately 15 min. The survey was available for approximately 6 months from the beginning of April to mid-October 2018 and was distributed using a non-random, non-stratified broadcast sampling method (similar to that used by Ayachi et al., 2015) to reach BC rainbow trout anglers within a population of unknown boundaries. The survey was distributed using social media platforms through personal researcher accounts (Twitter and Facebook), and paid targeted advertising (Facebook). Our partnering organizations (The Freshwater Fisheries Society of BC and Anglers Atlas) also contributed survey distribution by including the survey link in newsletters that were sent via email to their members.

3.2. Data completion and sample size

A total of 1171 individuals opened the survey link and viewed the survey. Of those, 47 individuals chose not to continue the survey after reviewing the consent form (~4%). The survey began with a weeding out question to ensure respondents were in fact rainbow trout anglers who fish in BC (*Do you fish for rainbow trout in British Columbia?*). At this point, six individuals indicated that they did not fish for rainbow trout in BC, automatically terminating their survey, nine individuals elected to abandon the survey without answering this question, and 57 individuals indicated they did fish for rainbow trout in BC but did not answer any subsequent questions (6%). Two respondents did not meet the minimum age for participation (18 years) and were removed from the sample. These exclusions resulted in a working dataset of 1051 rainbow trout

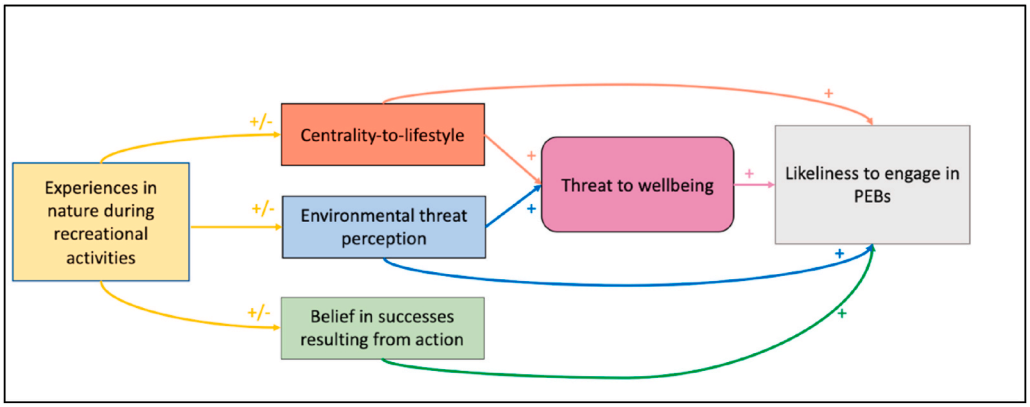

Fig. 1. Framework for predicting likeliness to engage in PEBS amongst outdoor recreationists. (Colour should be used). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

anglers. From these responses, we retained responses from surveys with a completion rate of 90% or higher to reduce bias, resulting in a sample size of 894 and a survey completion rate of ~85%. At the beginning of the survey, anglers were asked to select which subpopulation of rainbow trout they target most (steelhead in streams/rivers, rainbow trout in streams/rivers, rainbow trout in large lakes, rainbow trout in small lakes) and to answer all survey questions with that response in mind to account for differences in fishing experiences (see Table 1. Below).

4. Data analysis

Data was analyzed using SPSS version 25.

4.1. Testing hypothesis one: linear regressions

Three linear regressions were conducted for three investigated PEBs to test H1 and our predictions that 'environmental threat perceptions' and 'centrality-to-lifestyle' are predictors of PEBs, and that the interaction of these two variables (referred to as 'threat to wellbeing') and belief in successes resulting from action (here we use 'belief in C&R practices') are also strong predictors of PEB. The linear regression for each PEB investigated contained independent variables positioned into three blocks. The first block included demographic variables. The second block included the variable: 'angler group', and the third block included our predictor variables: 'centrality-to-lifestyle', 'environmental threat perception', 'threat to wellbeing' (i.e. 'centrality-to-lifestyle' x 'environmental threat perception'), and 'belief in C&R practices'. Independent variables were dropped from the regression if they were not significant in the block in which they first appeared.

4.1.1. Dependent variables: pro-environmental behaviours

The survey asked respondents to answer how likely they were to engage in three different PEBs. These were: 1. Limit the amount of time caught fish are exposed to air to 10 seconds or less, 2. Take a free online class on best fish handling practices, and 3. Buy scientifically backed fishing gear found to reduce harm to fish. Respondents answered on a 5-point Likert scale, with the option of answering 'I don't know' which we handled as blank responses in our analysis (see Table 1.). Engagement in PEB scores used as dependent variables in the three regressions each had a range of 1–5.

