

Experience beats confidence: a WVO-segmented model of flying fox conservation behaviour

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Abstract

Purpose – This Behavioural Insight Report aims to generate behavioural insights for flying fox conservation by testing how self-efficacy, prior experience and knowledge predict conservation behaviour, and whether these relationships differ across wildlife value orientation (WVO) segments.

Design/methodology/approach – A cross-sectional survey of Sunshine Coast residents measured Domination–Mutualism via four belief dimensions (use, hunting, social affiliation and caring), alongside psychological constructs and behaviour. Data were analysed using PLS-SEM for the overall sample, with exploratory segment-level comparisons across WVO groups.

Findings – Experience emerged as the principal driver of conservation behaviour, knowledge showed a smaller positive effect and evidence for self-efficacy was tentative and should be interpreted cautiously given measurement limitations. Segment-level estimates were obtainable for two of the four WVO segments (Mutualists, Traditionalists). Experience was a significant positive predictor of behaviour in both groups; knowledge was additionally significant for Mutualists but not Traditionalists, while self-efficacy was significant (negative) for Traditionalists but not Mutualists. The Distanced and Pluralist segments could not be modelled due to collinearity among knowledge indicators within these smaller subgroups.

Research limitations/implications – The modest, region-specific sample and reliance on self-report, cross-sectional data limit causal inference and generalisability; the Distanced and Pluralist WVO segments could not be modelled due to collinearity among knowledge indicators within these smaller subgroups, and between-group differences have not been formally tested for statistical significance. Measures for some constructs would benefit from stronger theory anchoring and refinement.

Practical implications – Practitioners should prioritise experience-building tactics (seminars, workshops, volunteer activities) supported by targeted information; this is best evidenced for Mutualists and Traditionalists, as the Distanced and Pluralist segments could not be modelled and no segment-specific guidance is currently available for them.

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Originality/value – This study applies WVO segmentation to flying fox conservation within a social marketing framework, identifying segment-level levers and highlighting the primacy of experience over self-efficacy in shaping behaviour.

Keywords Conservation, Flying fox, Wildlife value orientation

Paper type Research paper

Background

Flying foxes, also known as fruit bats, are native to Australia and vital to ecosystem function. Through their role as keystone pollinators and seed dispersers, they promote forest health and link fragmented habitats via long-distance movements (Law, 1995; Markus and Hall, 2004; Welbergen *et al.*, 2020). Due to the clearing of foraging and roosting habitat, flying foxes' populations have declined over the past century (Department of Agriculture, Water and the Environment, 2021; Kingston *et al.*, 2023). Although global reviews document the accelerating decline of flying foxes and call for urgent conservation action (Kingston *et al.*, 2023) to our knowledge, species-specific strategies tailored to the ecological and social contexts of flying foxes remain largely absent from policy and practice. Flying fox colonies can be found in areas with mangroves, wetlands, rainforests and occasionally dry sclerophyll forests (Palmer *et al.*, 2000; Yabsley *et al.*, 2021). Oftentimes, these habitats overlap with peri-urban regions. When roosts form near human settlements, this proximity to people places them increasingly at the centre of human–wildlife conflict. Residents report noise, odour and perceived disease risks, while farmers incur crop damage in agricultural areas (Currey *et al.*, 2018; Divljan *et al.*, 2011). The resulting conflict can undermine conservation outcomes (Welbergen *et al.*, 2020). These conflicts are not merely social – they have direct and measurable consequences for flying fox survival.

Human activities constitute a predominant source of morbidity and mortality in flying foxes: a 13-year Victorian wildlife-hospital data set attributes 63.7% of admissions to anthropogenic causes – most frequently fruit-tree netting entanglement (36.8%) and barbed wire (12.4%) – with an overall post-admission mortality of 59.3% (Scheelings and Frith, 2015). Disturbance associated with urban development and conflict-mitigation actions likewise imposes substantial welfare costs and uncertain conservation benefit; government case reviews document elevated mortality and widespread pup abandonment at camps adjacent to construction works, although causation was not always conclusively established, while a national assessment of 48 camp dispersals finds such interventions costly, often ineffective at resolving complaints and liable to exacerbate displacement and stress – underscoring the need for *in situ*, evidence-based management (Ecosure, 2021; Roberts *et al.*, 2021).

