



## OPEN ACCESS

EDITED BY  
Mohammad Farhadinia,  
University of Oxford, United Kingdom

REVIEWED BY  
Narayan Sharma,  
Cotton University, India  
Thomas A. M. Kaphegyi,  
Landespflege Freiburg, Institute for  
Conservation Ecology and Landscape  
Management, Germany

\*CORRESPONDENCE  
Phil Buckley  
✉ phil.buckley@canterbury.ac.uk

SPECIALTY SECTION  
This article was submitted to  
Animal Conservation,  
a section of the journal  
Frontiers in Conservation Science

RECEIVED 21 April 2022  
ACCEPTED 08 December 2022  
PUBLISHED 04 January 2023

CITATION  
Oliveira S, Buckley P and Consorte-  
McCrea A (2023) A glimpse of the long  
view: Human attitudes to an  
established population of Eurasian  
beaver (*castor fiber*) in the lowlands  
of south-east England.  
*Front. Conserv. Sci.* 3:925594.  
doi: 10.3389/fcosc.2022.925594

COPYRIGHT  
© 2023 Oliveira, Buckley and Consorte-  
McCrea. This is an open-access article  
distributed under the terms of the  
[Creative Commons Attribution License  
\(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or  
reproduction in other forums is  
permitted, provided the original  
author(s) and the copyright owner(s)  
are credited and that the original  
publication in this journal is cited, in  
accordance with accepted academic  
practice. No use, distribution or  
reproduction is permitted which does  
not comply with these terms.

# A glimpse of the long view: Human attitudes to an established population of Eurasian beaver (*castor fiber*) in the lowlands of south-east England

Sara Oliveira<sup>1,2</sup>, Phil Buckley<sup>1\*</sup> and Adriana Consorte-McCrea<sup>3</sup>

<sup>1</sup>Ecology Research Group, Canterbury Christ Church University, Canterbury, United Kingdom,  
<sup>2</sup>Laboratório da Paisagem de Guimarães, Guimarães, Portugal, <sup>3</sup>Academy for Sustainable Futures,  
Canterbury Christ Church University, IUCN-SSC CTSG Human-Wildlife Interactions Working Group,  
Canterbury, United Kingdom

**Introduction:** The Eurasian beaver (*Castor fiber*) is a native species to Britain that after being absent for 400 years has been restored to the English countryside. The first beavers were released into a reserve in Kent in 2001/02, making this one of the first beaver release areas in the UK. This paper examines attitudes towards beaver presence in the landscape as well as public perception of beaver benefits and impacts with respect to the environment and human society.

**Methods:** Qualitative questionnaires were utilised to investigate factors influencing social attitudes and support for beaver reintroduction, as well as the relationship between sociodemographic variables and attitudes. Inhabitants of Kent and its immediate surroundings were surveyed during June and July of 2020 (n=407) with a focus on three interest groups – environmentalists, farmers and the general public.

**Results:** Perceptions included mostly beneficial impacts on nature and biodiversity, whereas less positive impacts were associated with economics, agriculture and fisheries. In general, local attitudes towards beavers were positive, mainly sustained by feelings of liking this wildlife species and valuing their presence. People's attitudes positively influence willingness to support the reintroduction of beavers. Twenty years after their initial release, results indicate broad support for the beaver reintroduction in Kent and people's tolerance of beavers. The majority of respondents were in favour of nonintrusive management techniques to mitigate beavers' undesirable impacts.

**Discussion:** These findings suggest the need to develop an optimal management strategy that incorporates public views and gives advice on the

best approach to manage this wildlife species. This research provides theoretical and practical underpinning for beaver management and conservation in Britain.

#### KEYWORDS

wildlife management, human-wildlife interactions, human dimensions, conservation translocation, reintroduction, rewilding, Kent

## 1 Introduction

The Eurasian beaver was the first mammal to be successfully reintroduced into the wild in Britain after a 400 year period of absence (Gaywood, 2018). Beaver re-introduction is predicted to confer a number of benefits both in terms of human value and ecosystem services (Stringer and Gaywood, 2016; Auster et al., 2019; Thompson et al., 2021). In Britain, beaver reintroduction has taken two main forms with both licensed beaver reintroduction and a growing number of fenced projects in existence (Campbell-Palmer et al., 2016; Beaver Trust, 2022). The British population is currently estimated to be up to 2000 Eurasian Beaver (Rosell and Campbell-Palmer, 2022).

Reintroduction projects can unsettle social and ecological norms, are often controversial (Nyhus, 2016; Crowley et al., 2017), and can sometimes conflict with human interests as re-introduced wildlife disperses into new areas (Collen and Gibson, 2001; Schwab and Schmidbauer, 2003; Jonker et al., 2006; Jonker et al., 2006; Gaywood et al., 2008; Gaywood et al., 2015; Campbell-Palmer et al., 2016; Crowley et al., 2017). In order to integrate animals, such as the Eurasian beaver into the management of cultural landscapes and mitigate some of their undesirable impacts, it is recommended that the identification of conflicts with human interests should occur as soon as possible, and management techniques should be implemented before issues become more widespread (Campbell-Palmer et al., 2016). In Britain, national consultations and public surveys on the human-wildlife dimensions of beaver re-introduction have been conducted, and stakeholder engagement exercises are ongoing in the areas surrounding some areas where beaver have been introduced (Jones et al., 2012; Gaywood et al., 2015).

The most closely studied and documented Eurasian Beaver populations in Britain are currently the River Otter population in Devon and populations in Scotland (Beaver Trust, 2022; Rosell and Campbell-Palmer, 2022). These populations have been subjected to study, both in terms of ecology (e.g. Needham et al., 2021) and human-wildlife dimensions (e.g. Auster et al., 2019). It is perhaps worth noting that the origin of the River Otter beaver population is unknown (Auster et al., 2021).