4.1.2. Independent variables: demographic variables and other predictor variables

The demographic variables included in regressions were: 'age', 'education', and 'income' (see Table 1.). They were collected in the online survey and have been found to be predictors of PEBs in past studies (Gifford and Nilsson, 2014). The continuous variable 'age' passed the test of linearity using four categorical 'dummy' variables. Dummy variables were used for 'education' and 'income'. Dummy variables were dropped from the regression if they were not significant in the first block in which they appeared. 'Environmental threat perception' scores and 'belief in the effectiveness of C&R' scores were each built off of one 5-point Likert item question (see Table 1.) and once again, respondents were given the option to answer with 'I don't know' (these responses were treated as blanks, and were dropped). This gave respondents 'environmental threat perception' scores and 'effectiveness of C&R' scores with a range from 1 to 5. Centered 'environmental threat perception' and 'effectiveness of C&R scores were used in linear regressions.

A composite Likert item score was used for fishing centrality-to-lifestyle survey questions. Fishing 'centrality-to-lifestyle' scores were built from three 5-point Likert scale items similar in structure as those included in Mcfarlane (2004; see Table 1.). Cronbach's Alpha was calculated to ensure internal consistency between Likert items thus ensuring the reliability of scales. Cronbach's Alpha was found to be 0.713 which is a good level of reliability (Ursachi et al., 2015). We did

Table 1
Survey questions and response rates

Survey Questions Used	N	Mean	SD
Pro-Environmental Behaviour Likert Questions:			
1. Please indicate the likelihood that you would perform the following:			
• I am willing to voluntarily limit air exposure to ten seconds or less	884	4.61	0.667
a. Very likely (5)	603		
b. Likely (4)	235		
c. Neither likely nor unlikely (3)	34		
d. Unlikely (2)	5		
e. Very unlikely (1)	7		
2. Please indicate the likelihood that you would perform the following:			
• I would take a free online course on the proper handling of angled fish	**883**	3.74	1.33
a. Very likely (5)	330		
b. Likely (4)	265		
c. Neither likely nor unlikely (3)	105		
d. Unlikely (2)	94		
e. Very unlikely (1)	89		
3. Please indicate the likelihood that you would perform the following:			
• I would purchase fishing gear that has been scientifically tested to reduce harm to angled fish	**878**	4.21	0.928
a. Very likely (5)	395		
b. Likely (4)	338		
c. Neither likely nor unlikely (3)	96		
d. Unlikely (2)	28		
e. Very unlikely (1)	21		
Environmental Threat Perception Likert Question:			
1. Please indicate your level of agreement or disagreement with the following statements:			
• I believe that [previously selected fish] populations in British Columbia are currently at risk of decline due to environmental changes	**864**	3.66	1.14
a. Strongly agree (5)	229		
b. Agree (4)	311		
c. Neither agree nor disagree (3)	167		
d. Disagree (2)	118		
e. Strongly disagree (1)	39		
Centrality-to-Lifestyle Likert Questions:			
1. Please indicate your level of agreement or disagreement with the following statements:			
• Fishing is an important activity for my group of friends	**886**	3.92	0.964
i. Strongly agree (5)	271		
ii. Agree (4)	366		
iii. Neither agree nor disagree (3)	176		
iv. Disagree (2)	55		
v. Strongly disagree (1)	18		
2. Please indicate your level of agreement or disagreement with the following statements:			
• Fishing is my favourite leisure activity	**889**	4.10	0.897
a. Strongly agree (5)	357		
b. Agree (4)	312		
c. Neither agree nor disagree (3)	174		
d. Disagree (2)	43		
e. Strongly disagree (1)	3		
3. Please indicate your level of agreement or disagreement with the following statements:			
• Fishing is a big part of my life	**889**	4.22	0.861
a. Strongly agree (5)	401		
b. Agree (4)	326		
c. Neither agree nor disagree (3)	123		
d. Disagree (2)	34		
e. Strongly disagree (1)	5		
Belief in Catch & Release Likert Question:			
1. Please indicate your level of agreement or disagreement with the following statement:			
• I believe catch and release practices are an effective way to ensure conservation of angled fish species	**887**	3.95	1.05
a. Strongly agree (5)	305		
b. Agree (4)	362		
c. Neither agree nor disagree (3)	117		

(*continued on next page*)

Table 1 (*continued*)