Despite the intensification of conflict amidst the ongoing decline of many flying fox populations, research on the public's conservation behaviour towards flying foxes remains sparse. In particular, the socio-psychological drivers of pro-conservation behaviour – such as self-efficacy, experience and knowledge – have not been examined in this species-specific context, and audience segmentation approaches have yet to be applied to flying fox conservation within a social marketing framework. Addressing this gap is critical, as without understanding what motivates different community segments to act, conservation campaigns and conflict-mitigation strategies cannot be effectively targeted. Conservation outcomes are shaped by the public's values and beliefs. Wildlife value orientations (WVOs) offer a robust framework for understanding these perspectives, distinguishing between domination, where wildlife is viewed primarily as a resource for human use, and mutualism, which emphasises emotional connection, care and coexistence with wildlife. These orientations, reflected in beliefs about hunting, use,

Research purpose/aims

This Behavioural Insight Report (BIR) examines the socio-psychological drivers of flying fox conservation behaviour among peri-urban residents in the Sunshine Coast region, with the aim of informing targeted social marketing campaigns and evidence-based conflict mitigation strategies. Through exploratory formative research conducted through a social marketing lens, we investigated socio-psychological drivers of attitudes and behaviours towards flying fox conservation in the Sunshine Coast region. Social marketing – or the use of marketing strategies alongside social and behavioural science – plays a vital role in resource management and wildlife conservation (Coffie *et al.*, 2025; Foote *et al.*, 2024; Mehmet and Simmons, 2019). Alongside a focus on behaviour change, analysing the competition and identifying the exchange at play, audience segmentation is a core marketing tactic and a foundational tenet of social marketing (French, 2017). By identifying segment-specific behavioural levers, we aim to inform the design of targeted, socially acceptable management strategies.

Addressing calls for better insight into human behaviour and levers that can strengthen pro-conservation actions, this study develops and tests a behavioural model linking individual capabilities and experiences to intentions and behaviours towards flying fox conservation (Figure 1). We focus on three antecedents – self-efficacy, prior experience and knowledge – that are widely cited in behaviour-change theory but underexamined in this context. Drawing on social cognitive theory (Bandura, 1989), self-efficacy reflects an individual's perceived capability to undertake and persist with a course of action, particularly when that action requires effort or overcoming practical barriers. This provides the

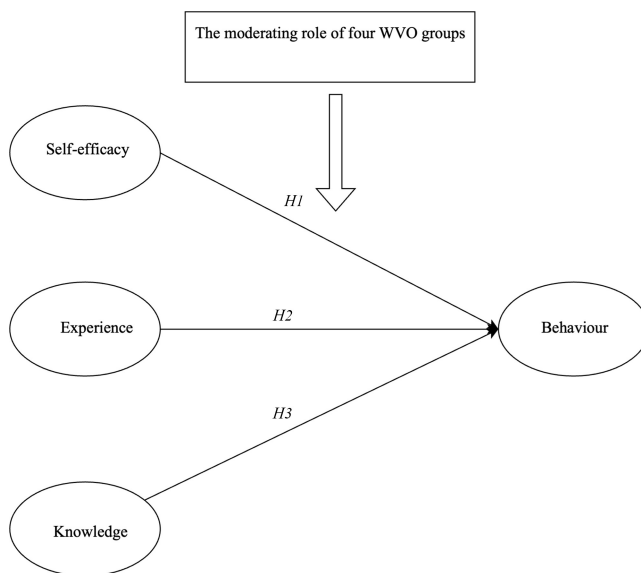


Figure 1. The proposed research model
Source: Authors' own work

theoretical basis for expecting self-efficacy to predict conservation behaviour. Previous research also links self-efficacy to volunteering and public-sphere environmental behaviour, although its effects vary across behavioural contexts (Hristova *et al.*, 2025; Yan *et al.*, 2024), and self-efficacy has also been shown to positively mediate the transition from easier to more difficult pro-environmental behaviours (Lauren *et al.*, 2016). Prior experience with wildlife has been shown to directly shape conservation engagement and attitudes (Soga and Gaston, 2016), while knowledge is a foundational driver of informed conservation participation (Gregg *et al.*, 2025). Together, these three constructs represent the individual-level cognitive and experiential factors most proximal to behaviour and most amenable to measurement in a cross-sectional formative survey. Accordingly, our first research question (RQ) asks:

RQ1. How do individuals' self-efficacy, experience and knowledge influence their conservation behaviour towards flying foxes?

We posit three direct-effect hypotheses:

- H1. Self-efficacy positively predicts conservation behaviour towards flying foxes (e.g. donating or reporting wildlife sightings).
- H2. Experience with flying foxes (e.g. encounters, volunteer work or conflict management) positively predicts conservation behaviour.
- H3. Knowledge about flying fox ecology, threats and management positively predicts conservation behaviour.