The beaver population in East Kent is at the same time relatively unstudied, and different, both in terms of human

population density in the surrounding area and landscape ecology when compared to the River Otter population and the populations found in Scotland. Eurasian beaver were released into Kent in 2001/2002, into an area enclosed by beaver proofed and electrified fencing, at Ham Fen near the town of Sandwich. The aim of this release was to help manage and enhance Kent's largest remaining fenland using rewilding techniques (The Wildlife Trust, 2017). A wild population established outside of the Ham Fen enclosure dates to 2008/2009 at the latest (Reid, R., personal communication), which makes the wild population in Kent at least contemporary to the first licensed re-introduction of free living beaver into Britain (Scottish Wildlife Trust, 2021). In 2016 beaver were described as 'very active' in the Kentish River Stour (Bramley et al., 2022), and featured in local press (Warren, 2016). The beaver population in East Kent has spread since 2008, with little initial recognition or engagement with stakeholders. The current distribution of Eurasian beaver is mainly in the Kentish Stour River catchment from east of the City of Canterbury downstream to the sea, and as far south as the marsh systems bordering the northern limits of the town of Deal (Bramley et al., 2022, personal communication). Beaver have therefore been a part of the East Kent landscape for 21 years at the time of writing, with a well established wild population about which no human dimensions work has been carried out and published subsequent to the release. The East Kent population is found in lowland grazing marsh in the east of its current range, between the towns of Deal and Sandwich. This area includes isolated small copses of trees, but is mostly open fields mainly vegetated by lowlying grasses. Towards Canterbury the population can be found in both the Stour, main river running through the area, and in reedbeds and wetlands lying on either side of the river. This is unlike the beaver population on the River Otter, which is mainly confined to the immediate river environment (Crowley et al., 2017).

The human population density in East Kent is also much higher than other release sites, potentially increasing the risk of human-beaver conflict.

A better understanding of the complex social dimensions of wildlife reintroduction amongst different interest groups could play an important role both in long term beaver conservation and sustainable beaver management (Ulicsni et al., 2020).

The aim of this exploratory study was to provide a baseline of attitudes towards presence, impact and mitigation of the established wild beaver population in a lowland marsh system near areas of relatively high human population density, which could serve as a baseline for future studies in this area as the expanding beaver population come into greater direct contact with human infrastructure. Objectives of this paper were to explore whether livelihood, distance from the original release site or gender affected human attitudes towards beaver. In order to maximise the use of this research for landowners and NGO's we also sought stakeholder opinion on perceived impacts of beaver, and the acceptable ways to manage beaver populations in potential conflict situations.

## 2 Method

The Theory of Planned Behaviour (Ajzen and Fishbein, 2005) was employed to produce a questionnaire that to measured knowledge, attitudes and beliefs in relation to the Eurasian beaver and its conservation in Kent. The questionnaire design was further influenced by similar studies on human dimensions in wildlife management, (Auster et al., 2019; Bath, 2008; Consorte-McCrea et al., 2017b).

The survey comprised a total of 32 beaver-related items and 6 sociodemographic questions. Different types of questions were formulated, including multiple-choice, scale and dichotomous questions. Questions of interest were closed-ended in order to yield quantitative data for statistical analysis. Additionally some qualitative data was gathered by means of a comment box where respondents could elaborate on the reasons for selecting their answers and leave further observations. The questionnaire was wide ranging, however this paper focuses on the portion of the questionnaire covering attitudes, impacts and management with respect to beaver in Kent.

### 2.1 Data collection and sampling

The survey was distributed using the online platform 'Qualtrics' between 24 June and 28 July 2020. In addition, the questionnaire was e-mailed to individual people working in environmental and wildlife organisations, including Wildwood Trust, Kent Wildlife Trust, Environment Agency and River Stour Internal Drainage Board. To capture views of the general public, the survey was also shared on several local Facebook groups of Canterbury, Sandwich, Whitstable and Herne Bay. The participants were invited to share the survey within their networks which allowed many participants to be recruited *via* the snowball method. Farmers and landowners were particularly sought, and were contacted by other participants and *via* email and LinkedIn through farmers' associations such as the National Farmers' Union. Despite this effort the number of farmers and landowners engaging with the study were not expected

to equal other groups, due to the low ratio of agricultural workers to other groups, and the analysis methods were chosen to allow for such an eventuality. All data were collected and analysed anonymously. Paper copies of the questionnaire were available to participants who desired an alternative to electronic submission, however no paper copy questionnaires were requested.

### 2.2 Attitudes towards beaver in Kent

Four questions concerning personal feelings about beavers and emotional responses to beaver existence were added together to form an overall Attitude score for beaver. Answers to these questions were presented as a 5 point Likert scale (Allen and Seaman, 2007). Attitudinal items were coded using a 5-point ordinal rating, ranging from -2 ("Strongly dislike") to +2 ("Strongly like"). Sum attitude scores (AS) therefore potentially ranged from -8 to +8. In addition, negative mean scores represented negative attitudes towards beavers while positive mean scores represented positive attitudes towards beavers.

### 2.3 Perception of beaver impact

Perceptions of beaver impacts were explored for 11 impact themes (Wildlife & Biodiversity; Habitat & Ecology; Trees and Forestry; Land use & Agriculture; Water Quality; Flooding; Fisheries; Economics; Recreation & Leisure; Health & Welfare and Education).

### 2.4 Beaver management

Participants were asked to score the following methods of beaver management, which were identified as best practice recommendations (Campbell-Palmer et al., 2016): *Dam removal, Flow control devices, Individual tree protection, Exclusion fencing, Creation of riparian buffer zones, Trapping animals for translocation, Lethal control, Fertility control, Other and No management.*

### 2.5 Sociodemographic details

Participant information about gender, age, occupation, level of education and residential area was also gathered. Ages were classified into 7 groups (18-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75 or older). Occupations were grouped into three categories (*Farming & Agriculture, Wildlife Conservation & Environmental Sciences and Other*).

