Received: 30 August 2018 | Accepted: 8 February 2019

DOI: 10.1002/pan3.18

RESEARCH ARTICLE

PEOPLE AND NATURE | BRITISH ECOLOGICAL SOCIETY

Stakeholder discourse and opinion towards a charismatic non-native lizard species: Potential invasive problem or a welcome addition?

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Funding information
Natural Environment Research Council, Grant/Award Number: NE/L002574/1

Abstract

1. Analysis of discourse between stakeholders is becoming increasingly recognised for its importance in resolving conflicts of opinion regarding complex environmental issues such as the human-mediated spread of invasive non-native species—one of the major drivers of biodiversity loss world-wide. Species' attributes, stakeholders' level of knowledge, perceptions of threat, attitudes towards intervention and nature values all have subjective influence on opinion, often creating highly opposed interests and perspectives that can create barriers preventing effective management.
2. Using a Q method approach towards analysis of subjective opinion among stakeholders, this study aimed to identify emerging viewpoints regarding the presence of Common Wall Lizards (*Podarcis muralis*) in the UK—an introduced, non-native species with which there are high levels of human interaction but low levels of knowledge regarding potential negative ecological impacts. It explores the ways in which different stakeholder groups (i.e., public, land managers, conservationists) might share views and the reasoning behind shared or opposing discourse between groups.
3. Three clearly defined viewpoints on the species' introduction emerge from the analysis of Q sorts: 'Innocent until proven guilty', 'Precautionary informed concern' and 'The more the merrier'. These perspectives reflect both stark differences and commonalities in stakeholder perceptions and opinion towards the species' introduction.
4. Whereas the 'Innocent until proven guilty' and 'Precautionary, informed concern' views are defined by differences in levels of ecological knowledge and impact uncertainty between them, the divergence of the 'More the merrier' view from both other viewpoints appears to be more reflective of pronounced variation between the groups deeper beliefs, perceptions and values about 'naturalness and balance', and overall relationship with nature.

5. These findings will be useful in identifying discordant attitudes and areas of potential contention between stakeholders that may arise in consideration of management decisions regarding non-native species more widely. The holistic method of interpreting the analysis gives insight into how and why stakeholders may have formulated certain viewpoints. This in turn could help conservation managers identify ways in which to appreciate and work with subjective influences on stakeholder perceptions in order to best communicate the complex challenges and opportunities presented by non-native species.

KEYWORDS
discourse analysis, invasive non-native species, non-native species, Q method, socio-environmental issues, stakeholder opinion

1 | INTRODUCTION

The interaction between nature and society has never been more complex, politicised or researched (Aitken, 2012; Biermann & Mansfield, 2014; Foss, 2018). This is particularly evident in relation to the causes and consequences of global loss in biodiversity, frequently regarded as one of the most pressing environmental challenges currently facing humanity (Skogen, Helland, & Kaltenborn, 2018). Loss in biodiversity has negative impacts on both ecosystem function and ecosystem services, ultimately threatening human well-being (Cardinale et al., 2012; Naeem, Chazdon, Duffy, Prager, & Worm, 2016). Human activities are the predominant drivers behind biodiversity loss (e.g. over exploitation, land use change, introduction of invasive species) (Maxwell, Fuller, Brooks, & Watson, 2016) and, as such, there are a multitude of associated socio-environmental issues that are often defined by highly opposed interests and perspectives amongst stakeholders (i.e. economical, political, ecological, cultural, social) and that prevent unilateral solutions to the wider problem.

The human-mediated introduction of invasive non-native species (INNS, see Box 1) beyond their natural range is one of the leading causes of biodiversity loss globally (Simberloff et al., 2013). With human dimensions being a feature of all aspects of the invasion process (García-Llorente, Martín-López, González, Alcorlo, & Montes, 2008; Tassin & Kull, 2015), several studies have sought to explore variation and discord amongst stakeholder opinion with regard to INNS to assess implications for support of management practices (Bremner & Park, 2007; Fischer, Selge, van der Wal, & Larson, 2014; Gobster, 2011). Species attributes, level of knowledge, perceptions of threat, attitudes towards intervention and nature values have all been found to be subjective influences on stakeholder opinion (Ford-Thompson, Snell, Saunders, & White, 2015; García-Llorente et al., 2008; Gozlan, Burnard, Andreou, & Britton, 2013; Shackleton & Shackleton, 2016; Verbrugge, Van den Born, & Lenders, 2013). Indeed, the discourse surrounding issues of INNS appears to be beset not only by the inherent uncertainty that surrounds ecological knowledge of biological invasions, their management and environmental implications (García-Llorente et al., 2008), but also by highly varied and subjective comprehension of emotive terms such as 'non-native', 'alien', 'exotic', 'pest', 'invasive species', 'ecological impact' and the connotations that arise through social representation of these concepts as a whole (DEFRA., 2009; Essl et al., 2018; Tassin & Kull, 2015). The way in which people become familiar with complex ecological concepts also has an important influence on the development of opinions and formation of perceptions. Non-scientists and scientists have varied frames of reference, and make comparisons with existing personal understanding from other domains to formulate their comprehension of the complex (and relatively new in public conscience) ecological concept of INNS (Fischer et al., 2014; Selge & Fischer, 2011). Differences between viewpoints based on these utilitarian, moralistic, humanistic or naturalistic values thus have potential to cause significant obstacles to management operations (e.g. public opposition to plans for eradication of the American grey squirrel in Italy where the species' poses a threat to native red squirrel [Bertolino & Genovesi, 2003]). The myriad factors that might shape opinion and ultimately result in contesting viewpoints can be understood within a conceptual framework of hierarchal influence. Within that framework, attitudes and opinion are defined by an individual's core values (i.e. stable mental constructs that transcend specific situations and represent personal needs according to enduring beliefs) and perceptions of risk (judgments of potential hazards influenced by heuristic rules and social context that simplify complex

Box 1 Definition of terms

The term 'non-native species' (NNS) is the equivalent of 'alien species' as used by the Convention on Biological Diversity (CBD) to describe species that occur in the wild (following introduction) beyond their natural geographic range. INNS or 'invasive non-native species' (the equivalent of 'invasive alien species' or 'IAS' are broadly defined as species whose introduction and/or spread threaten biological diversity or have other unforeseen impacts.

concepts and may misrepresent reality; Estévez, Anderson, Pizarro, & Burgman, 2015).

It has become increasingly recognised that discourses involving stakeholders should be a focus of analysis in environmental governance studies. These discourses are important for facilitating cooperation between diverse actors aimed at resolving complex environmental problems (Hagan & Williams, 2016; Hajer & Versteeg, 2005). Indeed, understanding of the role of discourse between actors of different status, and the inherent subjectivity that shapes personal perception and opinion driving the policymaking process has become a burgeoning science all of its own (Andersen, Schulze, & Seppel, 2018; Frate & Brannstrom, 2017).

