Attitudes to Exotic Parakeets: A Comparative Case Study and Citizen Science Review

ROTHERHAM, Ian D. <http://orcid.org/0000-0003-2903-5760> and WATCHMAN, Miles J.

diversity

MDPI

Article

Attitudes to Exotic Parakeets: A Comparative Case Study and Citizen Science Review

Ian D. Rotherham [1,*] and Miles J. Watchman [2]

[1] Advanced Wellbeing Research Centre, Sheffield Hallam University, City Campus, Sheffield S1 IWB, UK
[2] The Department of Architecture and Planning, Sheffield Hallam University, City Campus, Sheffield S1 IWB, UK
* Correspondence: ianrotherham36@gmail.com or i.d.rotherham@shu.ac.uk

Abstract: Invasive, non-native species are recognised as a global problem, and their dispersal and introduction are controversial topics. However, a source of particular interest is that of human–nature interactions and consequent perceptions of natives and non-natives, an issue complicated by misunderstandings of history and sometimes of science. Furthermore, there are only few studies on the perceptions of exotic species by people living in a region subject to invasion. The research compared local stakeholder responses to a non-native invasive bird (ring-necked parakeet *Psittacula krameri* Scopoli) in two areas with contrasting scenarios regarding the history of establishment, their spread, and their current status. In both locations, parakeets were considered by respondents to be attractive, but where long-established, they were also viewed as a nuisance. Desire for or tolerance of active control measures also increased in areas with a well-established population in comparison to where parakeets were still viewed as a novelty. Increased encounters between native birds and invasive parakeets influenced attitudes towards possible controls. An online survey gathered stakeholder responses, and long-term citizen science and action research were combined with data from Local Environmental Records Centres and ornithological recording groups for each region.

Keywords: invasive non-native species; ring-necked parakeet; stakeholder perceptions; recombinant ecology; action research; citizen science

Academic Editors: Michael Wink, Jan Riegert and Michał Budka

Received: 14 May 2025
Revised: 6 June 2025
Accepted: 9 June 2025
Published: 16 June 2025

Citation: Rotherham, I.D.; Watchman, M.J. Attitudes to Exotic Parakeets: A Comparative Case Study and Citizen Science Review. *Diversity* **2025**, *17*, 423. https://doi.org/10.3390/d17060423

1. Introduction

The research tested the idea that stakeholder responses to a highly visible, non-native, invasive species vary according to the degree of exposure to the invader. In order to compare stakeholder perceptions and reactions, the work used the example of a growing invasive, non-native bird in Britain, the ring-necked parakeet (*Psittacula krameri*) [1,2]. This parakeet is a long-standing (over sixty years) feral species in Great Britain, where feral is defined as a species escaping from captivity to establish self-sustaining, wild populations. The native range of this species extends from Central Africa (Senegal to Uganda) and across South Asia [3–6]. There are probably four recognised subspecies, and the British population is predominantly *P. krameri manillensis*, from India. The stakeholder and public responses were compared between a chosen core study region (Sheffield and South Yorkshire) where their establishment and spread are relatively recent (1990s), and a comparator region (Greater London) where the species is longer established (1960s) and, in places, is superabundant. Taking the two regions, data were gathered to illustrate the status and history of arrival, establishment, and spread in each region. The attitudes of the public and of conservation professionals to this non-native bird were assessed and

compared for each region. The context was a wider consideration of perceptions of and attitudes to non-native, invasive species and the issues raised.

1.1. Invasive, Non-Native Species

Local people's perceptions of and interactions with invasive, non-native species affect their perception of the species' impact, which may be considered beneficial in some cases and in others detrimental to the natural environment [7,8]. This situation is compounded by issues of subjectivity in human perception and of historical or scientific confusion (e.g., [9–12]). Furthermore, with changing environmental conditions and shifting baselines, the emergence of novel or recombinant ecologies is becoming increasingly inevitable [13]. However, this is a concept which remains highly controversial.

The ring-necked parakeet is a bird that epitomises the tensions around an attractive, charismatic species that is naturalised and spreading across the UK (see Figure 1) [14,15]. These are highly sociable birds that nest together and form large flocks as they feed and as they roost. In terms of their behaviour and ecology, they are also 'hemerophiles', i.e., species which adapt well to human and urban environments. Parakeets and other parrots have long been popular pets and are highly intelligent and long-lived. They have frequently escaped and can survive in the wild, though few species have established breeding colonies. Early records from London were from Dulwich in 1893 and Brixton in 1894, with one early report of wild breeding in Epping Forest, London, in 1930 [16]. In the Sheffield and South Yorkshire study area, the species was unknown in the 1980s, but recorded sightings increased dramatically in the early decades of the twenty-first century. By contrast, they were long-established in the comparator region of Greater London and their numbers grew significantly from the 1960s, with their rapid rise triggering questions about the future, and their potential impacts on native ecology.