To capture heterogeneity in the public, we draw on WVO, an approach commonly used to segment audiences in conservation and marketing research (French, 2017; Grilli *et al.*, 2018; Pang *et al.*, 2023). The WVO framework was selected over broader pro-environmental frameworks because it was specifically developed to capture public orientations towards wildlife, with domination and mutualism beliefs shown to directly predict wildlife-related attitudes and behaviours across multiple contexts (Grilli *et al.*, 2018; Teel and Manfredo, 2010). Its capacity for species-specific audience segmentation aligns directly with the social marketing principle of targeting (French, 2017; Pang *et al.*, 2023). While WVOs have been applied across diverse international contexts (Jacobs *et al.*, 2022) and their predictive power shown to vary by species conservation status and provenance (Kontsiotis *et al.*, 2021), to our knowledge, no prior study has examined WVO segmentation for a threatened, conflict-prone species such as the flying fox within a social marketing framework. This study extends the WVO literature by testing whether segment-level behavioural levers, not just attitudinal differences, hold for a species where human–wildlife conflict directly threatens conservation outcomes. Following Teel and Manfredo (2010), domination and mutualism are each operationalised through two belief dimensions: domination is measured via hunting and appropriate use beliefs, reflecting a utilitarian view of wildlife as a resource; mutualism is measured via caring and social affiliation beliefs, reflecting an egalitarian view of wildlife as part of one's social community. Respondents' relative scores on these dimensions are used to classify them into four WVO segments: Mutualists, Traditionalists, Pluralists and Distanced. Because WVO segments reflect fundamentally different orientations towards wildlife, the influence of self-efficacy, experience and knowledge on conservation behaviour may not be uniform across groups. Individuals who view wildlife as part of their social community may respond differently to the same behavioural levers than those who hold utilitarian views. This heterogeneity motivates our second research question:

RQ2. Do the relative strength and direction of the relationships between self-efficacy, experience, knowledge and conservation behaviour vary across WVO-defined segments, and, within each segment, which antecedents exert the strongest influence?

Based on this segmentation logic, we advance a segment-variation hypothesis:

H4. The relative strength and direction of the relationships between self-efficacy, experience, knowledge and conservation behaviour will vary across WVO segments.

The proposed model (Figure 1) is tested using survey data and structural equation modelling to generate practical guidance for targeted outreach, education, policy and conflict-mitigation programmes.

Method

We conducted a cross-sectional survey of residents in the Sunshine Coast region to examine demographic, psychographic and value-based correlates of flying fox conservation. The analytic sample comprised 172 complete questionnaires (complete-case analysis), with participation voluntary and anonymous. The instrument was self-administered and contained self-report items. Demographic variables included gender, age and educational attainment. Psychographic constructs comprised self-efficacy, experience, knowledge and conservation behaviour. WVOs were operationalised with 13 statements representing two higher-order orientations – Domination and Mutualism – via four belief dimensions (use belief, hunting belief, social affiliation, caring). Following standard WVO practice, respondents were segmented into four resident groups based on their relative standing on Domination and Mutualism. The segmentation logic for defining WVO groups is based on respondents' relative endorsement of two overarching orientations:

- (1) *Domination* – viewing wildlife primarily in terms of human use and control.
- (2) *Mutualism* – viewing wildlife as part of an extended social community deserving care and rights.

These orientations are measured using 13 statements that capture four belief dimensions:

- (1) use (e.g. wildlife should be used for human benefit);
- (2) hunting (e.g. support for hunting as a legitimate activity);
- (3) social affiliation (e.g. seeing wildlife as companions or part of a social group); and
- (4) caring (e.g. concern for animal welfare).

Following standard WVO practice, individuals are grouped by their relative scores on the Domination and Mutualism scales (Table 1), yielding four distinct WVO groups. Mutualists prioritise animal welfare, oppose hunting and view wildlife as part of their social world. Traditionalists emphasise human control over wildlife and support hunting and utilitarian use. Pluralists hold mixed views, supporting both use and care depending on context. Finally, the Distanced group shows low engagement with or interest in wildlife issues.