Survey Questions Used	N	Mean	SD
d. Disagree (2)	74		
e. Strongly disagree (1)	29		
Demographics Questions Free-Answer and Multiple Choice:			
1. Please indicate your age:	880	63.8	14.6 [textbox]
2. What is your highest level of education?	**888**	3.95	1.80
a. Did not attend high school (1)	2		
b. Some high school (2)	40		
c. Highschool diploma (3)	112		
d. Some college (4)	143		
e. College or vocational diploma (5)	229		
f. Some university (6)	61		
g. University undergraduate degree (7)	154		
h. University post-graduate or professional degree (8)	147		
3. What is your household income (before taxes)?	**843**	3.19	1.51
a. Under 25000$ (1)	42		
b. 25000-50000$ (2)	127		
c. 50000-75000$ (3)	176		
d. 75000-100000$ (4)	188		
e. 100000-125000$ (5)	123		
f. Over 125000$ (6)	187		
Angler Group Multiple Choice Question:			
1. Which out of the following do you targe most when out angling?	**893**	N/A	N/A
a. Rainbow trout from small lakes <1000 hectares	592		
b. Rainbow trout from large lakes >1000 hectares (example: Kootenay lake, Okanagan lake, Shuswap Lake, Quesnel lake)	58		
c. Rainbow trout in streams and rivers	108		
d. Steelhead	135		

not conduct list-wise deletion when addressing missing data (unanswered Likert items, or items answered 'I don't know'. We opted for the *person mean substitution method* (Downey and King, 1998; Huisman, 2000), as items were positively correlated. Answers for all questions in both question groupings were summed, giving each individual respondent a fishing 'centrality-to-lifestyle' score with a range of 3–15. Centered 'centrality-to-lifestyle' scores were used in linear regressions. The centered 'centrality-to-lifestyle' and 'environmental threat perception' scores were multiplied together to obtain their interaction, which we refer to as 'threat to wellbeing' scores.

4.2. Testing hypothesis two: Kruskal-Wallis and z-tests

The means of the significant predictors for PEBs determined in the linear regressions above ('centrality-to-lifestyle', 'environmental threat perception', 'belief in C&R', and 'threat to wellbeing') were compared across angler groups using a Kruskal-Wallis test to answer H2. Pairwise population proportion Z-tests were also used to determine if proportional participation rates in PEBs, 'environmental threat perception' scores, and 'centrality-to-lifestyle' scores, 'threat to wellbeing' scores, and 'belief in C&R' scores differed across angler groups. Here we used non-parametric tests because data retrieved from Likert scales are ordinal, failing the assumptions of parametric tests.

Anglers were divided into four groups to which they self-identified with at the beginning of the online survey. These groups are: 1) rainbow trout anglers fishing for resident trout in small lakes, 2) rainbow trout anglers fishing for resident trout in large lakes, 3) rainbow trout anglers fishing for rainbow trout in rivers/streams, and 4) steelhead (anadromous/migratory rainbow trout) anglers fishing in rivers/streams. Anglers were divided into groups because different waterbody types (i.e. rivers vs. lakes) are thought to result in differing angler experiences (Adrian Clarke, FFSBC, personal communication). Large lakes in BC for example, may be deep, thus masking the effects of climate change, whereas streams and rivers may be shallow, leaving them vulnerable to increased water temperatures under climate change. Furthermore, lakes in BC are heavily stocked with hatchery-bred trout, whereas rivers and streams are not (FFSBC, 2019), perhaps allowing wild population declines to be more evident to anglers in rivers. As well, observed declines in steelhead population numbers in BC in recent decades could also be shaping recreationist perceptions (COSEWIC, 2018). Demographics data was analyzed using Kruskal-Wallis non-parametric test and Z-tests to account for demographic differences across angling groups.

5. Results

5.1. Testing H1: determining predictors of PEB

The predictors 'environmental threat perceptions' and 'belief in C&R' are significant indicators of PEB across the three PEBs investigated. The predictors 'threat to wellbeing', and 'age' are only significant for the PEB 'limit air exposure'. The predictor 'centrality-to-lifestyle' was significant for the two PEBs 'limit air exposure' and 'buying a scientifically backed tool to reduce harm to fish'. The predictor 'angler group' was significant for the PEB 'limiting air exposure'.

5.1.1. PEB: limiting air exposure to less than 10 s

The regression equation for block three for the PEB 'limiting air exposure to 10 seconds or less' is: $F(6, 829) = 17.353$, $p < 0.001$. 'Age', angler group', 'belief in C&R', 'threat to wellbeing', 'centrality-to-lifestyle', and 'environmental threat perception' are significant predictors of this PEB (see Table 2.).

The interaction between 'environmental threat perception' and 'centrality-to-lifestyle', referred to here as 'threat to wellbeing' is found to be significant, yet the interaction is negative. The interaction is found to have more influence on the likeliness of engagement in PEBs if anglers score lower on both predictors, yet does not have much influence when anglers score high on one of the two predictors. This indicates a 'ceiling affect', suggesting that once a certain degree of 'threat to wellbeing' is achieved, increasing it will no loger yeild more likeliness of engagement in this specific PEB (see Fig. 2.).