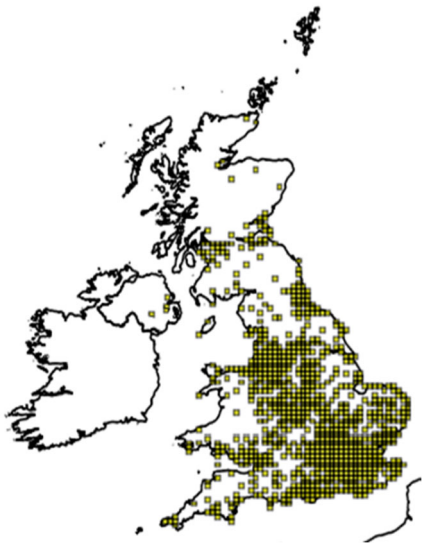


Figure 1. Ring-necked parakeets' UK distribution in 2019 (Source: National Biodiversity Network).

There is an extensive, growing literature on invasive, non-native (exotic or alien) species [12], but relatively little published research on community attitudes to invaders. Probably because of their public visibility, some work has been conducted on parakeets [17]. However, studies are relatively uncommon; in Britain, for example, even for familiar, well-researched interactions between native red squirrels (*Sciurus vulgaris* L.) and invasive grey squirrels (*Sciurus carolinensis* Gmelin), there was only one published work on public attitudes [18] in the early 2000s (Pat Morris, pers. comm.). More recently, several studies have focussed on public attitudes and opinions relating to non-native species [19–25].

However, for species management and conservation, particularly in urban and peri-urban situations, attitudes and perceptions may be critical in determining policy or funding [26]. This becomes more acute when dealing with high-profile species that are attractive and interesting to the wider public. These issues become very apparent when considering the rise in invasive ring-necked parakeets in the UK. For example, with other high-profile invasive bird in Britain, ruddy duck (*Oxyura jamaicensis* Gmelin) [27], some voluntary bird recording groups, such as the West Midlands Bird Group, simply began to suppress information on locations in species records of the bird, which was their adopted symbol (pers. obs.). Rotherham [28] examined public views of the invasive, non-native plant Himalayan balsam (*Impatiens glandulifera* Royle) in Britain. Not only did many people like it, but they actively spread it around the country and even overseas. These studies suggest that public awareness and support for controls cannot be assumed and there may be significant opposition to active extermination. Probably because of its stunningly exotic nature, loud and obvious behaviour, and resulting visibility, the parakeet is in the public eye and has even entered the local folklore and literature [4,29]. Its high visibility makes the species a suitable focus for citizen science research and public opinion assessments.

This study compared public attitudes to invasive parakeets in a region where the population is only recently entering a rapid growth phase (Sheffield and South Yorkshire) and one where the population is well-established and birds are super-abundant. In the former, the work drew on findings from long-term, citizen science research through local popular media.

1.2. Attitudes to Non-Native Species

A breakdown of established biotic barriers enables invasions by 'alien', 'exotic', or 'non-native' species into regions with previously long-term and distinct flora and fauna [11,12]. It is observed that "A massive biotic homogenization of the Earth's surface is occurring. . .." through the removal of former barriers to natural species dispersion [7,30]. Invasion biology uses adjectives such as 'alien' and 'exotic' to describe fundamental concepts of regional 'non-nativeness'. Essentially, this is an attribute of species considered to not belong in the 'original' ecology and introduced through human action, both directly and indirectly, beyond their native range [31]. However, there are issues with such definitions, especially regarding which species are considered desirable or troublesome in different places and throughout history [12]. Indeed, attitudes to deliberate introductions of non-native plants and animals around the world have changed from the early 1800s to the 2000s, from positive encouragement to attempts at control or eradication of established aliens. Major reasons for this change have included the impacts of widespread established non-natives and their increasingly obvious negative impacts on the assumed native wildlife.

In the United States of America, Pimentel et al. [32] estimated 'invading aliens' to include 50,000 species costing the US government USD 120 billion per year. In the UK, GBP 1.7 billion was calculated to be spent annually on non-native species control [20]. Furthermore, about 42% of species on the 'Threatened' or 'Endangered' species lists were primarily at risk because of aggressive, alien invaders. As more species arrive and naturalise, some are accepted and welcomed. Perceptions of what is native and what is a pest are frequently highly subjective and vary between individuals and communities, as well as between the public and conservation professionals [11,12,18]. Perceived species attractiveness influences public perception, and 'nativeness' concepts are frequently imbued with xenophobic attitudes [9]. With such issues, conservation responses and the possible management of invaders need to relate to ecological impacts and the history of human-facilitated introduction [7,11,12]. Furthermore, assumed public awareness of alien issues by professionals and support for conservation interventions to remove non-natives may be unfounded, e.g., [28].