Level of education was grouped into three levels: *Secondary education, Further education and Higher education.* Also,

respondents' first half of their postcode was requested. Postcodes were then arranged in 5 zones corresponding to distance from the original 2001 beaver release site, with zones 1-4 being inside Kent (Figure 1), and zone 5 encompassing all questionnaire returns from outside Kent.

Statistical analysis was performed using IBM SPSS Statistics 24 software. Attitudes data were not normally distributed (Shapiro-Wilk test;  $p < 0.05$  in all cases), therefore non-parametric Mann-Whitney U and Kruskal-Wallis tests were undertaken to examine differences in the attitudes to beaver between occupations, gender, and area. To understand if there was an association between distance from reintroduction site and attitude score, a Pearson's Correlation was performed. Finally, crosstabs were used to test measures of association for two-way tables and expected outcomes were compared with observed outcomes. Pearson Chi-square Test was applied to examine relationships between support for beaver reintroduction and support for beaver management techniques. Mean results were accompanied in the text with standard deviation in the form Mean  $\pm$  S.D.

### 3 Results

The questionnaire was completed by 407 individuals. The response rate varied among the three interest groups. A total of 50 environmentalists, 10 farmers and 347 respondents from the general public participated in the survey.

### 3.1 Sociodemographic characteristics

Respondents' sociodemographic characteristics are displayed in Table 1. The sample had a higher proportion of females (67.8%,  $n=276$ ) than males (31.2%,  $n=127$ ). Most environmentalists (66%,  $n=33$ ) and the public (69%,  $n=239$ ) were female. In contrast, there were more male landowners (60%,  $n=6$ ) than females. The most numerous age group in the sample was 45-54 (23.1%,  $n=94$ ), followed by 35-44 (21.6%,  $n=88$ ) and 55-64 (21.1%,  $n=86$ ). In particular, most landowners (30%,  $n=3$ ) and the public (23.1%,  $n=80$ ) were between 45-54 years, but most environmentalists (32%,  $n=16$ ) had an age between 25-34. Most respondents resided in the CT postcode area (Zone 1, 2 and 3), with the majority residing in Zone 3 (34.2%,  $n=139$ ).

### 3.2 Attitudes

Attitudes towards beavers were mainly positive among participants with an overall mean attitude score of  $5.91 \pm 2.54$  (Figure 2).

Only 9 respondents held general negative attitudes towards beavers (Figure 2). A Mann-Whitney U test found no significant gender difference between median attitudes towards beaver ( $U = 17,731.5$ ,  $p = 0.468$ ). All three interest groups held positive attitudes towards beavers. Environmentalists held the most positive attitudes ( $AS=6.22 \pm 2.71$ ) followed by members of the public ( $AS=5.91 \pm 2.40$ ) and farmers ( $AS=4.80 \pm 3.65$ ) who

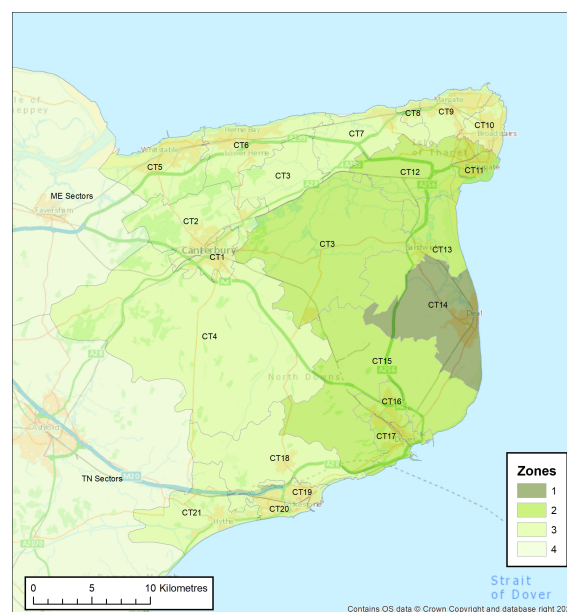


FIGURE 1  
Map of the postcode areas in Kent grouped in 5 residential zones according to distance from Deal (Zone 5 is not represented on the map).

TABLE 1 Frequency and percentage of respondents' gender, age group, education level, occupation, landownership and residential area.

Sociodemographic Variables		Frequency (n)	Percentage (%)
Gender	Male	127	31.2
	Female	276	67.8
	Unspecified	4	1
Age	18-24	35	8.6
	25-34	64	15.7
	35-44	88	21.6
	45-54	94	23.1
	55-64	86	21.1
	65-74	31	7.6
	75+	8	1.9
	Unspecified	1	0.2
Education	Secondary education	55	13.5
	Further education	55	13.5
	Higher education	291	71.5
	Unspecified	6	1.5
Occupation	Farming & Agriculture	10	2.5
	Wildlife Conservation & Environment Science	50	12.3
	Other (General Public)	347	85.3
Landowner	Yes	48	11.8
	No	357	87.7
	Unspecified	2	0.5
Residential Area	Zone1	15	3.7
	Zone 2	89	21.9
	Zone 3	139	34.2
	Zone 4	121	29.7
	Zone 5	28	6.9
	Unspecified	15	3.7

formed the negative end of the attitudinal spectrum. However, a Kruskal Wallis test found no significant difference between the three interest groups ( $H_{(2)} = 2.686$ ,  $p = 0.261$ ). A Pearson's correlation analysis found a significant positive correlation between distance from the beaver release site and attitudes ( $r=0.133$ ,  $p=0.008$ ).