Data were screened for completeness and plausible ranges, and items were coded so that higher scores indicated more of the underlying construct. Multi-item constructs (self-efficacy, knowledge and WVO dimensions) were modelled as reflective. Experience and conservation behaviour were modelled as separate composite indices based on binary indicators. Experience was assessed with two items (sum 0–2), reflecting engagement with workshops, educational programmes and relevant books or other resources. Conservation behaviour was assessed with four items (sum 0–4), reflecting actions such as donating,

Table 1. Wildlife value orientation

Mutualism/Domination	Domination (low)	Domination (high)
Mutualism (high)	Mutualists (<i>n</i> = 76, 44.2%)	Pluralists (<i>n</i> = 17, 9.9%)
Mutualism (low)	Distanced (<i>n</i> = 20, 11.6%)	Traditionalists (<i>n</i> = 59, 34.3%)

Note(s): Segment sizes reflect corrected Domination/Mutualism scores after reverse-coding the Hunting belief items (see Table 3 note), computed as the mean of each belief dimension’s items and classified by mean-split (respondents above/below the sample average on each dimension), consistent with Table 4 and the method described in the text. *n* = 172 valid classifications (excludes 83 respondents with any missing WVO item)

Source(s): Authors’ own work

participating in community discussions and reporting flying fox colonies. Higher scores indicated greater experience or conservation behaviour. Analyses proceeded in two steps. First, descriptive statistics were produced in SPSS to summarise sample characteristics and item distributions (frequencies and percentages for categorical variables; means and standard deviations for continuous variables). Multi-item constructs were validated using indicator loadings and internal consistency/validity indices, including Cronbach’s alpha, composite reliability (CR) and average variance extracted (AVE).

Second, a partial least squares structural equation modelling (PLS-SEM) was estimated in SmartPLS with behaviour as the endogenous variable predicted by self-efficacy, experience and knowledge. Following the standard two-stage approach, the measurement model was evaluated using outer loadings and the reliability/validity indices, after which the structural model was estimated. Non-parametric bootstrapping was used to estimate path coefficients and *p*-values for the hypothesised links from self-efficacy, knowledge and experience to behaviour in the overall sample. To explore heterogeneity in wildlife values, group-specific models were fitted for each WVO segment where estimable (two of the four: Mutualists and Traditionalists), and their segment-level path coefficients were summarised (see multigroup analysis path). Group comparisons were descriptive; no additional predictive indices or formal between-group significance tests are reported. The study received institutional ethics approval, and informed consent was obtained from all participants.

Results

Sample characteristics

Table 2 summarises demographic characteristics using valid percentages (system missing excluded). Among respondents who reported gender (*n* = 161), 75.2% identified as female and 24.8% as male. Employment status (*n* = 135) was most commonly “work in office” (35.6%) and “retired” (30.4%). Education (*n* = 173) was skewed towards higher qualifications, with 40.5% holding postgraduate degrees and 39.3% holding college degrees. Income responses (*n* = 173) were broadly distributed, with 20.2% in \$100,000–\$149,999 and 23.1% preferring not to answer.

Measurement model

Reliability and convergent validity evidence for the measurement model are summarised in Table 3. Most constructs met conventional thresholds (CR ≥ 0.70; AVE ≥ 0.50) (Bagozzi and Yi, 1988; Fornell and Larcker, 1981). Use belief (CR = 0.888, AVE = 0.727, α = 0.811), hunting belief (CR = 0.913, AVE = 0.778, α = 0.854; ht2 and ht3 were reverse-worded and were reverse-coded prior to estimation), social affiliation (CR = 0.928, AVE = 0.764, α = 0.896), Caring (CR = 0.923, AVE = 0.799, α = 0.874) and knowledge (CR = 0.957,

Table 2. Demographic characteristics of respondents

Variable (N)	Category	n	Valid (%)
Gender (161)	Female	121	75.2
	Male	40	24.8
Employment status (135)	Unemployed	2	1.5
	Semi-retired	16	11.9
	Work from home	28	20.7
	Work in office	48	35.6
	Retired	41	30.4
Education (173)	College degree	68	39.3
	Postgraduate degree	70	40.5
	Secondary (high) school	26	15.0
	Other	9	5.2
Household income (173)	Less than \$10,000	1	0.6
	\$10,000–\$24,999	8	4.6
	\$25,000–\$49,999	19	11.0
	\$50,000–\$74,999	14	8.1
	\$75,000–\$99,999	15	8.7
	\$100,000–\$149,999	35	20.2
	\$150,000–\$199,999	20	11.6
	\$200,000 or more	21	12.1
	Prefer not to answer	40	23.1

Note(s): Valid percentages are computed within each variable and exclude system missing. Total survey $n = 255$

Source(s): Authors' own work

AVE = 0.847, $\alpha = 0.931$) all performed strongly, with loadings typically ≥ 0.77 (e.g. $us2 = 0.916$; $ht2 = 0.921$; $sa2 = 0.913$; $cr1 = 0.928$; $k1 = 0.952$). Social efficacy was marginal (CR = 0.733, AVE = 0.604, $\alpha = 0.489$) due to one weak indicator ($S1SQ004 = 0.487$) alongside $S1SQ001 = 0.985$. At the second order, Domination (CR = 0.882, AVE = 0.555, $\alpha = 0.838$) and Mutualism (CR = 0.939, AVE = 0.690, $\alpha = 0.923$) both showed acceptable reliability and convergent validity. Measurement quality was therefore acceptable for all constructs except self-efficacy, which retains marginal reliability due to one weak indicator; results involving self-efficacy should be interpreted with some caution.