Age is found to be a significant indicator of engagement in the PEB 'limit air exposure to 10 seconds or less'. Overall, older anglers tend to be less likely to engage in limiting air exposure in fish to 10 seconds or less compared to younger anglers (see Fig. 3.).

5.1.2. PEB: taking a free fish handling class

The regression equation for block three is: $F(2, 845) = 22.113$, $p < 0.001$. Only 'environmental threat perception' and 'belief in C&R practices' are found to be significant predictors for taking a free fish handling class (see Table 3).

5.1.3. PEB: buying science-backed fishing gear

The regression equation for block three is: $F(4, 824) = 8.592$, $p < 0.001$.

The predictors 'environmental threat perception', 'centrality-to-lifestyle', and 'belief in C&R practices' are found to be significant predictors for buying science-backed fishing gear. The predictor 'age' was significant in block 1, but it is not significant when grouped with other predictors (see Table 4.).

5.2. H2: impact of experiences on likeliness to engage in PEBs

Differences across angler groups found amongst PEB predictors (see Table 5.) and angler likeliness to engage in two out of three PEBs (see Table 6.) suggest that differences in experience resulting from targeting different species and using different environments result in varied likeliness to engage in PEBs.

5.2.1. Demographic variables across angler groups

Angling groups did not significantly differ in gender ($p = 0.111$),

Table 2
Regression coefficients table for PEB: 'limiting air exposure to <10 s'.

	R2	R2(Adjusted)	B	t	Sig.	95% Confidence Intervals.	
						Lower	Upper
Block one	0.017	0.016					
Constant			4.935	55.428	<0.001*	4.760	5.110
Age			−0.006	−3.780	<0.001*	−0.009	−0.003
Block two	0.030	0.028					
Constant			4.952	55.876	<0.001*	4.778	5.126
Age			−0.006	−3.770	<0.001*	−0.009	−0.003
RT anglers in small lakes			−0.319	−3.380	0.001*	−0.504	−0.134
Block three	0.112	0.105					
Constant			4.833	55.903	<0.001*	4.663	5.003
Age			−0.004	−2.497	0.013*	−0.007	−0.001
RT anglers in small lakes			−0.254	−2.796	0.005*	−0.433	−0.076
Centrality-to-lifestyle			0.040	3.897	<0.001*	0.020	0.060
Environmental threat perception			0.086	4.395	<0.001*	0.048	0.124
Threat to wellbeing			−0.025	−2.890	0.004*	−0.042	−0.008
Belief in C&R			0.100	4.639	<0.001*	0.057	0.142

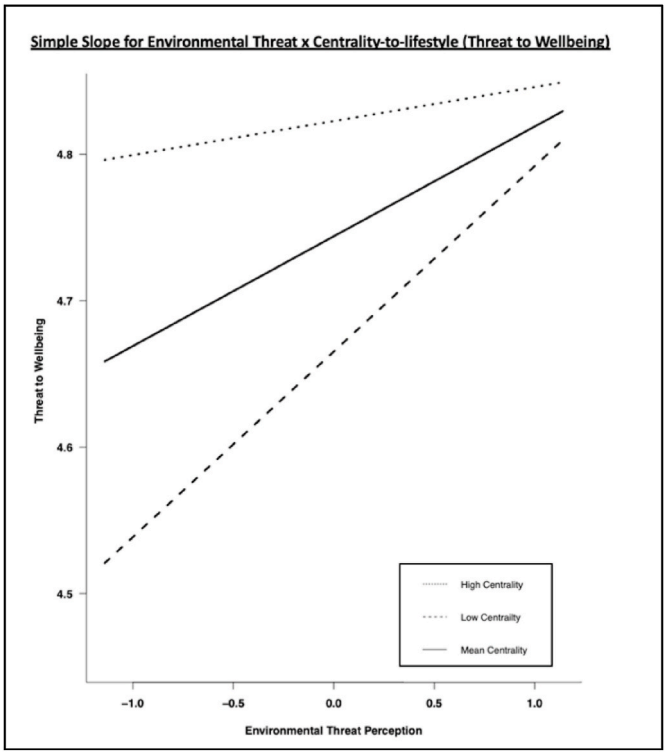

Fig. 2. Simple slope for 'Environmental threat perception' x 'Centrality to Lifestyle'. 'High Centrality' represents 1 SD above the mean; 'Low Centrality' represents 1 SD below the mean.