### 3.3 Perception of beaver impact on the landscape

Overall, respondents perceived beavers to have positive impacts in each measured category (Figure 3). Perceived

impacts followed this ascending order according to their mean rate: *Wildlife & Biodiversity*; *Habitat & Ecology*; *Education*; *Water Quality*; *Recreation & Leisure*; *Flooding*; *Health & Welfare*; *Trees & Forestry*; *Economics*; *Land use & Agriculture* and *Fisheries*.

### 3.4 Support for beaver reintroduction

Respondents' support for the beaver reintroduction in Kent was broad, with: 91.6% ( $n=373$ ) agreeing or strongly agreeing that re-introduction was a positive action, 5.4%

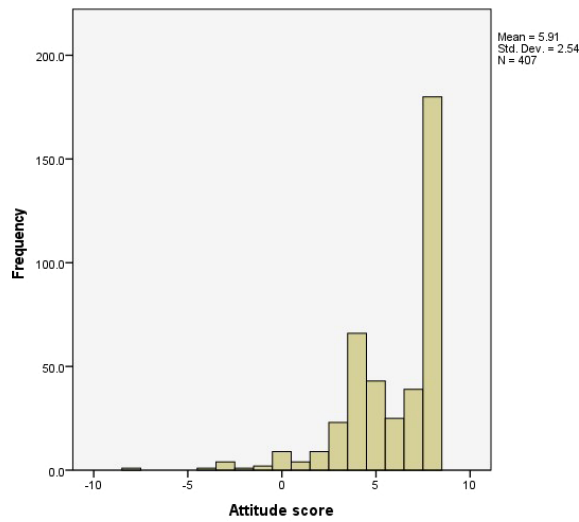


FIGURE 2  
Beaver-related attitude frequency distribution for all survey participants.

(n=22) neutral and 2.9% (n=12) disagreeing or strongly disagreeing with beaver re-introduction.

hand, *trapping animals for translocation, dam removal, fertility control* and *lethal control* did not receive much support (Figure 4). No significant association was found between support for beaver reintroduction and support for beaver management ( $\chi^2 = 5.139, p=0.273$ ).

### 3.5 Priorities for beaver management

Respondents' support for different beaver management techniques was diverse. More than a quarter of participants (27.8%, n=113) disapproved any type of management to mitigate beaver impacts or control beaver populations. Of the management measures presented, the most supported was *individual tree protection*, followed by *exclusion fencing, flow control devices* and *creation of riparian buffer zones*. On the other

## 4 Discussion

The present study provides an exploratory insight into social attitudes and perceptions among different members of a local community in the UK, almost 20 years after Eurasian beavers were introduced to the county. The main findings suggest a high degree of tolerance and acceptance towards the Eurasian beaver

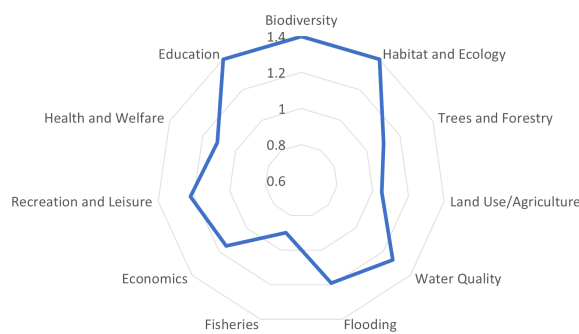


FIGURE 3  
Respondents' perceived beaver impact scores for each impact theme.

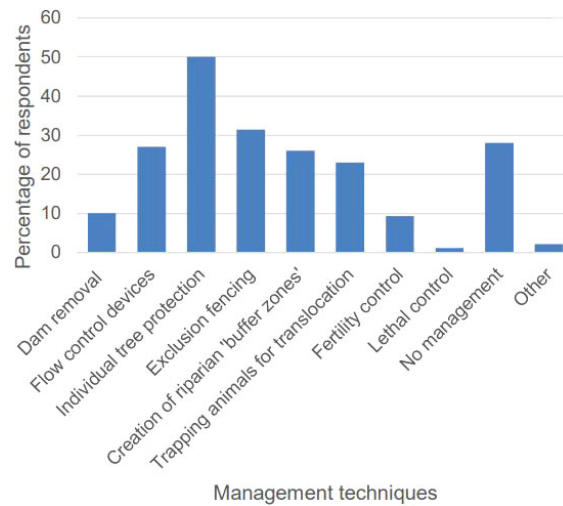


FIGURE 4  
Respondents' support for potential beaver management techniques (participants could select multiple answers).

from the local people surveyed, as well as interest and support for beaver reintroduction and conservation. Many respondents highlighted attractive traits of beavers in free comments. This has particular relevance because evidence shows that human aesthetic appreciation of wildlife species influences public attitudes towards their conservation (Kellert, 1994; Gunnthorsdottir, 2001; Roque de Pinho et al., 2014). Only one individual respondent reported signs of fear or apprehension towards beaver in any of the responses, suggesting that beaver could be aggressive. The overall positive attitude is consistent with findings from the literature that herbivores, such as beaver, do not raise anxieties about public safety nor livestock depredation, which are mainly associated with large carnivores (Bath et al., 2008; Consorte-McCrea, 2011; Dabon, 2018; Castillo-Huitrón et al., 2020).

The results for perceptions of beaver impacts indicated that public concerns about beaver reintroduction were more focused on aspects associated with human livelihoods and that the perceived detrimental impacts are, essentially, on land uses and human activities. A nationwide survey about social attitudes towards beavers in Britain conducted in 2017 reported identical results (Auster et al., 2020). Conversely, disparities in perceptions of beavers' role in nature were evident in Scotland (Coz and Young, 2020). This was linked to a similar dynamic to the wild Kent beaver population, where a similar lack of detailed planning of the wider reintroduction process and little guidance for the management of beavers as in Tayside occurred.