Self-efficacy exhibited a low Cronbach's alpha ($\alpha = 0.489$) alongside acceptable composite reliability (CR = 0.733) and convergent validity (AVE = 0.604). Given that alpha assumes tau-equivalence and is known to underestimate reliability for short scales with heterogeneous loadings (Sijtsma, 2009), we interpret the alpha with caution. One indicator showed a weak loading (approximately 0.487), which likely depressed alpha. Accordingly, we temper our interpretation of effects involving this construct and treat self-efficacy findings as exploratory.

Wildlife value orientation types

Four WVO types were identified based on domination and mutualism (see Table 4): Mutualists (44.2%, $n = 76$), Traditionalists (34.3%, $n = 59$), Distanced (11.6%, $n = 20$) and Pluralists (9.9%, $n = 17$), based on $n = 172$ respondents with complete WVO data. Group membership was determined by whether respondents scored above or below the sample average on Domination and Mutualism, yielding the four segment combinations low-high, low-low, high-low and high-high.

Table 3. Measurement model: reliability, validity and item loadings

Construct / indicator	Estimate	C.ratio	SE	CR	AVE	α	Mean	SD
Dominant				0.882	0.555	0.838	2.74	0.45
Use belief				0.888	0.727	0.811	2.46	0.79
us1	0.776	14.397	0.054				3.19	1.219
us2	0.916	51.729	0.018				2.22	1.283
us3	0.860	51.395	0.017				1.98	1.172
Hunting belief				0.913	0.778	0.854	2.26	0.49
ht1	0.790	25.438	0.031				1.41	0.817
ht2	0.921	51.991	0.018				4.44	0.946
ht3	0.929	63.789	0.015				2.17	1.346
Mutualism				0.939	0.690	0.923	4.09	0.89
Social affiliation				0.928	0.764	0.896	4.01	0.96
sa1	0.772	17.281	0.045				3.86	0.889
sa2	0.913	64.255	0.014				4.38	1.124
sa3	0.895	53.406	0.017				4.11	1.393
sa4	0.907	59.607	0.015				3.67	1.16
Caring				0.923	0.799	0.874	4.15	0.88
cr1	0.928	57.423	0.016				3.94	1.167
cr2	0.860	25.404	0.034				4.22	0.955
cr3	0.893	43.950	0.020				4.30	0.834
Self-efficacy				0.733	0.604	0.489	3.12	0.79
S1SQ001	0.985	16.993	0.058				3.84	1.29
S1SQ004	0.487	2.044	0.238				2.41	1.01
Experience	1.000	n/a	0				3.66	1.38
Knowledge				0.957	0.847	0.931	3.03	0.62
k0	0.947	16.031	0.059				0.11	0.315
k1	0.952	16.584	0.057				4.39	1.14
k2	0.950	17.795	0.053				4.43	1.079
k4	0.828	11.154	0.074				3.19	0.939
Behaviour	1.000	n/a	0				1.25	1.20

Note(s): CR = composite reliability; AVE = average variance extracted; α = Cronbach's alpha. For single-item variables (Experience, Behaviour) reliability indices are not estimated. ht2 and ht3 were reverse-worded items; they were reverse-coded prior to model estimation, and loadings/means shown here reflect the corrected direction (previously reported as negative loadings; see text for details). Values in red were updated following the reverse-coding correction; self-efficacy, experience, knowledge and behaviour rows are unchanged from the prior submission

Source(s): Authors' own work

Structural model

The model explained a substantive proportion of variance in behaviour ($R^2 = 0.299$; $n = 172$), and the validated overall model is presented in Figure 2. Model fit and predictive assessment indices are reported in Table 5; overall, the model showed acceptable fit and meaningful out-of-sample predictive relevance for behaviour. Bootstrap inference (Figure 3) indicated that experience had the strongest positive association with behaviour ($\beta = 0.462$, $p < 0.001$, supporting H2), followed by knowledge ($\beta = 0.171$, $p = 0.003$, supporting H3), while self-efficacy showed a negative association ($\beta = -0.208$, $p < 0.001$, H1 not supported). This self-efficacy finding should be interpreted cautiously given the scale's marginal reliability.