Discourse analysis has received much attention in the environmental sciences, particularly in politically charged arenas of response to climate change (Foss, 2018; Lansing, 2013), renewable energy (Mukonza, 2017; Rennkamp, Haunss, Wongsa, Ortega, & Casamadrid, 2017), land use change and sustainable development (Cook, Pieri, & Robbins, 2004; Soini & Birkeland, 2014; Walder & Kantelhardt, 2018). Identification of social perspectives through such analysis may avoid conflict and barriers to planned strategies and suggest socially acceptable solutions for their implementation (Frate & Brannstrom, 2017; Mayett-Moreno, Villarraga-Flórez, & Rodríguez-Piñeros, 2017). Arguably, the most emotive and polarized discourse within environmental science can be found in regard to contention over issues of wildlife management. Such conflicts are often characterised by arguments over scientific truth claims and the addition of ethical/animal welfare dimensions as typified by such issues as the culling of badgers (*Meles meles*) to control the spread of bovine tuberculosis in the UK (Price, Saunders, Hinchliffe, & McDonald, 2017), lethal control of wild deer populations, and other 'pest' species (Dandy et al., 2012; Wallwork & Dixon, 2004; White et al., 2003). However, uncertainty borne from knowledge gaps and deficiencies in data often pervades understanding of such environmental issues. Thus, in the absence of, and perhaps sometimes in despite of (Gozlan et al., 2013) empirical evidence, actors involved in associated discourses necessarily construct their viewpoints and understanding based on subjective influences (i.e. scientific reasoning/theory, personal experience, historical/cultural bias, economical, ethical values, heuristic judgement) (Davidson, Cambell, & Hewitt, 2013).

Studies investigating stakeholder discourse have done so largely through standard interview and questionnaire techniques and quantitative analysis of participant responses aimed at providing a representative overview of attitudes held (Bremner & Park, 2007; García-Llorente et al., 2008; Hoyle, Hitchmough, & Jorgensen, 2017; Poudyal, Bowker, & Moore, 2016). Other authors have employed qualitative techniques such as focus groups to delve deeper into the reasoning behind the formation of particular viewpoints, enabling an interpretation of the data that allows for a broader understanding and recognition of important patterns and themes within the discourse (Dandy et al., 2012; Selge, Fischer, & van der Wal, 2011). One method that combines both qualitative and semi quantitative analysis of subjective opinion among stakeholders is Q method (Brown, 1993; Yang, 2016). Although frequently used in analysis of discourse within the environmental sciences (Brannstrom, 2011; Hagan & Williams, 2016; Lansing, 2013; Walder & Kantelhardt, 2018) the method has seen very little application in regard to discourse on NNS (Falk-Petersen, 2014).

Here, we use a Q method approach to investigate the discourse surrounding the presence of Common wall lizard *Podarcis muralis* in the UK—a species that has established numerous populations in the South of England following introduction from mainland Europe and is thriving in habitats ranging from coastal cliffs of Dorset to highly urbanised areas of West Sussex (Michaelides, While, Zajac, & Uller, 2015). The presence of wall lizards poses a potential risk to native lizards through contest and transmission of pathogens, and possible wider impacts on invertebrate communities (Foster, 2015), although to date there is only anecdotal evidence to suggest negative impacts are apparent (Mole, 2010). Being locally abundant and gregarious in behaviour the lizards are frequently encountered by members of the public, particularly in areas of high public footfall such as the seafronts of Bournemouth and Eastbourne. No control measures are currently in place to manage existing populations, and further ecological research into established populations is needed to assess viability and justification for management (Foster, 2015). This situation presents an interesting opportunity to investigate people's attitudes towards the lizards in the face of high levels of interaction but potentially low levels of knowledge regarding possible negative ecological impacts. Through use of a holistic Q method approach this study aims to identify emerging viewpoints regarding the presence of wall lizards, and explores the ways in which different stakeholder groups (i.e. public, land managers, conservationists) might share views and the reasoning behind shared or opposing discourse between groups. Such insight will be useful in identifying discordant attitudes and areas of potential contention between stakeholders that may arise in consideration of management decisions regarding NNS more widely. In addition, the analysis will also help illustrate how people reason their subjective views regarding complex ecological concepts in general. Specifically, we ask: How and why do stakeholders group in their opinions towards the lizard introduction? What does the discourse in this case study tell us about perceptions and attitudes towards management of introduced species more generally?

2 | MATERIALS AND METHODS

All Q studies are reconstructive and characterized by two key features. Firstly, the collection of data is done in the form of Q sorts (Hagan & Williams, 2016; Watts & Stenner, 2012). This is typically done by presenting people with a sample of statements (or items) about the given topic, which is referred to as the Q set. The selected participants, or P-set, are then instructed to rank-order the statements from their personal point of view on a score sheet. Participants work with their subjective interpretation of the statements thus

revealing their subjective viewpoint in the final rank order of statements. Secondly, these Q sorts are factor-analysed to establish different patterns ('discourses'). Unlike in standard survey analysis this factor analysis is not aimed at establishing patterns across individual characteristics such as age, gender and class, but rather patterns within and across individuals by focusing on their discursive understanding of a particular issue (Hagan & Williams, 2016; Watts & Stenner, 2012).

2.1 | Q set design

The Q set was developed from statements generated from several sources in direct response to (or pertaining to) the open question of 'Do you have any thoughts or feelings about the presence of wall lizards in the UK?' Sources included; (a) responses from the general public, to whom this question was posed in conjunction with a 2017 citizen science campaign conducted through freepost survey returns and in the regional and national media aimed at garnering wall lizard sighting records (bit.ly/lizarduk), (b) informal conversation with the public and landowners/managers engaged with whilst conducting field work at wall lizard localities in southern England during 2016–2018 as part of wider ecological research into the species introduction, (c) Relevant statements that could be regarded as an opinion towards the presence of the lizards found through extensive internet searches of non-scientific press and on social media forums.

A total of 128 statements were collected, at which point no further original opinion/sentiment was found. A review process to fine-tune the final Q set (in terms of reduction in number of statements and maintenance of plain language) was then undertaken through careful review of each statement, rewording and removal or consolidation of statements conveying similar sentiment. This process was informed by piloting and input from peers with expert knowledge in ecology and public engagement regarding NNS. During this revision process, several statements were found to confer a negative opinion of the wider issue of NNS and species introductions in general. Although the initial intention was to keep the discourse case specific, these very broad statements were retained and balanced with the inclusion of alternate broad views on NNS from the academic literature. This revision process resulted in the construction of a final Q set consisting of 76 statements that provided a comprehensive and balanced coverage of the study topic (Table 1).