There was evidence in the survey results of diverse perceptions of the impacts of beavers on ecosystem services, being that the effects of beavers on cultural services (aesthetic

values) have been mostly perceived as positive in comparison to provisioning and regulating services (Ulicsni et al., 2020). Public appreciation and awareness of the Eurasian beaver might have been enhanced by the extensive UK press coverage about the return of beavers, which has made news in the *Daily Mail*, *Sky News*, *Daily Telegraph*, *Guardian*, *Independent* and *BBC News*. Very commonly, beaver coverage has an affectionate and curious tone (Gurnell et al., 2009) which might have been able to popularise wildlife conservation knowledge (Blewitt, 2011) and, in turn, influenced people's impressions about and attitudes towards beavers. Additionally, local zoos might have played an important role in people's views on beavers, which is consistent with the finding of Consorte-McCrea et al. (2017a) who suggested that zoos offering a wide range of learning experiences with live animals may encourage empathy. In particular, Wildwood Trust, the nearby wildlife park responsible for sourcing and providing the initial population for reintroduction into Ham Fen, is the only wildlife park in the South East of England that has a beaver exhibit and actively disseminates information and news about beaver status and importance.

Social studies on human interactions with the Canadian beaver in North America demonstrate strong negative correlations between factors such as experience of beaver damage (Jonker et al., 2006), or beaver density (Siemer et al., 2017) and attitudes to beaver. The attitudes of stakeholders could worsen if the frequency or severity of beaver impacts increase. Work on the population dynamics and general ecology of beaver in the marsh systems and adjoining urban areas is at an early stage, and could add to the considerations of future human dimension studies of this population.

## 4.1 Differences between interest groups

The opinions expressed by the three interest groups – environmentalists, farmers and the general public – about beavers and their reintroduction were not significantly different to each other in attitude scores. These results differed from similar research (Auster et al., 2019; Gurnell et al., 2009) which found that respondents whose occupation were in ‘Farming & Agriculture’, as well as ‘Fisheries & Aquaculture’, had less positive views about the Eurasian beaver, in contrast to those in ‘Environment, Nature & Wildlife’ who held the most positive attitudes.

Great effort was made to recruit farmers to participate in the survey. Despite this the number of farmers in this study is small (n=10). According to the census for Kent (Kent County Council, 2021) only 1% of Kent’s population is made up of skilled agricultural workers, and 10 individuals represent proportionally over twice the number of farmers expected in a sample of this size. However, the investigation of attitudes among key stakeholders and the differences between them could have been affected by this extreme inequality in group sample sizes, for example the attitude of each individual farmer who participated would have been amplified, which could misrepresent the attitudes of all farmers. Therefore, these results should be viewed with appropriate caution. Future work could increase farmer participation by physically visiting a sample of farmers to seek their participation, and actively distributing paper copies of the questionnaire, rather than just offering it as an option. This targeting could coincide with work planned next year to map out the distribution of beaver in east Kent more accurately.

## 4.2 Sociodemographic characteristics

The majority of respondents in this sample were female and aged between 35–54, however attitudes towards beavers did not seem to be associated with gender, age groups or education levels. The relationship between gender and attitudes towards the Eurasian beaver in this study differs from the results in other human dimensions studies that have found variations in attitudes between females and males (Bath et al., 2008; Decker et al., 2009). In particular, Kellert and Berry (1987) argued that gender is among the most important demographic factors in determining attitudes towards animals in American society. However, these study findings suggest this does not apply in the case of social attitudes and perceptions towards beavers in Kent.

Regarding residential areas, there was a positive correlation between residence distance from the beaver release site and attitudes. Although evidence of beavers has been reported outside of Ham Fen in the River Stour Catchment (Beaver Trust, 2022), this relation could be an effect of beaver

presence, or perceived presence. (Bath et al., 2008), reported a similar effect indicating that positive attitudes may increase with distance from release site, although they also reported that in some cases living in the locality of a species could increase positive attitudes towards that species. Participants experience of Eurasian beaver and beaver impact and any influence on participant attitudes could therefore form a useful basis for future work.

## 4.3 Beaver reintroduction

The process of Eurasian beaver reintroduction in Kent received overwhelming support from the participants. This is in accordance with several public consultations which suggest that public support for beaver reintroduction is high and rising (Gaywood et al., 2015). A repeated study of Attitudes to Beaver re-introduction found a rise between 2017 and 2019 from 86.25% to 89.64% (Brazier et al., 2020). In England, the positive public reception is mirrored by largely positive media coverage (Gurnell et al., 2009).

Those in favour of beaver reintroduction tended to focus on specific environmental benefits associated with beaver dam systems. Many respondents highlighted the sense of human responsibility to restore a species extirpated by humans as a moral duty which is a common argument for reintroducing the Eurasian beaver to Britain (Philip and MacMillan, 2005). Additionally, some participants recognised some opportunities to humans that may arise from beaver presence. However, no respondents mentioned the potential economic benefits stemming from eco-tourism which is frequently cited as an important aspect of beaver reintroduction (Gurnell et al., 2009; Jones et al., 2013).

## 4.4 Beaver management

Debates regarding beaver conservation and management in Britain tend to be polarised and controversial (Jones et al., 2013). Predominantly, participants were in favour of some form of beaver management to mitigate beaver impacts or control beaver populations. The majority of respondents considered that a regulating system for beaver populations is necessary. Noninvasive techniques, were the most highly selected, whereas more invasive techniques, were less preferred. These results agree with other studies that have found more support for indirect techniques, such as education in order to address misinformation with respect to beavers (Brazier et al., 2020; Campbell et al., 2007). The least supported option was *lethal control*, in accordance with other evidence showing wider social interest in non-lethal wildlife management solutions (Campbell-Palmer et al., 2015). The acceptability of lethal control has been reported to increase over time as beaver populations expand and



the reality of living again with the impacts of this species becomes an actual experience (Jonker et al., 2006; Siemer et al., 2017), which is a further argument for a future follow up study. As the beaver situation in Britain changes rapidly and dynamically and social opinions develop, it is important that beaver management strategies are adaptive (Ulicsni et al., 2020).