Multi-group analysis

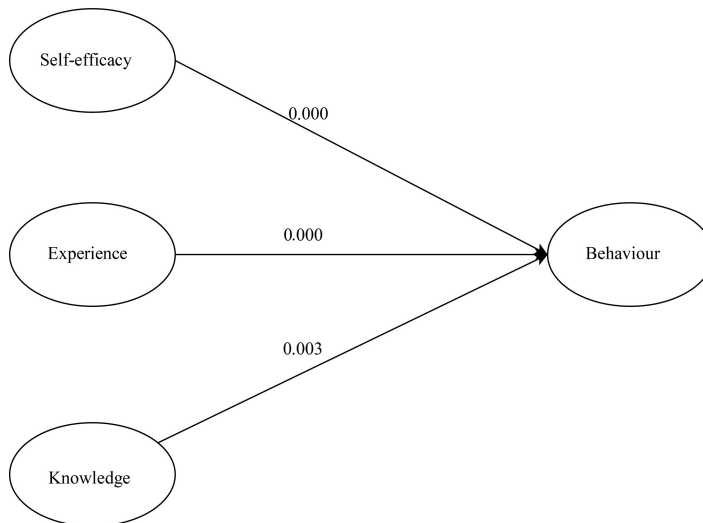
MICOM and permutation testing did not establish measurement invariance. However, because the WVO segments were defined *a priori* from the established Domination–Mutualism

Table 4. WVO segments: means (SD) by belief dimensions

Value orientation/ belief dimension	Mutualist (44.19%) Mean (SD)	Distant (11.63%) Mean (SD)	Traditionalist (34.30%) Mean (SD)	Pluralist (9.88%) Mean (SD)
Dominant	1.20 (0.26)	1.50 (0.24)	2.79 (0.59)	2.36 (0.49)
Use belief	1.21 (0.36)	1.65 (0.50)	2.73 (0.85)	1.98 (0.98)
Hunting belief	1.19 (0.40)	1.35 (0.46)	2.86 (0.94)	2.75 (0.79)
Mutualist	4.80 (0.26)	3.60 (0.33)	3.18 (0.67)	4.70 (0.29)
Social affiliation	4.83 (0.28)	3.61 (0.42)	3.00 (0.79)	4.59 (0.50)
Caring	4.78 (0.38)	3.58 (0.46)	3.37 (0.79)	4.80 (0.31)

Note(s): Values are means (standard deviations) computed within each WVO segment, using the corrected (reverse-coded) hunting belief items; $n = 172$ respondents with complete WVO data (83 respondents with any missing WVO item excluded). Segment definitions and sizes match [Tables 1](#) and [6](#)

Source(s): Authors' own work

**Figure 2.** The validated model – overall

Source: Authors' own work

framework and independently of the behavioural model, the group-specific estimates provide theory-driven exploratory evidence. As shown in [Table 6](#), the multi-group PLS-SEM analysis indicated that, overall, self-efficacy was negatively associated with behaviour ($\beta = -0.208$, $p < 0.001$), while experience ($\beta = 0.462$, $p < 0.001$) and knowledge ($\beta = 0.171$, $p = 0.003$) were positively related to behaviour. Group-level estimates were obtained for two of the four WVO segments. For Mutualists, both experience ($\beta = 0.493$, $p < 0.001$) and knowledge ($\beta = 0.225$, $p = 0.016$) were significant predictors of behaviour; self-efficacy was not ($\beta = -0.095$, $p = 0.564$). For Traditionalists, both self-efficacy ($\beta = -0.329$, $p = 0.002$) and experience ($\beta = 0.502$, $p < 0.001$) were significant, while knowledge was not ($\beta = 0.174$, $p = 0.202$). This theoretically coherent divergence suggests that knowledge may be more relevant to conservation behaviour among Mutualists, whereas self-efficacy may operate differently

Table 5. Model fit and predictive assessment

Indicator	Value	<i>t</i>	<i>p</i>
<i>R</i> ² (behaviour)	0.299		
<i>R</i> ² adjusted (behaviour)	0.291		
SRMR (saturated model)	0.060		
SRMR (estimated model)	0.060		
NFI	0.940		
Q ² predict (behaviour)	0.270		
CVPAT vs indicator average (δ loss)	-0.266	3.52	< 0.001
CVPAT vs linear model (δ loss)	-0.023	1.82	0.070