2.2 | Participants

Twenty-six participants across seven stakeholder groups (Table 2) took part in the Q sorts in the summer of 2017. Participants from the land manager group were invited to take part through having had previous contact with the lead researcher in granting consent to conduct field work at wall lizard sites in Dorset and East/West Sussex as part of wider ecological research into the introduction. Although employed in environmental management/conservation officer roles, their specific knowledge of the wall lizard introductions was not assumed. The public group consisted of participants who again had previously been engaged with during ecological field work in Devon, Somerset and West Sussex during 2016–2017 and were known to at least be aware or have direct experience of wall lizards in their local area (e.g. has them present in garden, encounters them frequently). Members of the public with no experience of the lizards were not considered to take part in this Q sort as many of the statements in the Q set would have no personal relevance to such a group, thus making interpretation and sorting of statements problematic (see Q sort Methods). Participants forming the environmental advisory group were invited to take part based on their expertise in the field of INNS and national biosecurity—their specific knowledge of the wall lizard introductions was also not assumed. Reptile enthusiasts were represented by three individuals who share a passion for herpetology, two of which keep exotic lizards in private collections (including *P. muralis*), and one individual who volunteers in monitoring reptile species locally (Dorset). The participant ecological consultants (n = 2) were both experienced ecologists working nationally, with no presumed knowledge of wall lizard populations in the UK. Perhaps, most familiar with the topic at hand were representatives from a reptile conservation NGO. Both participants are concerned with active conservation and management of native species and familiar with the UK wall lizard populations. The two academics selected to participate had specific interest in biosecurity and reptile ecology, respectively, with no specific knowledge of wall lizard introductions. A greater number of participants were included for the land manager and public groups as it was considered there might be greater scope for variation in experience and opinion within these sectors compared to other groups. Participants were given the same background information before the Q sort regarding the non-native status of wall lizards in the UK, but no other information was given about the consequences of their presence. Instructions were also careful to point out that none of the statements were to be considered as 'scientific fact', and merely represent a point of view.

2.3 | The Q sort

The Q sort was administered either in person or online using software developed by Pruneddo (2013). Thirteen participants conducted their Q sorts in the presence of the lead researcher. The Q set was given to the respondent in form of a deck of randomly numbered cards. Each card contained one of the 76 statements from the final Q set. The participant was first instructed to sort the deck into three piles; 'identify/agree', 'neutral/undecided' and 'do not identify/disagree', depending on his/her personal point of view. This initial 'sort' served to familiarize the participant with the nature of the statements and start formulating their own viewpoint. Thereafter, the respondent was instructed to sort out the statements on a score sheet with a pyramidal, or 'quasi-normal', sorting distribution, ranging from 'strongly disagree' (−6) to 'strongly agree' (6). The sorting distribution was pre-arranged; the whole Q set had to be allocated a ranking relative to one another within this distribution (Watts & Stenner, 2012) (see Figure 1). Participants were

TABLE 1 The final Q set' of statements (and their ID numbers) representing the overall discourse surrounding the presence of *Podarcis muralis* in the UK

ID	Statements		
1	The more wall lizards the merrier	39	There is a bias against alien species
2	Wall lizards are much prettier to look at than our native lizards	40	We see less sand lizards due to loss of habitat so the wall lizards are a nice substitute
3	If wall lizards are in our garden then they become like our pets	41	Wall lizards live where other lizards don't, so that's ok
4	I would feel quite privileged to have wall lizards in my garden	42	It's nice to see wall lizards in the wild
5	I'm happy to have wall lizards here	43	Wall Lizard spotting is great fun
6	I hope wall lizards thrive in the UK	44	As long as wall lizards don't upset local ecology then I enjoy their presence
7	I don't want to see the wall lizards killed	45	I'm unsure of their effect on populations of native lizards
8	Wall lizards are welcome wherever they are	46	It is good to see wall lizards appear to be thriving here
9	Wall lizards feel almost out of place here	47	It is a pleasure and a privilege to observe wall lizard behaviour
10	Wall lizards really shouldn't be here	48	I find wall lizards intriguing and interesting.
11	These wall lizards are invading the UK	49	Wall lizards are a great subject to photograph
12	Prefer if wall lizards were in their own environment best suited to their well-being	50	It's great for the kids to have wall lizards in the garden
13	If wall lizards don't cost anything (financially) then their presence is not a problem	51	I don't mind that wall lizards are not native to the UK
14	Wall lizards co-exist quite happily with common lizards on the continent so there's no reason why they wouldn't here.	52	No problems with wall lizards being here as far as I am aware
15	Wall lizards seem harmless enough.	53	Nice to see wall lizards but I'd rather see a native lizard
16	I feel wall lizards are not competing with our native species.	54	The wall lizards always give a topic of conversation when they come out in the warmer weather
17	I cannot see that wall lizards are likely to become a problem	55	It's a shame people don't consider wall lizards when repairing/pointing walls
18	Wall lizards are not detrimental to our gardens	56	I would make special trips to see wall lizards
19	I think wall lizards should be protected here	57	Don't know how I feel about wall lizards being here
20	I am always unhappy about ANY introductions, which are usually bad news for native species.	58	I am concerned there are likely to be more currently unrecorded wall lizard populations.
21	The presence of species which did not arrive here under their own steam is a concern	59	I wish we had wall lizards in the garden. Can I have some
22	It would be a shame if native lizards got edged out of our landscape by wall lizards.	60	The wall lizards provide the only chance we get to see lizards
23	I don't want wall lizards to damage native species	61	I don't want wall lizards to be removed.
24	I'm concerned about Wall Lizards affecting native Sand Lizards and Common Lizards both in terms of competition and pathogens.	62	It's really nice to have this wildlife (wall lizards) in our garden
25	I do wonder if global warming is a factor to wall lizards being here	63	No strong feelings about wall lizards one way or another
26	I have nothing against wall lizards but would like to see some scientific studies investigating their impacts	64	Classifying wall lizards according to our standards of whether or not they should be here is not useful
27	It is worrying that wall lizards are surviving in a colder climate than they are used to.	65	Many non-native species have become established here, wall lizards are just another
28	We should stop wall lizards spreading if possible	66	The wall lizards add to the character of our garden and village

(Continues)

TABLE 1 (Continued)

ID	Statements		
29	I feel that we don't know enough about what these wall lizards bring and take away from our native wildlife.	67	The wall lizards help to keep down garden pests
30	Just leave the wall lizards alone	68	What classes as native anymore!
31	I can't see how you can eliminate wall lizards without harming other species	69	Reptiles are so rare I'm excited to see any lizard, native or not
32	The authorities should do something about wall lizards spreading	70	Wall lizards cause a loss in conservation value of sites planned for reintroduction of sand lizard
33	We must embrace the fact ecosystems now incorporate many alien species and not try to achieve the often impossible goal of controlling their abundance	71	I know summer has arrived when wall lizards first start to appear on a sunny day
34	Conservationists should focus much more on the wall lizards ecological role, and much less on where they originated from	72	Wall lizards are killing off our native lizards
35	The public must be vigilant of such introductions and support management efforts	73	We have a somewhat impoverished fauna, but wall lizards add to it
36	It's like being on holiday with wall lizards here	74	If wall lizards are breeding they are obviously happy to be here
37	Having a local colony of wall lizards is great	75	We (humans)bought wall lizards here, so we shouldn't complain
38	We should be grateful wall lizards are here to enjoy	76	As average temperatures rise it is to be expected that wall lizards are thriving here

TABLE 2 Participant groupings and number of representative participants

Group	Number of participants
Land managers (local council conservation officers, National Trust)	6
Public	8
Environmental advisory	3
Reptile enthusiast	3
Ecological consultant	2
Reptile conservation NGO	2
Academic	2

encouraged to rearrange the position of statements until they were satisfied their placement represented as closely as possible their personal point of view. Each Q sorting was combined with discussion with the researcher during the process where participants were asked to elaborate on his/her point of view, explain the most salient statements and discuss whether there were any themes not represented by the items in the Q set. Participants (n = 13) completing their Q sort online (Q-software [Pruneddo, 2013]) followed exactly the same procedure by dragging and dropping items into their desired arrangement in the fixed distribution. Follow-up discussions were conducted via email.