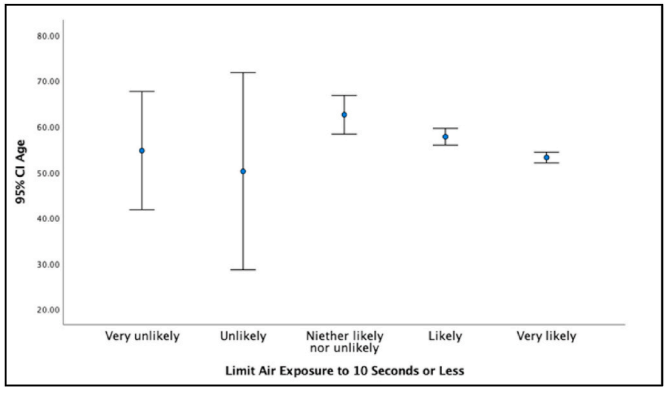

Fig. 3. Differences in age across likeliness to engage in the PEB 'limit air exposure to 10 seconds or less'.

income (0.124) or education level (0.140) but did differ significantly in age (p = <0.001; see Fig. 4.). Steelhead anglers and rainbow trout anglers fishing in rivers/streams were significantly younger in age than small lake rainbow trout anglers (p = 0.001 and p = <0.001 respectively).

5.2.2. Differences in PEB predictor scores across angler groups

There are significant differences across angler groups in 'environmental threat perception', 'centrality-to-lifestyle', 'threat to wellbeing', and 'belief in C&R practices' scores (p < 0.001; see Fig. 5.). 'Environmental threat perception' scores do not significantly differ between anglers fishing in large and small lakes, yet anglers fishing for rainbow trout in rivers score significantly higher than lake anglers, and significantly lower than steelhead anglers also fishing in rivers. Steelhead anglers demonstrate significantly higher 'environmental threat perception' scores than all other groups. Centrality-to-lifestyle scores do not significantly differ across the three groupings of rainbow trout anglers, yet steelhead anglers score significantly higher than all others. 'Belief in C&R practices' scores are significantly different between rainbow trout anglers fishing in large lakes, and river anglers targeting both steelhead and rainbow trout. 'Threat to wellbeing' is significantly different between steelhead anglers, and rainbow trout anglers fishing in rivers and large lakes (see Table 5.).

5.2.3. Differences in engagement in PEBs across angler groups

In all, anglers are more likely to engage in all PEBs than not likely to engage in PEBs. Anglers are more likely to engage the PEB 'limiting air exposure to 10 seconds or less', and are least likely to engage in the PEB 'taking a free fish handling class'. There are significant differences in likelihood of engagement in the PEBs 'limiting air exposure to 10 seconds or less (p < 0.001), and 'buying science-backed fishing gear' (p = 0.003) across angler groups, yet there is no such difference for the PEB 'taking a free fish handling class' (p = 0.372; see Fig. 6.). Large lake rainbow trout anglers are significantly less likely to engage in limiting air exposure than rainbow trout anglers in rivers and steelhead anglers in rivers. Small lake rainbow trout anglers are less likely to limit air exposure than steelhead anglers in rivers. The only significant difference across groups for the PEB 'buying scientifically-backed gear' is between rainbow trout anglers in small lakes and steelhead river anglers (see Table 6.).

Table 3
Regression coefficients table for PEB- 'taking a free fish handling class'.

	R2	R2 (Adjusted)	B	t	Sig.	95% Confidence Intervals	
						Lower	Upper
Block Three	0.050	0.047					
Constant			3.730	83.369	0.000*	3.642	3.817
Environmental threat perception			0.223	5.628	0.000*	0.145	0.301
Belief in C&R			0.120	2.779	0.006*	0.035	0.204

Table 4
Regression coefficients table for PEB: 'Buying Science-backed Fishing Gear'.

	R2	R2(Adjusted)	B	t	Sig.	95% Confidence Intervals	
						Lower	Upper
Block one	0.006	0.005					
Constant			4.482	35.665	0.000*	4.236	4.729
Age			−0.005	−2.284	0.023*	−0.009	−0.001
Block three	0.040	0.035					
Constant			4.370	34.762	0.000*	4.124	4.617
Age			−0.003	−1.400	0.162	−0.007	0.001
Centrality-to-lifestyle			0.031	2.083	0.038*	0.002	0.060
Environmental threat perception			0.091	3.207	0.001*	0.035	0.147
Belief in C&R			0.093	3.207	0.003*	0.032	0.153

Table 5
Pairwise Z test across angler groups for predictors of PEBs.