Note(s): SRMR = standardized root mean square residual; NFI = normed fit index; Q²predict = cross-validated redundancy for out-of-sample prediction (PLSpredict); CVPAT = cross-validated predictive ability test; indicator average and linear model are naïve and non-PLS benchmark models, respectively; Δ loss = average loss difference (PLS-SEM benchmark)

Source(s): Authors' own work

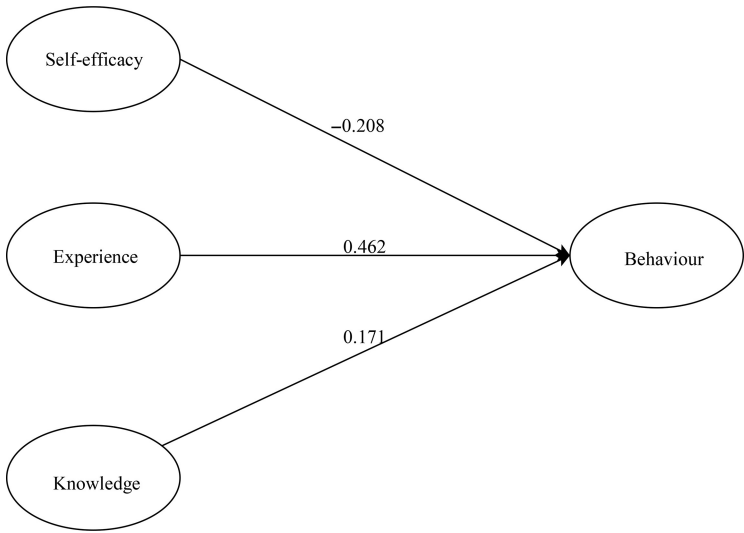


Figure 3. Bootstrapping results

Source: Authors' own work

among Traditionalists. Path coefficients could not be estimated for the Distanced (*n* = 20) or Pluralist (*n* = 17) segments because of within-group collinearity among the Knowledge indicators. The observed patterns are therefore consistent with the segment-variation proposed in *H4* and provide useful theory-driven exploratory evidence, but they should not be interpreted as statistically confirmed differences between WVO groups.

Discussion

Overall findings

Given the formative BIR format, the discussion prioritises practical behavioural insight over extended theoretical elaboration. This BIR clarifies how different levers translate into

Table 6. Multi-group analysis (WVO segments): standardised path coefficients (β) and p -values

Path	Overall		Mutualist		Distanced		Traditionalist		Pluralist	
	β	p	β	p	β	p	β	p	β	p
Self-efficacy $\rightarrow$ behaviour	-0.208	< 0.001	-0.095	0.564	n/a	n/a	-0.329	0.002	n/a	n/a
Experience $\rightarrow$ behaviour	0.462	< 0.001	0.493	< 0.001	n/a	n/a	0.502	< 0.001	n/a	n/a
Knowledge $\rightarrow$ behaviour	0.171	0.003	0.225	0.016	n/a	n/a	0.174	0.202	n/a	n/a

Note(s): β = standardised path coefficient; two-tailed bootstrap p -values (5,000 subsamples) reported where available. Segment sizes (mean-split of raw belief-dimension averages, post reverse-coding correction of Hunting belief; see [Tables 3](#) and [4](#) notes): Mutualist $n = 76$, Traditionalist $n = 59$, Distanced $n = 20$, Pluralist $n = 17$; Overall $n = 173$ (the overall/pooled model; excludes respondents with missing confidence, experience, knowledge or behaviour data – a slightly larger sample than the $n = 172$ used for WVO segmentation). Distanced and Pluralist: not estimable, even descriptively – within both subgroups at least two of the five knowledge indicators were perfectly or near-perfectly collinear, producing a singular indicator correlation matrix. Formal PLS-MGA/permutation/MICOM significance testing for between-group differences was attempted for Mutualist vs Traditionalist (the only pair in which both segments could be individually estimated) but did not complete, for the same reason (see [Table 6](#)). No between-group differences in this table have been formally tested for statistical significance

Source(s): Authors' own work

conservation behaviour in the challenging context of urban flying fox management. By applying the WVO segmentation framework, we show that behaviour is most strongly driven by prior engagement, followed by knowledge, with self-efficacy playing a limited or even negative role. Framed through a social marketing lens, this approach highlights how segmentation and behavioural levers can be systematically applied to tailor interventions that resonate with diverse community groups ([French, 2017](#); [Pang et al., 2023](#)).