2.4 | Ethics statement

This research received ethics approval from the Biological Sciences Faculty Research Ethics Committee, University of Leeds. Written consent was secured in advance of every Q sort undertaken in person. Those participating online consented by proceeding to the start screen following the introductory brief. The following statement was included in the introductory brief: I agree to complete this online/in-person questionnaire for research purposes and that the aggregate anonymous data derived from this questionnaire may be made available to the general public in the form of public presentation, report and journal article.

2.5 | Statistical analysis

A total of 26 Q sorts were intercorrelated and factor-analysed using the dedicated computer package PQMethod (Schmolck, 2002). Factors were extracted (centroid analysis) and rotated using an initial varimax rotation followed by additional by-hand adjustments to ensure the maximum number of participants could be included within the Q sort groupings across factors and to bring said groupings 'into focus' (Brown, 1993; Watts & Stenner, 2012). In this case, an anticlockwise rotation of −2° was applied to factors 1 and 2. The common criterion in deciding how many factors to retain for rotation is for the eigenvalue of each factor to be greater than 1 (Addams, 2000; Brannstrom, 2011). Others have suggested a suite of criteria should be considered that ultimately lead to a reasoned extraction of factors of both statistical and theoretical significance (Eden, Donaldson, & Walker, 2005; Watts & Stenner, 2012). We selected significant factors for rotation from an initial extraction of seven factors based on consideration and reasoned assessment of the factor eigenvalues (from both centroid and principle component analysis methods of extraction), % variance

−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6
13. If wall lizards don't cost anything (financially) then their presence is not a problem	1. The more wall lizards the merrier	19. I think wall lizards should be protected here	59. I wish we had wall lizards in the garden. Can I have some	68. What classes as native anymore!	16. I feel wall lizards are not competing with our native species.	64. Classifying wall lizards according to our standards of whether or not they should be here is not useful	20. I am always unhappy about ANY introductions, which are usually bad news for native species.	66. The wall lizards add to the character of our garden and village	47. It is a pleasure and a privilege to observe wall lizard behaviour	34. Conservationists should focus much more on the wall lizards ecological role, and much less on where they originated from	45. I'm unsure of their effect on populations of native lizards	23. I don't want wall lizards to damage native species
60. The wall lizards provide the only chance we get to see lizards	73. We have a somewhat impoverished fauna, but wall lizards add to it	75. We (humans)bought wall lizards here, so we shouldn't complain	31. I can't see how you can eliminate wall lizards without harming other species	2. Wall lizards are much prettier to look at than our native lizards	52. No problems with wall lizards being here as far as I am aware	4. I would feel quite privileged to have wall lizards in my garden	67. The wall lizards help to keep down garden pests	58. I am concerned there are likely to be more currently unrecorded wall lizard populations.	43. wall Lizard spotting is great fun	53. Nice to see wall lizards but I'd rather see a native lizard	22. It would be a shame if native lizards got edged out of our landscape by wall lizards.	29. I feel that we don't know enough about what these wall lizards bring and take away from our native wildlife.
	41. Wall lizards live where other lizards don't, so that's ok	40. We see less sand lizards due to loss of habitat so the wall lizards are a nice substitute	51. I don't mind that wall lizards are not native to the UK	61. I don't want wall lizards to be removed.	27. It is worrying that wall lizards are surviving in a colder climate than they are used to.	18. Wall lizards are not detrimental to our gardens	49. Wall lizards are a great subject to photograph	28. We should stop wall lizards spreading if possible	42. It's nice to see wall lizards in the wild	12. Prefer if wall lizards were in their own environment best suited to their well being	26. I have nothing against wall lizards but would like to see some scientific studies investigating their impacts	
	8. Wall lizards are welcome wherever they are	33. We must embrace the fact ecosystems now incorporate many alien species and not try to achieve the often impossible goal of controlling their abundance	46. It is good to see wall lizards appear to be thriving here	56. I would make special trips to see wall lizards	37. Having a local colony of wall lizards is great	72. Wall lizards are killing off our native lizards	39. There is a bias against alien species	50. It's great for the kids to have wall lizards in the garden	10. Wall lizards really shouldn't be here	21. The presence of species which did not arrive here under their own steam is a concern	24. I'm concerned about Wall Lizards affecting native Sand Lizards and Common Lizards both in terms of competition and pathogens.	
		3. If wall lizards are in our garden then they become like our pets	30. Just leave the wall lizards alone	14. Wall lizards co-exist quite happily with common lizards on the continent so there's no reason why they wouldn't here.	69. Reptiles are so rare I'm excited to see any lizard, native or not	65. Many non-native species have become established here, wall lizards are just another	76. As average temperatures rise it is to be expected that wall lizards are thriving here	15. Wall lizards seem harmless enough.	74. If wall lizards are breeding they are obviously happy to be here	44. As long as wall lizards don't upset local ecology then I enjoy their presence		
			6. I hope wall lizards thrive in the UK	5. I'm happy to have wall lizards here	17. I cannot see that wall lizards are likely to become a problem	32. The authorities should do something about wall lizards spreading	62. It's really nice to have this wildlife (wall lizards) in our garden	54. The wall lizards always give a topic of conversation when they come out in the warmer weather	48. I find wall lizards intriguing and interesting.			
			38. We should be grateful wall lizards are here to enjoy	36. It's like being on holiday with wall lizards here	55. It's a shame people don't consider wall lizards when repairing/pointing walls	11. These wall lizards are invading the UK	25. I do wonder if global warming is a factor to wall lizards being here	9. Wall lizards feel almost out of place here	35. The public must be vigilant of such introductions and support management efforts			
					71. I know summer has arrived when wall lizards first start to appear on a sunny day	63. No strong feelings about wall lizards one way or another	7. I don't want to see the wall lizards killed					
						70. Wall lizards cause a loss in conservation value of sites planned for reintroduction of sand lizard							
						57. Don't know how I feel about wall lizards being here						

FIGURE 1 Q sort factor array demonstrating the fixed quasi-normal distribution of statements. Ranking values range from −6 to 6

explained by each factor, the scree slope, the 'composite reliability' of factors (a statistical criterion which depends on how many respondents define a particular factor; the more the respondents that define a factor, the higher the reliability [Hagan & Williams, 2016]), and factors presenting a meaningful social perspective (see Watts and Stenner 2012 for in-depth process behind criteria used in factor extraction).