By the 1990s, invasive, non-native species were widely recognised as having global impacts [33,34]. Typical responses to increased awareness are expressed in national and international strategies to conserve native species, e.g., England's 'Biodiversity 2020'. With increasing evidence of invasive alien species aggressively competing with native species and some becoming major threats to ecosystems and biodiversity [35], these issues are significant public concerns [36,37]. As invasive, non-native species become more prevalent, with problematic species affecting ecosystems and even economies, increased knowledge is needed to predict future impacts. Addressing possible management options and understanding local stakeholder opinions is important [14].

1.3. The Arrival and Establishment of Ring-Necked Parakeets in England

The global status of ring-necked parakeets (Figure 2) as an introduced, non-native bird was described by Long [38] and Lever [39,40]. This status includes the initial nineteenth- and twentieth-century populations introduced to England. Earlier introductions petered out, but the species have regularly bred in south-east England since 1969. Ring-necked parakeet (*Psittacula krameri*) is a popular cage-bird with many feral populations established from frequent escapees [41]. The British population comprises *P. k. manillensis* and hybrids with *P. k. borealis*, both from Asia [42]. The exact dates of the arrival and establishment of parakeets are debated, and whilst recorded wild in Britain since the mid-1800s and occasionally breeding, early escapees did not establish colonies. However, feral birds were in and around London in the 1960s and by the early 1970s, breeding colonies, probably escaped from pet-shops, were well-established. The main concentration of feral birds remains in and around London and the south-east of England, with scattered but increasing records further north. The bird was accepted onto the 'British List' in 1983 [29], by which time there were around 1000 birds established and records from fifty counties. By the early 2000s, there were at least 6000 breeding pairs with 30,000+ individuals, with this number increasing by 30% per annum [39,40,42]. Their status, spread, and behaviour in Britain were described in detail by Pithon and Dytham [5,41,42], and Butler et al. [3]. Cocker and Mabey [29] noted the species as "*. . .one of the latest, most surprising and most successful additions to the British avifauna*".

Figure 2. Ring-necked parakeet on a garden feeder, Sheffield © Ian Rotherham.

In the UK, ring-necked parakeet populations have expanded to colonise new regions, increasingly recorded north of Greater London. Indeed, the British Trust for Ornithology noted it as the fastest-growing population of any British bird. Between 1995 and 2007, it increased by 600%. It maintains a strong affinity to Greater London, where it is highly visible and an "undeniably spectacular" bird [43].

Whilst ring-necked parakeets are attractive in both their plumage and behaviour, evidence suggests they have negative impacts on native bird species and on bats [44]. They may impact on foraging behaviour, increase competition with cavity-nesting species (e.g., nuthatch *Sitta europaea* L., starling *Sturnus vulgaris vulgaris* L., and stock dove *Columba oenas* L.), and predate on smaller birds [45]. When present in large numbers, parakeets may adversely affect commercial fruit and soft-fruit production. In India, for example, they sometimes damage staple human food crops [46]. As an invasive species, their fecundity and expansion may be limited by temperature, food availability, and nesting opportunities. During winter in temperate Europe and Britain, they are probably supported by domestic garden feeders [47]. Increasingly favourable breeding conditions trigger colony expansion, with the species probably continuing to expand its UK range. Ring-necked parakeet is now on the 'General Licence' for control, and concerned landowners can apply to shoot and remove them.

Understanding the scientific and ethical issues surrounding possible controls is important in developing future management strategies for non-native invaders. Furthermore, whilst scientists and professionals may hold clear views regarding the merits of containment and control, public opinion may differ [48]. This means that to develop future species management plans for non-natives and natives that are effective and acceptable, public and professional views are needed [7].

This study provides an insight into perceptions in Sheffield and South Yorkshire (where the parakeets are in the early stages of establishment), and Greater London (where ring-necked parakeets are well-established). The findings relate to positive or negative reactions to the situation, the species, and possible control programmes [23]. Within this broad context, human perceptions of invasive species and associated issues are important and potentially significant [8].