An alternative strategy for managing conflict and damage caused by wildlife is the establishment of compensation schemes to reimburse farmers, gamekeepers and landowners who experience damages (Morzillo and Needham, 2015). Government compensation schemes for damages or losses inflicted by beavers are generally popular with the public, as well as payments for landowners to host beavers (Auster et al., 2019; Gurnell et al., 2009). However, results show no predominant opinion on this topic among residents of Kent, suggesting this might need further deliberation if ever considered. If landowners get advice, help and financial support in case of problems with beavers they can be more willing to accept beaver presence (Schwab and Schmidbauer, 2003). These findings suggest that strategic decisions are needed on what beaver management should occur in Britain, particularly by whom, as this will be affected by any level of legal protection applied. Currently, the UK Government is being urged, by conservationists, to legally classify beavers as a 'native species' and give the species more protection in Britain (Beaver Trust, 2022). In the same way, almost all respondents felt beavers should be given some form of legal protection, a finding mirrored in the national study by Auster et al. (2019).

Other studies have identified stakeholders concerns about the consideration of future beaver management, with special attention to who would be responsible for management in practice, management funding and the actual management techniques that could be employed in the future (Auster et al., 2019; Gurnell et al., 2009; Brazier et al., 2020). A Beaver Management Strategy Framework has been published to help inform decisions regarding the long-term management of beavers in Devon (River Otter Beaver Trial Steering Group, 2020). However, there is a need for a National Beaver Strategy for any further releases that incorporates all these aspects and social concerns and establishes an effective management process for free-living beaver populations, as suggested by the English Beaver Strategy Working Group (in preparation).

## 5 Conclusions

The Eurasian beaver was portrayed as a popular species among many inhabitants of Kent, emotionally engaging a broad segment of the public. Most survey respondents recognised the value of beaver to ecosystems, perceiving their impacts to be essentially beneficial in all of the areas analysed by the study. Still, a positive correlation between greater distance from release

site and positive attitudes towards the beavers requires further investigation. Attitudes may change as beaver density and distribution changes, therefore longitudinal studies over time may help understand these dynamics.

Should wildlife managers wish to generate more acceptance for beavers, communication strategies for any future consultation over proposed reintroduction plans could be based on the positive feelings associated with beavers and focused on the potential environmental benefits they can provide. Reintroduction projects need to be clear and carefully designed, while also devising and disseminating accurate information as a mean to raise public support for the conservation of the Eurasian beaver in England.

These study findings suggest the need to strengthen cooperation between nature conservationists and local communities and incorporate public views on beaver management decision-making process, in order to prevent potential future conflicts from establishing. Indeed, in beaver reintroduction, management decisions can and should be made proactively before conflicts arise (Auster et al., 2019). As there is no evidence of strong beaver-human conflict in Kent, there is an opportunity to design an effective strategic approach for tackling challenges head-on and promote human-beaver coexistence.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving human participants were reviewed and approved by Faculty Ethics Committee, Faculty of Social and Applied Sciences, Canterbury Christ Church University. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

SO designed and carried out the research and wrote up the main body of the writing as part of an MSc dissertation thesis. PB provided the original idea for the study and provided initial industry contacts and initial direction of the research. He also supervised the research and re-structured the thesis into a shorter final paper for submission. AC-M provided substantial help to structure the questionnaire, supervised the research and provided expertise on framing the research to maximise

consideration of the human dimensions of European beaver re-introduction into the UK. All authors contributed to the article and approved the submitted version.

## Funding

Funding is provided through the University's Individual Research report and Proposal funding stream.

## Acknowledgments

We would like to thank Harry Sanders for his expertise with modifications to the initial analysis and John Hills for his help with ArcGIS. We would also like to thank Rob Collins from the Rivers Trust and John Wilson from Kent Wildlife Trust for their enduring support of our Ham Fen work. Several organisations directly or indirectly contributed to this study, these were the

landowner Kent Wildlife Trust, East Kent Beaver Group, the Coca Cola Foundation and the Rivers Trust.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## References