Conceptually, Q sorts that load significantly on a particular factor (i.e. factor defining Q sorts) do so because they exhibit a very similar sorting pattern and therefore share a distinct viewpoint in respect to the presence of wall lizards in the UK. These defining Q sorts were then merged to form a single idealised-typical Q sort for each factor called a factor array. The factor array looks like a single complete Q sort and is calculated by a procedure of weighted averaging (i.e. defining Q sorts are given more weight in the averaging process since they better exemplify the factor (Watts & Stenner, 2012; Figure 1). Factor arrays then provided the basis for interpretation of each individual factor by means of a careful and holistic inspection of the patterning of items in each factor array using a crib sheet system (Stenner, Cooper, & Skevington, 2003; Watts & Stenner, 2012). Crib sheets enable factor arrays to be systematically organised allowing identification of the important issues about which a given viewpoint is polarized, and how the viewpoint is polarized relative to the views defining the other factors. The interpretation aimed to uncover, understand and fully explain the viewpoints captured by each factor and thus shared by significantly loading participants. Credence was given to correct interpretation by insights gained from the open-ended discussion held with participants during or after (online) their sort was completed. Comments made by participants are quoted where they clarify the interpretation.

3 | RESULTS

Each of the factors extracted from the analysis has been given a summary title and a textual interpretation of the subject viewpoint which the factors express. To ease interpretation, numbers in brackets have been included to refer to the statement number (in bold; see Table 1) and the array score. For example, (**8**, −3) refers to a score of minus three (relatively strong disagreement) given to statement eight for the particular viewpoint/factor.

The factor analysis revealed three lines of discourse relating to the presence of wall lizards in the UK. These three factors together explained 53% of the study variance. Twenty-three of the 26 Q sorts loaded on one or other of these three factors. Factor loadings of ±0.31 or above were significant at the $p < 0.01$ level (Brown, 1980). However, due to several confounding Q sorts (Q sorts with significant loading on more than one factor) in the solution using this loading parameter, the level of significant factor loading was raised to >0.5 (Table 2 rotated factor matrix). This higher threshold is justified as long as it is applied consistently across all factors (Watts & Stenner, 2012). Of the three Q sorts that did not load on any factor

TABLE 3 Rotated factor matrix and factor characteristics following Q sort analysis pertaining to attitudes towards introduced wall lizards in the UK. Values in bold indicate significant loading for given factor. Asterisk denotes Q sorts that did not load on any factor

Q SORT	Factor 1 'Innocent until proven guilty'	Factor 2 'Precautionary, informed concern'	Factor 3 'The more the merrier!'
Land manager	**0.59**	0.46	0.05
Land manager	0.33	**0.54**	−0.08
Land manager	**0.55**	0.47	−0.07
Land manager	**0.73**	0.34	0.12
Land manager	**0.57**	0.42	−0.19
Land manager	0.49	**0.69**	−0.15
Ecology consultant	**0.56**	0.03	0.12
Ecology consultant	**0.64**	0.49	−0.19
Reptile enthusiast	0.12	**0.71**	0.01
Reptile enthusiast	0.48	**0.52**	0.04
Academic	0.45	**0.71**	−0.29
Academic *	0.23	0.11	−0.14
Environmental advisory	0.18	**0.67**	−0.27
Environmental advisory	**0.65**	0.49	−0.33
Environmental advisory	0.44	**0.65**	−0.12
Public	**0.53**	0.42	−0.01
Public	0.01	−0.16	**0.52**
Public	−0.08	−0.25	**0.61**
Public *	0.29	0.42	0.41
Public	0.04	−0.44	**0.65**
Public	**0.53**	0.1	0.11
Public *	0.40	0.45	0.02
% Explained variance (rotated)	1 9	25	9
Number of defining variables (Q sorts)	9	10	4
Composite reliability %	97.3	97.6	94.1
Correlation between factor scores			
Factor 1		0.79	−0.16
Factor 2			−0.37

(15, 23, 26), two were from the 'public' group, the other 'academic'. Factor characteristics are also summarised in Table 3. In this three-factor solution, factor 3 had a negative correlation with factor 1 (−0.16) and factor 2 (−0.37). Factor 1 was positively correlated with factor 2 (0.79), indicating commonalities between the constituent defining Q sorts (Table 2).

Table 4 reports the items for which there was most consensus across the three factors. Respondents were in general agreement that wall lizard spotting is great fun; that the lizards are intriguing and interesting, and that their presence adds character to the local area. Impacts to gardens were scored neutrally across factors. The desire to have wall lizards in the garden received consistently negative rankings. It is important to note that Q sorts giving negative scores for this item (59) could reflect either disagreement with the statement or indicate they have lizards in the garden already.

3.1 | Factor interpretation

3.1.1 | Factor 1: 'Innocent until proven guilty'

This viewpoint identifies a lack of personal knowledge and stresses need for evidence of specific impacts of wall lizards on native fauna (**29**,6; **26**,5; **45**,5; **34**,4; **57**,1) in order to be able to express strong positive or negative feeling towards the lizards (**63**,0). Despite this lack of knowledge it is considered that, in principal, the introduction and presence of wall lizards in the UK is not a good thing (**10**,3; **9**,2; **38**,−3; **46**,−3; **51**,−3; **75**,−4; **41**,−5; **1**,−5; **13**,−6). This is likely based on existing broad theoretical understanding held about the potential ecological impacts of NNS in general (**21**,4; **68**,−2; **33**,−4). However, there is a feeling that in the case of wall lizards their ecological role is far more pertinent in making a judgment on their presence than the species origins alone (**34**,4), and that there is an

TABLE 4 Top 10 statements and factor scores sorted by consensus following Q sort analysis of attitudes towards presence of wall lizards in the UK

Item number/statement	Factor 1 'Innocent until proven guilty'	Factor 2 'Precautionary, informed concern'	Factor 3 'The more the merrier!'	Z-Score variance
43. Wall lizard spotting is great fun	3	2	2	0.003
66. The wall lizards add to the character of our garden and village	2	1	1	0.004
67. The wall lizards help to keep down garden pests	1	1	0	0.007
18. Wall lizards are not detrimental to our gardens	0	0	0	0.015
54. The wall lizards always give a topic of conversation when they come out in the warmer weather	2	2	1	0.017
48. I find wall lizards intriguing and interesting.	3	2	4	0.032
69. Reptiles are so rare I'm excited to see any lizard, native or not	−1	1	0	0.037
59. I wish we had wall lizards in the garden. Can I have some	−3	−2	−3	0.041
74. If wall lizards are breeding they are obviously happy to be here	3	2	1	0.058
56. I would make special trips to see wall lizards	−2	0	−2	0.059

automatic negative bias against NNS in the absence of ecological knowledge (**39**,1).