	Std. Error	Std. Test Statistic	Adj. Sig.
Centrality-to-lifestyle			
RT Small Lakes-RT Large Lakes	35.324	1.912	0.335
RT Small Lakes-RT Rivers	26.652	0.379	1.000
RT Small Lakes-SH Rivers	24.293	−4.645	0.000*
RT Large Lakes-RT Rivers	41.700	−1.378	1.000
RT Large Lakes-SH Rivers	40.234	−4.484	0.000*
RT-Rivers-SH Rivers	32.883	−3.739	0.001*
Belief in C&R			
RT Small Lakes-RT Large Lakes	33.459	2.045	0.245
RT Small Lakes-RT Rivers	23.020	−2.532	0.068
RT Small Lakes-SH Rivers	23.020	−2.136	0.196
RT Large Lakes-RT Rivers	39.548	−3.354	0.005*
RT Large Lakes-SH Rivers	38.096	−3.087	0.012*
RT-Rivers-SH Rivers	31.216	0.482	1.000
Environmental Threat Perception			
RT Small Lakes-RT Large Lakes	33.580	−0.815	1.000
RT Small Lakes-RT Rivers	25.171	−5.619	0.000*
RT Small Lakes-SH Rivers	23.099	−11.129	0.000*
RT Large Lakes-RT Rivers	39.473	−2.890	0.023*
RT Large Lakes-SH Rivers	38.185	−6.016	0.000*
RT-Rivers-SH Rivers	31.050	−3.725	0.001*
Threat to Wellbeing			
RT Small Lakes-RT Large Lakes	35.132	0.367	1.000
RT Small Lakes-RT Rivers	41.205	0.456	1.000
RT Small Lakes-SH Rivers	23.969	−3.760	0.001*
RT Large Lakes-RT Rivers	23.020	−2.136	0.196
RT Large Lakes-SH Rivers	39.877	−2.584	0.059
RT-Rivers-SH Rivers	32.219	−3.781	0.001*

6. Discussion

The objective of this study was to: 1) investigate the influence of the egocentric predictor 'threat to wellbeing', as well as the known predictors 'environmental threat perception', 'centrality-to-lifestyle', and 'belief in successes resulting from one's actions' on PEB engagement amongst recreationists; and 2) investigate how differences in recreational experiences shape engagement in PEBs amongst recreationists. For this work, we used rainbow trout anglers in BC as representatives of recreationists. We found partial support for our H1 as all predictors included in our theoretical framework (Fig. 1) were found to be significant predictors of the PEB 'limit air exposure to 10 seconds or less', yet were not significant across all three investigated PEBs. Only

Table 6
Pairwise Z test across angler groups for PEBs. The PEB 'take a free fish handling course' was not significantly different across angler groups and was therefore excluded here.

	Std. Error	Std. Test Statistic	Adj. Sig.
Limit Air Exposure to <10 Seconds			
RT Small Lakes-RT Large Lakes	28.842	2.481	0.079
RT Small Lakes-RT Rivers	21.769	−1.969	0.293
RT Small Lakes-SH Rivers	19.968	−4.235	0.000*
RT Large Lakes-RT Rivers	34.030	−3.362	0.005*
RT Large Lakes-SH Rivers	32.906	−4.744	0.000*
RT-Rivers-SH Rivers	26.924	−1.548	0.729
Buy Science-Backed Fishing Gear			
RT Small Lakes-RT Large Lakes	32.170	0.390	1.000
RT Small Lakes-RT Rivers	24.480	−2.616	0.053
RT Small Lakes-SH Rivers	22.666	−2.874	0.024*
RT Large Lakes-RT Rivers	38.030	−2.014	0.264
RT Large Lakes-SH Rivers	36.889	−2.106	0.211
RT-Rivers-SH Rivers	30.416	−0.036	1.000

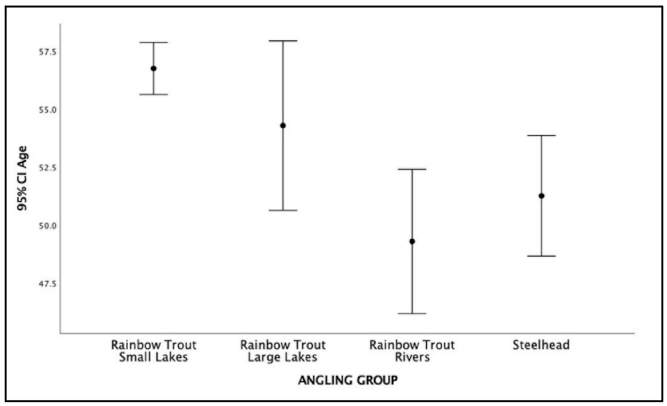

Fig. 4. Distribution of 'age' across angler groups.