Implications for practice

Across the overall sample, experience was the strongest driver of behaviour. Activities such as attending seminars, workshops or community events appear to build familiarity, skills and social connections that lower barriers to action. This reflects the principle of exchange: residents are more willing to bear the perceived costs of conservation when they gain tangible benefits such as competence and connection. Knowledge also supported behaviour, though less strongly, suggesting that information is most effective when it scaffolds participation rather than standing alone.

By contrast, self-efficacy showed a negative association with behaviour. This pattern is consistent with the broader attitude-behaviour gap literature, which shows that environmental attitudes do not always reliably translate into costly, effortful actions ([Farjam et al., 2019](#)); by analogy, our finding of a negative self-efficacy-behaviour path may reflect a similar readiness-behaviour gap rather than a true absence of capability. Taken together, the evidence supports prioritising experience-building tactics, with information acting as scaffolding. Findings for self-efficacy are tentative. Given the scale's marginal reliability and a weak indicator, we refrain from drawing strong inferences about efficacy pathways and instead view them as hypothesis-generating, pending scale refinement and replication. Interventions should emphasise seminars, workshops and citizen-science activities, supported by targeted information. Efficacy-based messaging may be trialled cautiously and evaluated rigorously before scale-up.

Segment-specific strategies

For Mutualists, experience and knowledge were significant predictors of conservation behaviour, whereas self-efficacy was not. For Traditionalists, experience and self-efficacy

were significant, whereas knowledge was not. Although these patterns are indicative rather than conclusive, they suggest that experience-building should form the common foundation of interventions across both segments. Councils could provide accessible activities such as short seminars, hands-on workshops, volunteer days and citizen-science tasks. For Mutualists, these activities may be reinforced with targeted information and practical household guidance. For Traditionalists, communication should emphasise concrete, low-risk actions and observable benefits rather than relying primarily on self-efficacy-building appeals.

Seasonal campaigns delivered through bus stops, shopping centres, schools and community noticeboards could also normalise actions such as wildlife-safe fruit-tree netting, bringing laundry inside at night and sheltering vehicles. Such messages are more likely to reach and be noticed by residents when delivered through visible, high-reach out-of-home channels (Wilson, 2023). Any differentiated messaging should be trialled and evaluated before wider implementation, as targeted communication may produce unintended spillover effects in other audiences (Truelove *et al.*, 2014). Overall, these findings offer a behavioural contribution by (i) applying the WVO framework in an Australian flying fox context, (ii) providing descriptive evidence that experience appeared to be the strongest driver of behaviour, followed by knowledge, while self-efficacy showed a negative association, although the relative magnitude of these effects was not formally tested for statistical difference and (iii) highlighting the need for experience-led interventions. Whereas traditional conservation education has relied on generic information, this study supports a universal, experience-first programme – grounded in seminars, workshops and community advertising – for the segments that could be reliably assessed (Mutualists, Traditionalists). This behaviourally informed approach offers councils a practical pathway to build participation and balance costs and benefits.

Conclusion

This BIR offers an initial, resident-focused view of drivers of flying fox conservation behaviour, but several limitations temper inference. First, the sample was modest and confined to one region, limiting power – especially for WVO subgroups – and generalisability beyond the Sunshine Coast. Second, measures relied on self-report in a single cross-sectional wave, so common-method bias and ambiguity about directionality remain. Third, some constructs were *ad hoc* rather than theory-anchored; the self-efficacy scale showed marginal internal consistency with one weak indicator, and experience/past behaviour were simplified into a composite. Fourth, measurement invariance and formal between-group differences could not be established because redundant Knowledge indicators produced singular matrices within the two smaller segments and instability during permutation testing. The segment findings therefore remain useful as theory-guided exploratory evidence, although larger stratified samples and a more parsimonious Knowledge measure are required for confirmatory multigroup testing. Finally, our practical recommendations (workshops, seminars, outdoor advertising) were not experimentally evaluated here.

Future work should use larger, stratified samples across more communities and roost contexts, with oversampling to ensure adequate representation of each WVO segment. Measures should be refined using a clearer theoretical framework, such as social cognitive theory, which recognises interactions between personal, social/environmental and behavioural factors (Bandura, 1989). To move beyond correlation, conduct longitudinal studies to follow people over time after participation in workshops and evaluate the impact of handbooks, seasonal out-of-home messages and other strategies and tactics. Tracking actual behaviours is essential – event sign-ins, volunteer hours, citizen-science uploads – rather than relying only on self-reports. Test likely moderators such as distance to roosts, perceived costs and local norms. Plan

and deliver the work with councils and community partners so the interventions are practical, fair and scalable. Journal of Social Marketing

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