1.4. Target Regions

Observer records submitted to local biological records centres and ornithological groups across the region indicate the frequency of encounters with ring-necked parakeets in Sheffield from 1981 to 2018 (Figure 3). Figure 4 shows the equivalent data for Greater London. Citizen science records obtained from publicity and promotion in local newspapers and magazines, in addition to social media, provide further insight to their status and history in Sheffield and South Yorkshire (Table A1).

1.5. Research Questions

The research set out to compare the histories of parakeet invasion in two contrasting regions and to investigate human–parakeet interactions, as well as people's perceptions and attitudes. In particular, the questions addressed whether or not human perceptions and attitudes varied between two contrasting regions subjected to different time periods of invasion. A subsidiary question considered was whether citizen science surveys through popular media can be effective in providing information and data on an invasive non-native species that would not otherwise be generated. Furthermore, if new data are forthcoming, we investigate whether the new responses to the invader match with or differ from those generated by the online surveys.

Figure 3. Parakeets on garden feeders in Sheffield © Ian Rotherham.

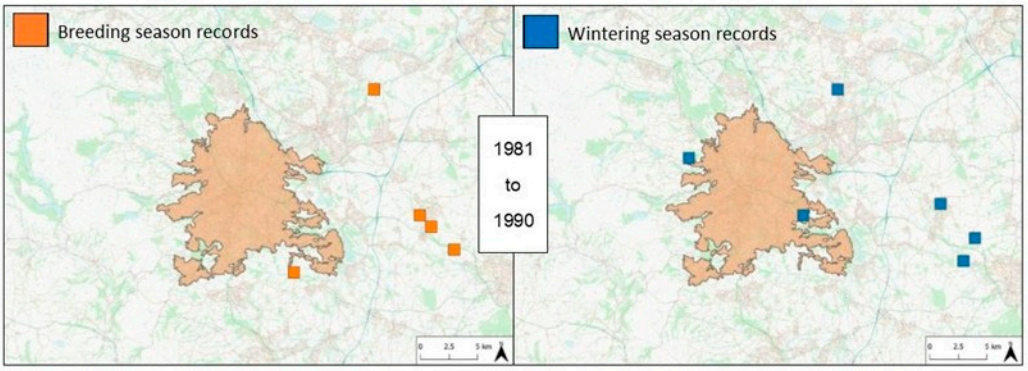


Figure 4. *Cont.*

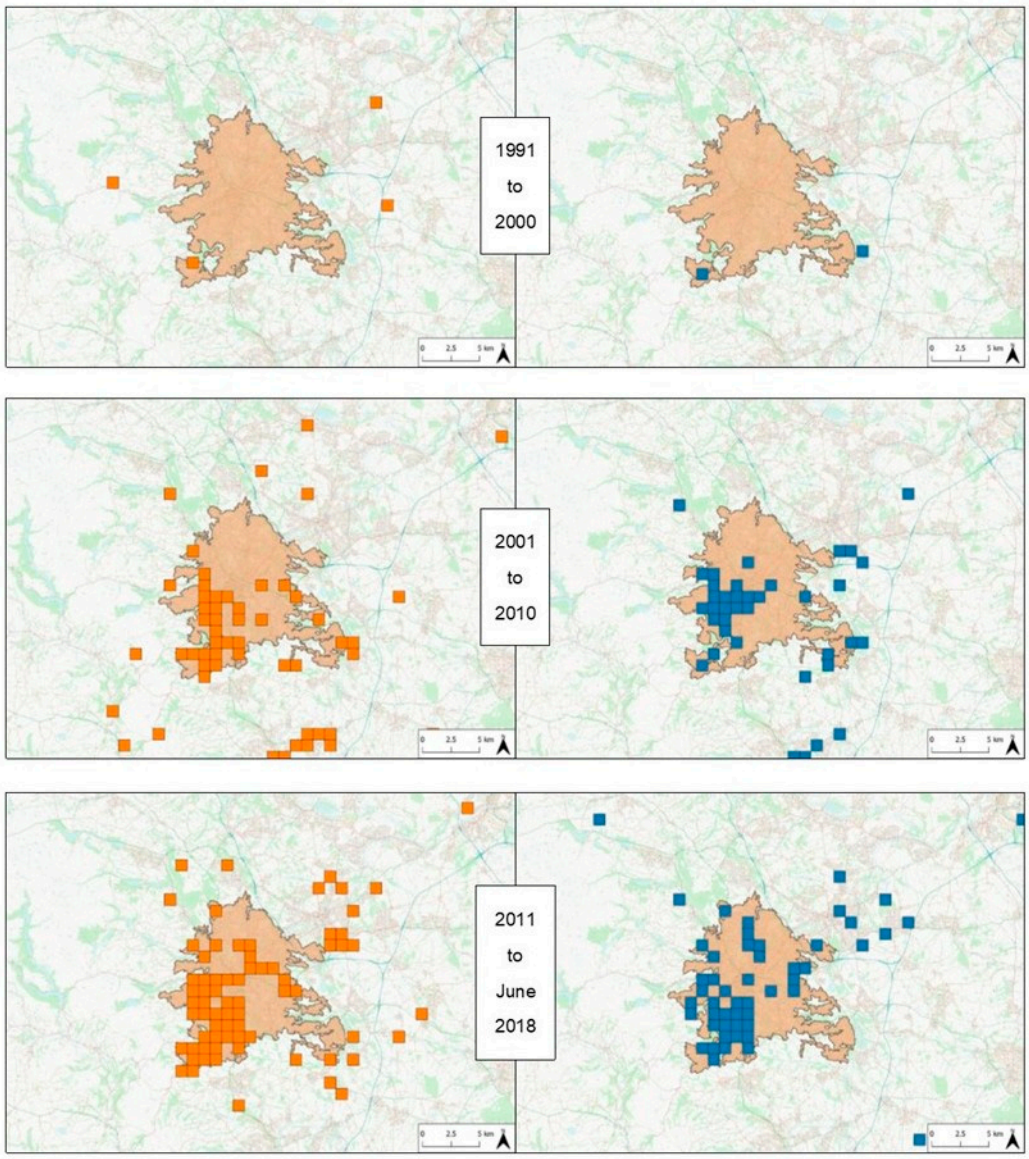


Figure 4. Records of ring-necked parakeets in the Sheffield region. Records provided by Derbyshire Biological Records Centre, Derbyshire Ornithological Society, Doncaster Biological Records Centre, Sheffield Biological Records Centre, Sheffield Bird Study Group, Nottinghamshire Biological and Geological Records Centre, and Rotherham Biological Records Centre, January 2018. Contains Ordnance Survey data © Crown copyright and database right. Reproduced in QGIS 3.2.

2. Materials and Methods

A long-term citizen science survey [49] was undertaken and is ongoing. The survey was distributed through social media and popular local media, such as magazines, newspapers, and local radio. The dissemination included regular wildlife columns in local and regional newspapers, and articles in several popular magazines distributed free to all households across the Sheffield and South Yorkshire study region. Talks and presentations to local community groups supported the publicity, and action research [50] was also undertaken via observations of public–parakeet interactions on-site. This work gathered past and present records to help gauge public responses and reactions to the arrival and spread of parakeets across the Sheffield and South Yorkshire region. A review of the relevant literature, particularly local and county bird reports, provided context for the occurrences recorded by local birdwatchers.