> "We just don't know if they are causing any harm. It's difficult! I don't want them to push out native species but I would want to see evidence that this is happening. If it's not, then is there really a problem with them being here?"

Although native fauna is held in greater regard than non-native wall lizards (**23**,6; **53**,4; **73**,−5), and encounters with native lizards are not uncommon (**69**,−1; **60**,−6), the viewpoint acknowledges a value in the presence of wall lizards in terms of the opportunity they provide to engage with wildlife (**42**,3; **43**,3; **54**,2; **66**,2; **62**,1; **49**,1). There is however little sentimental attachment towards the wall lizards (**55**,−1; **59**,−3; **3**,−4) and thus control of the species (on condition of proven impact) may be acceptable to this group.

3.1.2 | Factor 2: 'Precautionary, informed concern'

Whilst similar to factor 1 in many ways, the factor 2 perception varies in that the presence of wall lizards is viewed as a very definite ecological threat (**11**,0; **15**,−3; **17**,−5) without the expressed need for scientific evidence of impact. This opinion is based on existing subject knowledge about specific potential risks, and perhaps first-hand experience/observations driving perceptions of negative impacts on native lizards (**24**, 6; **70**,5; **72**,1; **52**,−4; **14**,−4; **16**,−4). Existing theoretical knowledge about the invasion process and concern about the ecological impacts of species introductions in general may also be an a priori influence on this perceived risk associated with wall lizards (**20**,4; **21**,4; **65**,−1; **64**,−2). The viewpoint considers climate change and evolutionary adaptability as having a key role in the long-term survival and range expansion of wall lizard populations in the UK (**76**,2; **27**,1; **25**,1).

> "I know they're entertaining to watch and it's nice that people get protective about them, but any impact that wall lizards are having may be so subtle we might not notice till it's too late. Native lizards have enough to contend with, a potential competitor or novel disease is the last thing they need."

Proponents of this viewpoint see no place for wall lizards within our wildlife, particularly at the expense of native lizards (**22**,6; **9**,2; **40**,−5), and in the absence of sentimental attachment to wall lizards (**42**,0; **4**,−2; **37**,−2; **38**,−3; **46**,−3; **5**,−3; **19**,−5) their presence is not at all welcomed (**10**,3; **1**,−5; **6**,−6; **8**,−6). As such, there is concern about the likelihood of there being more wall lizard populations in the UK than currently documented (**58**, 5) and a belief that the public have a role to play in being vigilant about introductions and supportive of a proactive

approach to managing the species. (**28**,5; **35**,4; **32**,3; **7**,−1; **61**,−2; **31**,−3; **30**,−4). Despite the unfavourable opinion towards the wall lizard introduction, their presence does hold a novelty value (**54**,2; **36**,0) and their conspicuousness compared to native lizards provides opportunity for education and engagement (**50**,3; **49**,1; **69**,1; **60**,0) which is more likely to be actively sought than in other viewpoints (**56**,0).

3.1.3 | Factor 3: The more the merrier!

Framing this viewpoint are scores for statement indicating very strong feelings about the lizards and their presence in the UK (**63**,−5; **57**,−5). These feelings are expressed in extremely positive ways towards wall lizards from a very personal point of reference (**4**,6; **5**,6; **44**,5). The wall lizards are enthusiastically welcomed (**8**,3; **38**,3; **12**,−4) with an accompanying desire for them to thrive here (**6**,5; **1**,4; **46**,3; **27**,−5), providing there are no financial implications (**13**,4). Furthermore, wall lizards are more likely to be seen as a welcome addition to UK fauna than in other viewpoints (**73**,0). This positive sentiment would appear to result solely from glad acceptance of having a local colony of wall lizards (**37**,2; **9**,−6) and the opportunities it has provided to become familiar with the lizards and to enjoy observing their behaviour (**47**,5; **48**,4). Familiarity borne from frequent, incidental, observation rather than actively sought engagement (**56**,−2), may have shaped a unique view of perceived ownership and sentimental attachment (**71**,2) to the wall lizards, to the point where they are considered almost as 'pets' (**3**,0). With this frequent 'up close and personal' interaction being limited to wall lizards however, no such attachment is applied to native lizards (**53**,−1). Even so, beyond this very personal interaction there is a general feeling of apathy towards engaging with wall lizards (**50**,−1; **62**,−1; **56**,−2; **49**,2; **59**,−3), perhaps because there is no particular novelty value attributed to them (**36**,−2; **2**,−3).

> "I see the lizards all the time. I'm glad they are doing so well…we don't have much wildlife in the garden so I'm glad they are here. They're not causing any harm, so I'd rather they were just left alone."

The strong feelings extend to certainty about the wall lizards being harmless and posing no threat to native fauna. As far as this viewpoint is concerned, there is no knowledge gap regarding the potential ecological impacts of wall lizards (**45**,−1; **29**,−3) and there are no perceived potential threats (**15**,3; **17**,1; **52**,0). Additionally, the statement scores indicate a belief that wall lizards are having no negative effects on native lizards and the introduction does not represent an 'invasion' (**70**,−1; **72**,−3; **11**,−6). Any concern for disturbance to local ecology by wall lizards (**44**,5; **24**,0) is muted by this conviction that there are no negative impacts, and the prospect of there being further populations therefore raises no concern (**58**,−3). Agreement with the statement 'what classes as native anymore!' (**68**,1), suggests the concept of NNS and biological invasions is perhaps not fully understood, although certainly not seen as cause for concern (**21**,−3; **20**,−4). Neither are the origins of the wall lizards (**64**,2; **51**,3; **10**,−4). In fact, the prevalence of NNS is seen as just one of several conditions justifying the presence of wall lizards (**33**,4; **14**,3; **65**,2; **68**,1; **75**,0) and their 'right' to be here (**10**,−4). There is no agreement with any statements relating climate to the wall lizard introduction (**76**,−1; **25**,−2; **27**,−5). The sentiment highlighted so far underlies a definite protectionist attitude towards interference and outside interest in the lizards (**30**,4; **55**,2), regardless of any ecological knowledge that might be gained (**26**,0; **34**,−1). This 'hands off' opinion is expressed particularly strongly in opposition to statements about potential management and control of wall lizard populations (**7**,5; **31**,3; **61**,1; **28**,−3; **35**,−4; **32**,−5).

4 | DISCUSSION

In this study, we used Q methodology to identify and describe stakeholders' perspectives towards the established presence of a non-native lizard species introduced to the UK. We were able to extract three clearly defined viewpoints on the species' introduction, which term: 'Innocent until proven guilty', 'Precautionary informed concern' and 'The more the merrier'. These perspectives reflect both differences and commonalities in stakeholder perceptions and opinion regarding the species' presence, which are discussed here with reference to the conceptual framework for understanding social perceptions towards NNS described by Estévez et al. (2015).