- Ajzen, I., and Fishbein, M. (2005). "The of attitudes on behavior," in *The handbook of attitudes*. Eds. D. Albarracín, B. Johnson and M. Zanna (Mahwah, NJ: Lawrence Erlbaum Associates), 173–221.
- Allen, I., and Seaman, C. (2007). Likert scales and data analyses. *Qual. Prog.* 40, 64–65. Available at: <https://www.bayviewanalytics.com/reports/asq/likert-scales-and-data-analyses.pdf>
- Auster, R., Puttock, A., and Brazier, R. (2019). Unravelling perceptions of Eurasian beaver reintroduction in Great Britain. *Area* 52 (2), 364–375. doi: 10.1111/area.12576
- Auster, R., Puttock, A., and Brazier, R. (2021). Improving engagement in managing re-introduction conflicts: learning from beaver re-introductions. *J. Environ. Plann. Manage.* 64 (10), 1713–1734. doi: 10.1080/09640568.2020.1837089
- Bath, A., Olszanska, A., and Okarma, H. (2008). From a human dimensions perspective, the unknown Large carnivore: Public attitudes toward Eurasian lynx in Poland. *Hum. Dimensions Wildlife* 13 (1), 31–46. doi: 10.1080/10871200701812928
- Beaver Trust (2022) *Map of beavers in Britain*. Available at: <https://beavertrust.org/index.php/reintroducing-beavers-and-endangered-wildlife-on-a-stream-near-you/> (Accessed 7th July 2022).
- Blewitt, J. (2011). The media, animal conservation and environmental education. *Environ. Educ. Res.* 17 (6), 711–718. doi: 10.1080/13504622.2011.625624
- Bramley, J., Parfitt, O., Armstrong, J., Bramley, T., Furlotte, D., Bramley, O., et al. (2022) *Field guide to beaver signs recorded in south East England* (Bramley Associates, Manager's House, Ratling Court Farm, Ratling Road, Aylesham, Kent CT3 3HN). Available at: <https://www.bramleyassociates.co.uk/blog/field-guide-to-beaver-signs-recorded-in-south-east-england> (Accessed 7th July 2022).
- Brazier, R., Elliott, M., Anderson, E., Auster, R., Bridgewater, S., Burgess, P., et al. (2020). River otter beaver trial. *Sci. Evidence Rep.*, 79–90.
- Campbell-Palmer, R., Gow, D., Campbell, R., Dickinson, H., Girling, S., Gurnell, J., et al. (2016). *The Eurasian beaver handbook: Ecology and management of castor fiber*. Exeter (UK: Pelagic Publishing), 1–62.
- Campbell-Palmer, R., Schwab, G., Girling, S., Lisle, S., and Gow, D. (2015). *Managing wild Eurasian beavers: a review of European management practices with consideration for Scottish application* (Inverness, Scotland: Scottish Natural Heritage Commissioned Report No.812).
- Campbell, RD, Dutton, A., and Hughes, J. (2007). Economic impacts of the beaver. *Report for the Wild Britain Initiative*. 28. Available at: [https://www.researchgate.net/publication/261727410\\_Economic\\_Impacts\\_of\\_the\\_Beaver](https://www.researchgate.net/publication/261727410_Economic_Impacts_of_the_Beaver)
- Castillo-Huitrón, N., Naranjo, E., Santos-Fita, D., and Estrada-Lugo, E. (2020). The importance of human emotions for wildlife conservation'. *Front. Psychol.* 11, 1277. doi: 10.3389/fpsyg.2020.01277/full
- Collen, P., and Gibson, R. J. (2001). The general ecology of beavers (*Castor* spp.), as related to their influence on stream ecosystems and riparian habitats, and the subsequent effects on fish – a review. *Rev. Fish Biol. Fisheries* 10, 439–461. doi: 10.1023/A:1012262217012
- Consorte-McCrea, A. (2011). *Conservation of the maned wolf (Chrysocyon brachyurus): carnivore and people relationships in the southeast of Brazil*. Ph.D. thesis (Kent, UK: University of Kent).
- Consorte-McCrea, A., Bainbridge, A., Fernandez, A., Nigbur, D., McDonnell, S., Morin, A., et al. (2017a). Understanding attitudes towards native wildlife and biodiversity in the UK: the role of zoos. In book: *Sustainable Development Research at Universities in the United Kingdom, World Sustainability Series*. Springer International Publishing. Editors: W. Filho Leal, chapter 17, 295–311. doi: 10.1007/978-3-319-47883-8\_17
- Consorte-McCrea, A., Nigbur, D., and Bath, A. (2017b). 'Implications of teenagers' attitudes toward maned wolf conservation in Brazil. *Canid Biol. Conserv.* 20 (5), 16–24.
- Coz, D., and Young, J. (2020). Conflicts over wildlife conservation: Learning from the reintroduction of beaver in Scotland. *People Nat.* 2 (2), 1–14. doi: 10.1002/pan3.10076
- Crowley, S., Hinchliffe, S., and McDonald, R. (2017). Nonhuman citizens on trial: The ecological politics of a beaver reintroduction. *Environ. Plann. A* 49 (8), 1846–1866. doi: 10.1177/0308518X17705133
- Dabon, C. (2018). *Understanding the acceptability of lethal management towards canids on the island portion of Newfoundland and Labrador*. MSc thesis (Newfoundland, Canada: Memorial University of Newfoundland, St. John's).
- Decker, D., Siemer, W., Leong, K., Riley, S., Rudolph, B., and Carpenter, L. (2009). Conclusion: What is wildlife management. *Wildlife and society: the science of human dimensions*. Island Press, Washington, DC, 315–328.
- Department for Environment, Food & Rural Affairs and Natural England (2020) *Five-year beaver reintroduction trial successfully completed*. Available at: <https://www.gov.uk/government/news/five-year-beaver-reintroduction-trial-successfully-completed> (Accessed 24 August 2020).
- Gaywood, M. (2018). Reintroducing the Eurasian beaver *Castor fiber* to Scotland. *Mammal Rev.* 48, 48–61. doi: 10.1111/mam.12113
- Gaywood, M., Batty, D., and Galbraith, C. (2008). Reintroducing the European beaver in Britain. *Br. Wildlife* 19 (6), 381–391.
- Gaywood, M., Stringer, A., Blake, D., Hall, J., Hennessy, M., Tree, A., et al. (2015). Beavers in Scotland: A report to the Scottish government. *Scottish Natural Heritage Inverness*, 108–149.