'environmental threat perception' and 'belief in C&R' were significant predictors of the PEB 'taking a free online fish handling course', and only 'centrality-to-lifestyle', 'environmental threat perception', and 'belief in C&R' were significant predictors of the PEB 'buying a scientifically backed fishing tool'. We found \support for our H2 as predictors of PEB

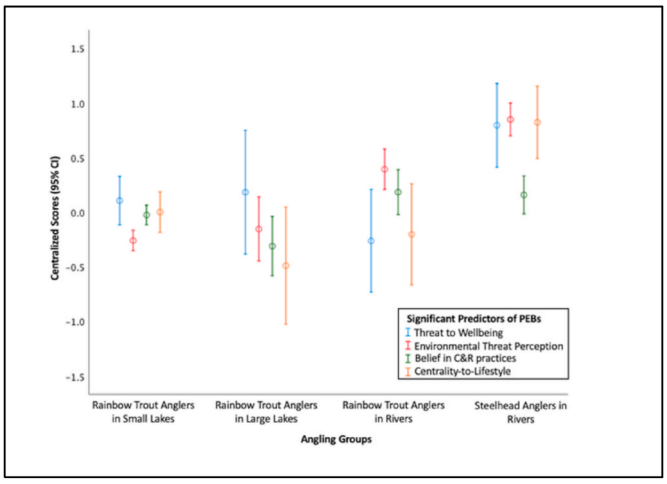

Fig. 5. Scores for significant PEB predictors across angler groups. (Colour should be used). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

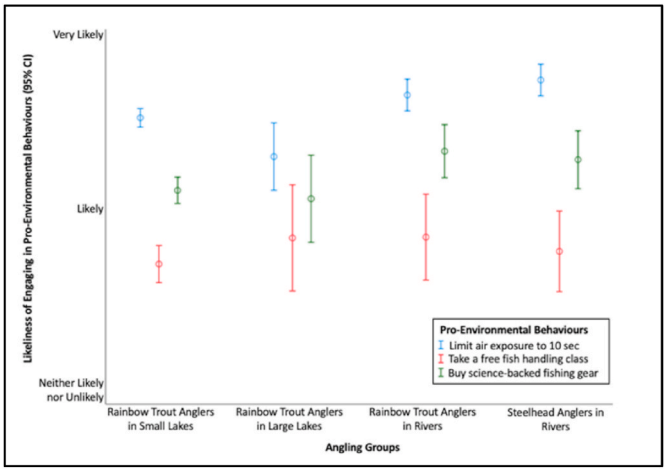

Fig. 6. Scores for likelihood to engage in PEBs across angler groups. (Colour should be used). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

and level of likeliness to engage in two out of three PEBs differed across angler groups tested.

The linear regressions for the three PEBs investigated under our first hypothesis all revealed 'environmental threat perception' and 'belief in C&R' as significant predictors for all three PEBs. This supports theories such as VBN theory (Stern, 2000) and other works (Bamberg and Moser, 2007) that demonstrate belief in successes resulting from actions is a strong determinant of PEB. Our findings also support past literature that suggests 'environmental threat perception' can be used as an indicator of likeliness to engage in PEB (Johnson and Frickel, 2011; Hartmann et al., 2015). The two variables 'RT (rainbow trout) anglers in small lakes' and 'age' were not part of our framework (see Fig. 1.) but were also found to be significant predictors of the PEB 'limit air exposure to 10 seconds or less'. 'RT anglers in small lakes' was a dummy varable for 'angler groups'. These findings suggest that engagement in this specific PEB can be predicted based on which angler group recreationists are a part as well as their age. The predictors 'age' and 'angler group' were not however found to be significant for the other two PEBs investigated.

Differences in significance of framework variables (excluding 'belief in resulting success of actions' and 'environmental threat perception'), as well as the variables 'age' and 'angler group' in predicting the remaining two PEBs 'taking a free online fish handling course' and 'buy a tool backed by science' may be due to the nature of the PEBs investigated. The PEB in which all predictors were found to be significant ('limit air exposure to 10 seconds or less') was the one that scored the highest for most likeliness of engagement by respondents (see Table 1.). Furthermore, it was the only PEB that had a direct impact on fish, as it takes place whilst actually fishing. The other two PEBs had indirect impacts on fish, as engagement in those behaviours would in time result in benefits for fish during fishing. Perhaps predicted predictors are strongest for behaviours that are enacted whilst engaging directly with nature, such as limiting the duration for which fish are exposed to air to 10 seconds or less while participating in C&R fishing. This explanation is supported by the finding that PEBs are non-transferable across contexts, and that experience and commitment to an environment may greatly alter one's behaviour at said location, but not others (Dunlap and Heffernan, 1975; Miao and Wei, 2013; Cooper et al., 2015).

Our prediction that PEBs are enacted by recreationists for egocentric reasons is not fully supported by our findings, as 'threat to wellbeing' was only significant for the PEB 'limiting air exposure to 10 seconds or less'. 'Threat to wellbeing' is high when anglers scored either 'centrality-to-lifestyle' or 'environmental threat perception' as high, and does not increase much when both scores are high (see Fig. 2.). Perhaps seeing an activity dependent on the environment as central to one's life, and perceiving high levels of environmental threat on used environments are strong predictors of 'threat to wellbeing' on their own. More work is needed to best measure perceived 'threat to wellbeing' and egocentric motives amongst recreationists and how this concept relates back to PEBs.