In comparing and contrasting the three viewpoints, we identified four key areas of disagreement, specifically 'acceptance of wall lizards', 'concern about the ecological threat posed by wall lizards', 'attitudes toward NNS in general' and 'opinion towards management/control of the species'. These four areas of disagreement are inextricably linked and may arise due to variation in the level of knowledge (actual or perceived) and uncertainty of actors within each group regarding the ecological impact posed by wall lizards. Accordingly, theory holds that when faced with insufficient information individuals will process this limited information and develop their judgement heuristically (Trumbo, 2002). Levels of knowledge (or lack thereof) and uncertainty are thus likely to be the main drivers shaping all subsequent opinion within each viewpoint (i.e. whether or not the lizards are welcomed, support for management/control) as individuals rely on heuristic value methods to reach their conclusions and assessment of risk (Davidson et al., 2013; Kahan et al., 2012). Defining themes and values between groups are discussed below.

4.1 | How and why do stakeholders group differ in their opinions?

Both the 'Innocent until proven guilty' and the 'Precautionary, informed concern' views appear to build their opinions by drawing on a source of theoretical knowledge of species introductions and the associated potentially negative ecological implications. This is not surprising considering the majority of actors (84% across both views) expressing these views come from an environmental science

background and are likely to be familiar, to varying extent, with concepts and terminology regarding NNS (Selge & Fischer, 2011). As a result, both views express elements of a precautionary approach to NNS introductions conforming to some degree with guiding principles of best practice that permeate through such professions (DEFRA, 2003). There are however significant differences in perceived knowledge and levels of uncertainty between the two groups.

The reluctance for the 'Innocent until proven guilty' view to make a judgment in the case of wall lizards is due to self-confessed personal knowledge gap regarding the species' impacts, suggesting participants were more likely to evaluate the species via heuristic methods (Davidson et al., 2013; Trumbo, 2002). This makes sense considering the majority of the participants holding the 'Innocent until proven guilty' view come from backgrounds conferring a broad ecological knowledge rather than being specialist in a particular field (i.e. ecological consultants, land managers). Interestingly, the 'Innocent until proven guilty' view also hints at a deviation (at least where wall lizards are concerned) from the normative assumption that all NNS should be treated as a potential threat (Rejmanek & Simberloff, 2017; Simberloff et al., 2011). Instead, this discourse is inclined to agree that there is a pervasive bias against NNS and that detailed case-specific knowledge is a prerequisite for judgements about whether a particular species' should be labelled a threat or not (Davis et al., 2011; Guerin, Martín-Forés, Sparrow, & Lowe, 2018; Van Der Wal, Fischer, Selge, & Larson, 2015; Warren, King, Tarsa, Haas, & Henderson, 2017). This finding is very much the basis for the viewpoints' 'Innocent until proven guilty' label and is the traditional and assumed approach in empirical scientific research and, within this, impact studies (Davidson et al., 2013; Mapstone, 1995). Knowledge gaps and uncertainty are recognised as important factors in predicting concern about NNS impacts (Gozlan et al., 2013; Verbrugge et al., 2013). Biosecurity experts assessing the risk posed by aquatic non-native species tended to assign lesser concern about potential impacts when faced with little information and other uncertainties about species traits (Davidson et al., 2013). In this study, when faced with great uncertainty over impacts, the 'Innocent until proven guilty' view also appears to use another heuristic influence to form its perceptions of the lizard introduction. This appears to be formed on the relationship between the positive value (benefits) exponents place on engagement opportunities with the lizards and the perceived ecological risks of the species. Judgement based on this emotive 'affect heuristic' follows theory of a negative correlation between risk and benefit in the decision-making process (Finucane, Alhakami, Slovic, & Johnson, 2000; i.e. positive feelings garnered from opportunities for engagement with wall lizards translates to lower perceived risk).

In contrast, the theoretical knowledge drawn upon to form the 'Precautionary, informed concern' viewpoint appears to be supported by heuristics based on direct experience and/or specialist knowledge leading to less uncertainty and more concern about the potential impacts of wall lizards on native fauna, thus informing a more hard-line precautionary approach to the introduction than that of the 'Innocent until proven guilty'. In this case, negative feelings towards the wall lizards arising from observed or anecdotal evidence of ecological impact has resulted in an opposite pattern to 'Innocent until proven guilty', whereby negative feeling and experience translates as higher perceived risk (Finucane et al., 2000). Those holding the 'Precautionary, informed concern' view are also those most likely to have specialist knowledge of invasion biology and/or reptile ecology (i.e. environmental advisory, conservation NGO, academia) and be in professions where standards (in this case the precautionary approach) are often ingrained, creating a filter through which the individual perceives risk, often unconsciously and through conformance with policy (Sjoberg, 2002).

Despite indicating assured knowledge that there are no adverse consequences to the wall lizard introductions, the 'more the merrier' view is not anchored in the same theoretical knowledge domain as the other two viewpoints. This is not entirely surprising given the 'More the merrier' group constituents (three members of the public and one reptile enthusiast) are less likely to have either empirical or specialist scientific knowledge of the discourse topic. Instead, 'More the merrier' protagonists have constructed a viewpoint purely from a positive affect heuristic, creating a parochial knowledge that appears to have limited engagement with scientific evidence and is derived from positive personal experience (i.e. perceptions based on encounters with wall lizards in the garden). Positive personal experience or perceptions amongst the public have also been associated with supportive attitudes and increased doubts in evidence of ecological impacts regarding the presence of non-native deer (Ford-Thompson et al., 2015).

Whereas the 'Innocent until proven guilty' and 'Precautionary, informed concern' views are defined by differences in levels of ecological knowledge and impact uncertainty between them, the significant divergence of the positive 'More the merrier' view from these two viewpoints in the absence of such influence (a lay person perspective) appears to be more likely a reflection of pronounced variation between the groups deeper beliefs, perceptions and values about 'naturalness and balance' and overall relationship with nature. This is in accordance with the *visions of nature* concept (Dandy et al., 2012; Van Den Born, Lenders, de Groot, & Huijsman, 2001), wherein those who place value in the functionality of nature for humans may have a different perspective on NNS than people who highly value the (albeit subjective) 'authenticity' of nature (Verbrugge et al., 2013). A study of social perceptions of the impacts and benefits of NNS within the Doñana region of Spain also found remarkably different perceptions between professional and non-professional stakeholder groups (García-Llorente et al., 2008). The same study also identified two different conservation professional groups defined by slightly divergent viewpoints very much akin to those of the 'Innocent until proven guilty' and 'Precautionary, informed concern' groups emergent in this study. Similarly, both studies found a small subset of the public (nature aware/nature tourists) having a shared perception of NNS with conservation professionals. Other studies have also found little divergence between public and professional views on NNS and go further to argue that although the content of their thoughts might

diverge slightly, ecological professionals and the lay public essentially share the same structure of thought about the natural environment in general (Fischer et al., 2014; Selge et al., 2011; Van Der Wal et al., 2015). Our findings do not entirely support this, as the 'More the merrier' viewpoint was held by a majority of lay public participants who clearly constructed their opinions from different values and influences to those in other groups.