- Gunnthorsdottir, A. (2001). Physical attractiveness of an animal species as a decision factor for its preservation. *Anthrozoos* 14 (4), 204–215. doi: 10.2752/089279301786999355
- Gurnell, J., Gurnell, A., Demeritt, D., Lurz, P., Shirley, M., Rushton, S., et al. (2009). *The feasibility and acceptability of reintroducing European beaver to England* (Sheffield, UK: Natural England/People's Trust for Endangered Species).
- Jones, S., Gow, D., Jones, A., and Campbell-Palmer, R. (2013). The battle for British beavers. *Br. Wildlife* 24 (6), 381–392.
- Jones, A., Halley, D., Gow, D., Branscombe, J., and Aykroyd, T. (2012). *Welsh beaver assessment initiative report: An investigation into the feasibility of reintroducing European beaver (Castor fiber) to Wales* (UK: Wildlife Trusts Wales).
- Jonker, S., Muth, R., Organ, J., Zwick, R., and Siemer, W. (2006). Experiences with beaver damage and attitudes of Massachusetts residents toward beaver. *Wildlife Soc. Bull.* 34 (4), 1009–1021. doi: 10.2193/0091-7648(2006)34[1009:EWBDAA]2.0.CO;2
- Kellert, S. (1994). Public attitudes toward bears and their conservation. *Int. Bear Conferences* 9, 43–50. doi: 10.2307/3872683
- Kellert, S., and Berry, J. (1987). Attitudes, knowledge, and behaviors toward wildlife as affected by gender. *Wildlife Society Bulletin (1973-2006)* 15 (3), 363–371. doi: <https://www.jstor.org/stable/3782542>
- Kent County Council, Statistical Bulletin (2021). Available at: [https://www.kent.gov.uk/data/assets/pdf\\_file/0008/8189/Labour-force-profile.pdf](https://www.kent.gov.uk/data/assets/pdf_file/0008/8189/Labour-force-profile.pdf) (Accessed 10th July 2022).
- Morzillo, A. T., and Needham, M. D. (2015). Landowner incentives and normative tolerances for managing beaver impacts. *Hum. Dimensions Wildlife* 20, 514–530. doi: 10.1080/10871209.2015.1083062
- Needham, R. J., Gaywood, M., Tree, A., Sotherton, N., Roberts, D., and Bean C.W. and Kemp, P. S. (2021). The response of a brown trout (*Salmo trutta*) population to reintroduced Eurasian beaver (*Castor fiber*) habitat modification. *Can. J. Fisheries Aquat. Sci.* 78 (11), 1650–1660. doi: 10.1139/cjfas-2021-0023
- Nyhus, P. (2016). Human-wildlife conflict and coexistence. *Annu. Rev. Environ. Resour.* 41, 143–171. doi: 10.1146/annurev-environ-110615-085634
- Philip, L., and MacMillan, D. C. (2005). Exploring values, context and perceptions in contingent valuation studies: The CV market stall technique and willingness to pay for wildlife conservation. *J. Environ. Plann. Manage.* 48 (2), 257–274. doi: 10.1080/0964056042000338172
- de Pinho, R. J., Grilo, C., Boone, R., Galvin, K., and Snodgrass, J. (2014). Influence of aesthetic appreciation of wildlife species on attitudes towards their conservation in Kenyan agropastoralist communities. *PLOS ONE* 9 (2), e88842. doi: 10.1371/journal.pone.0088842
- River Otter Beaver Trial (ROBT) Steering Group (2020). *River Otter Beaver Management Strategy Framework*. Available at: <https://www.devonwildlifetrust.org/sites/default/files/2019-07/River%20Otter%20Beaver%20Management%20Strategy%20Framework%20-%20final%20proof.pdf>
- Rosell, F., and Campbell-Palmer, R. (2022). *Beavers: Ecology, behaviour, conservation and management* (Oxford: Oxford University Press).
- Schwab, V., and Schmidbauer, M. (2003). Beaver (*Castor fiber* L., castoridae) management in Bavaria. *Denisia* 9, zugleich Kataloge der OÖ. Landesmuseum Neue Serie 2 (2003), 99–106. Available at: [https://www.zobodat.at/pdf/DENISIA\\_0009\\_0099-0106.pdf](https://www.zobodat.at/pdf/DENISIA_0009_0099-0106.pdf)
- Scottish Wildlife Trust *Scottish Beavers* (2021). Available at: <https://scottishwildlifetrust.org.uk/our-work/our-projects/scottish-beavers/> (Accessed 15th July 2022).
- Siemer, W. F., Jonker, S. A., Decker, D. J., and Organ, J. F. (2017). Towards an understanding of beaver management as human and beaver densities increase. *Human-Wildlife Interact.* 7 (1), 114–131.
- Stringer, A. P., and Gaywood, M. J. (2016). The impacts of beavers *Castor* spp. on biodiversity and the ecological basis for their restoration to Scotland, UK. *Mammal Rev.* 46 (4), 270–283. doi: 10.1111/mam.12068
- The Wildlife Trust (2017) *The wildlife trust's beaver reintroductions*. Available at: [https://www.wildlifetrusts.org/sites/default/files/2018-11/181023%20Beaver%20Brochure\\_WEB.pdf](https://www.wildlifetrusts.org/sites/default/files/2018-11/181023%20Beaver%20Brochure_WEB.pdf) (Accessed 23 July 2020).
- The Wildlife Trust (2020) *Support a national beaver strategy*. Available at: <https://action.wildlifetrusts.org/page/60782/data/1?locale=en-GB> (Accessed 19 August 2020).
- Thompson, S., Vehkaoja, M., Pellika, J., and Nummi, P. (2021). Ecosystem services provided by beavers *castor* spp. *Mammal Rev.* 51, 25–39. doi: 10.1111/mam.12220
- Ulicsni, V., Babai, D., Juhász, E., Molnár, Z., and Biró, M. (2020). Local knowledge about a newly reintroduced, rapidly spreading species (Eurasian beaver) and perception of its impact on ecosystem services. *PLoS One* 15 (5), 1–17. doi: 10.1371/journal.pone.0233506
- Warren, G. (2016) *Beaver sighting in stour sparks hopes of a colony' Kent online 17th may 2016*. Available at: <https://www.kentonline.co.uk/canterbury/news/rare-beaver-sighting-in-kent-95960/> (Accessed 15th July 2022).