We also found most demographic variables were not significant predictors of PEB amongst recreationists when coupled with our other predictors. Some studies have suggested age to be a significant predictor of PEBs (Gifford and Nilsson, 2014; Chankrajang and Muttarak, 2017; Escario et al., 2020), yet this trend was only apparent for the PEB 'limiting air exposure to 10 seconds or less'. When looking at our data (see Fig. 3.), older respondents were less likely to limit air exposure compared to younger respondents which fits with the literature above suggesting that younger individuals are more likely to engage in PEBs. Existing literature also suggests that higher education is correlated with PEBs as scientific knowledge is believed to influence one to engage in PEBS (Gifford and Nilsson, 2014; Escario et al., 2020), yet this was not apparent in our study.

Our findings support our second hypothesis as anglers from different angler groups (representative of different experiences and environments used for recreation) demonstrate significantly different scores across PEB predictors, and significantly different likeliness to engage in two out of the three PEBs investigated. For example, 'environmental threat perception' scores were significantly lower in lake rainbow trout anglers over river anglers, and those targeting steelhead rather than rainbow trout had significantly higher scores. Furthermore, anglers targeting steelhead (the anadromous form of rainbow trout) yielded significantly higher 'centrality-to-lifestyle' scores over the other angling groups (suggesting that steelhead anglers are more committed or more specialized).

When looking at engagement in investigated PEBs, Kruskal-Wallis tests found significant differences in likelihood to engage in PEB across angler groups in two of the three PEBs investigated. Our findings are consistent with other literature suggesting PEBs enacted by recreationists are dependent on experiences (Lin and Lee, 2020). In regard to our specific findings, they can be explained by differences in experiences anglers may have on the water in BC, as lakes are heavily stocked with hatchery-raised rainbow trout in BC, and streams and rivers are not (FFSBC, 2019). Declines in populations as a result of stressors may therefore not be as evident in lakes, thus potentially contributing to lower threat perception scores. Furthermore, steelhead are more challenging to capture, and are more elusive than rainbow trout (many populations in BC are of critical concern following dramatic population

declines; COSEWIC, 2018), suggestive of a different fishing experience over rainbow trout.

It is important to note that rainbow trout anglers fishing in rivers and steelhead anglers were found to be significantly younger in age compared to small lake rainbow trout anglers (see Fig. 4.). We recognize 'age' may be influencing engagement in the PEB 'limit air exposure to 10 seconds or less' (as 'age' was found to be a significant predictor of this PEB). We also recognize that survey respondents make up a non-random sample as surveys were distributed using a broadcast sampling method. As anglers completed our survey without any form of compensation, our sample of recreationists may be biased towards motivated, invested, and dedicated anglers. Future work should continue to determine predictors of PEBs amongst recreationists and continue to explore the effects of experience and chosen environments on likeliness to engage in PEBs during recreational activities. It is important to understand PEB motivators among members of this group because such actions have social, economic, and ecological value (Korpela et al., 2014; Outdoor Industry Association, 2017; Eigenschenk et al., 2019). PEBs are relevant for mitigating and restoring the impacts of what is, in the aggregate, a large-scale human intervention in nature.

7. Recommendations to decision-makers working with recreationally used environments

Recreationists are not a homogenous group as they are demonstrated in this work to hold their own views, perceptions, and likeliness to engage in specific behaviours. For this reason, management approaches for recreationally used environments should look to define groups amongst recreationists and account for differences across groups. An understanding of behaviours and perceptions across groups can help environmental management personnel to cater management approaches to fit the needs and wants of specific groups, thus promoting the uptake of management strategies. Furthermore, an understanding of likeliness to engage in impactful PEBs on the landscape across groups of recreationists can help management personnel account for such behaviours and can help with developing impactful and targeted educational programs.

Recreationists are influenced by their belief in successes resulting from their own actions, as 'belief in C&R' was found to be a strong predictor of likeliness to engage in PEBs. Recreationists are also influenced by perceived environmental threat perceptions of utilized landscapes, as 'environmental threat perception' was found to be a strong predictor of likeliness to engage in PEBs. Those tasked with managing recreationally used landscapes can use these finding to their advantage. Recognizing successes from PEB engagement and actively demonstrating how engagement in PEBs yields success may lead to higher participation in PEBs during recreational activities. Similarly, communicating environmental threats of utilized landscapes to increase 'environmental threat perception' amongst recreationists may also lead to higher participation in PEBs.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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