4.2 | What does the discourse in this case study tell us about perceptions and attitudes towards management of introduced species more generally?

The discourse emerging in this study provides an insight into attitudes regarding the potential management of an introduced species' when faced with little knowledge or evidence of negative impact. Our findings are in concordance with higher levels of knowledge (of biological invasions, ecological principles) being associated with increased support for NNS management options (Bremner & Park, 2007; García-Llorente et al., 2008)—in this case adoption of either the precautionary ('Innocent until proven guilty', 'Precautionary, informed concern') as opposed to the 'hands off' ('More the merrier') approach. Perceptions of risk, abundance and detrimental impacts have also been seen to strongly inform participants' attitudes towards management of NNS (Selge et al., 2011), with some authors suggesting that these factors, rather than non-nativeness, have the greatest influence on judgment (Estévez et al., 2015; Gobster, 2011; Van Der Wal et al., 2015). In our analysis, the origins of the wall lizards per se certainly appear to be of less concern in this overall discourse compared to perceived risks and impacts. This is most apparent in the 'More the merrier' viewpoint where the foreign origins of the lizards have no bearing on the perception of there being no negative ecological impacts, leading ultimately to the 'hands off' approach. Meanwhile the 'innocent until proven guilty' group are more concerned with the potential impacts of non-native species, but appear to evaluate on a case-by-case basis rather than assuming that all non-native species are inevitably detrimental (Davis et al., 2011). Although beyond the scope of this discussion, our findings are indicative of the wider discussions on the dichotomy of native species-good, non-native species-bad and the deeper arguments regarding ideologies of 'nativeness' and 'naturalness' (Goodenough, 2010; Low, 2007; Rejmanek & Simberloff, 2017; Schlaepfer, Sax, & Olden, 2012).

The wall lizards evidently have a charismatic appeal, as shown by the items of consensus amongst the three viewpoints (Table 3). Attractiveness and charisma are well recognised as key influences on peoples attitude towards to NNS (Bremner & Park, 2007; Fischer et al., 2014; Verbrugge et al., 2013), and can thus have significant bearing on support for species management operations (Estévez et al., 2015). Although, as is the case in this study, others have found that whilst those from ecology backgrounds appreciate these values they often regard them as ambiguous attributes that are not necessarily a legitimate criterion to which to base their judgments about species management (Selge et al., 2011). In this study it is the 'More the merrier' viewpoint again that appears most influenced by these attributes, perhaps because the wall lizards are amongst the most conspicuous of wildlife regularly encountered by this group.

4.3 | Limitations

It is important to recognise that the Q methodology and subsequent analysis can provide only a limited description of the prevailing discourses surrounding a topic at a given time and place, and that the resultant interpretation is not directly transferable. For example, notably different discourses may be evident surrounding introductions of *P. muralis* elsewhere (i.e. Vancouver Island, BC, Cincinnati, USA).

Whilst every care was taken to remove ambiguous statements from the Q set and make the Q sort as intuitive as possible to all participants, we recognise that this is difficult to achieve when studying responses of such a heterogeneous group of participants. As a consequence there is the possibility that some statements may have been perceived as having little relevance to an individuals' personal experience and would thus have been difficult to rank objectively. Our Q set of 76 statements could also be considered fairly large. Although this lends confidence to having obtained a comprehensive representation of the available discourse, engagement with the Q sort process may have been adversely affected as a result. This may be particularly true for those Q sorts conducted electronically in the absence of the lead researcher. In addition, the simple 'drag and drop' method of sorting statements used by the software may have reduced the diligence applied to rearranging such a large number of statements into the final sort arrangement.

5 | CONCLUSIONS AND WIDER IMPLICATIONS

The holistic method of interpreting the analysis gives insight into how and why stakeholders may have formulated certain viewpoints regarding their perceptions towards introduced NNS. This in turn could help conservation managers identify ways in which to work with these subjective influences in order to best communicate the dichotomies and complexities surrounding the introduction of NNS, with an aim towards a more informed and balanced discourse. Our analysis of the discourse highlights three interesting issues that relate not only to the wall lizard introduction, but approaches to NNS and their management more generally. Firstly, there is significant variation between stakeholder groups regarding the presence and management of NNS. The analysis flags early signs that opposing views between a subset of the public and decision-makers has potential to present obstacles should management of the species ever be considered justifiable and practical. Indeed, with the majority of the UK wall lizard populations being found in residential or busy public areas, any operation involving

the lizards is likely to be met with some opposition from those with a protectionist view that may not be equipped, or care, to reconcile with views of conservation managers (Temple, 1990). Furthermore, finding such strong positive sentiment towards the lizards amongst a subset of the public holding a possessive view about the wildlife they frequently encounter is illustrative of a mindset that could facilitate the spread of a charismatic NNS where ecological impacts are not known, or are perhaps considered but disregarded. Secondary human movement of wall lizards from established populations is the most likely pathway for rapid range expansion of wall lizards into new areas of the UK (Foster, 2015; Michaelides et al., 2015). Secondly, the discourse analysis illustrates that awareness of the wider concepts of NNS (invasion ecology) is lacking, particularly amongst the general public, and suggests that in the public domain scientific evidence alone may not be sufficient to inform perceptions of risk. In this regard, engagement with a characterful, conspicuous NNS may provide useful opportunities not only to educate the public on the ecological concepts and dichotomies associated with NNS and INNS, but also to promote wider interaction with nature and general interest in conservation. On another level, our analysis shows that communication of scientific evidence between scientists and conservation managers implementing policy is wholly necessary in order for personal judgment of NNS risks and management decisions to be made. Finally, the discourse highlights that a softer view of NNS, one that does not assume negative impacts in the face of limited evidence, is held personally by some professional's in contention to the policy of a precautionary approach that governs their profession.

CONFLICT OF INTEREST

Nothing to declare.

ACKNOWLEDGEMENTS

We thank all those who gave their time to participate in the study. This work was supported by the Natural Environment Research Council NE/L002574/1.

AUTHORS' CONTRIBUTIONS

R.W .and C.H. conceived the ideas and designed methodology; R.W., collected and analysed the data; C.Q., A.D. and C.H. provided guidance on the final Q set. R.W. led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

DATA ACCESSIBILITY

Raw data in the form of the original Q sorts associated with this paper are openly available from the NERC Environmental Information Data Centre https://doi.org/10.5285/a9c314d8-8a87-4992-9677-d9705c380f10 (Williams et al., 2019).

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How to cite this article: Williams RJ, Dunn AM, Quinn CH, Hassall C. Stakeholder discourse and opinion towards a charismatic non-native lizard species: Potential invasive problem or a welcome addition?. *People Nat*. 2019;1:152–166. https://doi.org/10.1002/pan3.18