For the core study area, information on ring-necked parakeet records was gathered from local and national biological record data centres, and local societies, particularly the Sheffield Bird Study Group. Records for Greater London were obtained from Greenspace Information for Greater London. Both sets of information were processed and presented via open-source ordinance survey maps using an open-source geographical information system (QGIS). Data were blurred to an accuracy of 100 m to keep records discrete. The records were split between breeding and wintering seasons. Additionally, for both study areas, historical records were reviewed from the published literature.

Along with the spatial and historical records, a survey was undertaken focusing on both public and conservation professionals' responses to the presence and status of parakeets in the main study area and in the comparator region. The survey was an online questionnaire using Survey Monkey Pro. The initial questionnaire was tested by a small sample of stakeholders and appropriate modifications made, and the research was subject to peer review and ethics assessment at Sheffield Hallam University. The launch of the survey was promoted both in popular media and on social media to raise awareness and ensure effective engagement. The 'snowball sampling technique' promoted the questionnaire through the media and interested social networks [51]. To reflect the research questions, seven key issues were identified for the questionnaire:

- Participant details;
- Participant's interest in wildlife;
- Awareness of ring-necked parakeets;
- Level of exposure to ring-necked parakeets;
- Perceptions and attitudes to ring-necked parakeets;
- Knowledge of and attitudes towards non-native species;
- Attitudes to and perceptions of non-native wildlife management issues.

Questions were scored with a standard Likert Scale: 1 = Strongly Agree; 2 = Agree; 3 = Neutral; 4 = Disagree; 5 = Strongly Disagree. The questionnaire included an open-ended question providing an opportunity to provide a comment on the topic and issues [52].

Closed question answers were transformed and coded by number to enable descriptive and statistical analyses using SPSS 16 (IBM). Cross-tabulation and correlation were applied to provide further insight into the responses. A descriptive analysis suitable for non-parametric data was used with median comparison to determine initial differences in the data between the core study area and the comparator region. Statistical differences were considered between the medians of groups using a non-parametric Mann–Witney-U test [53]. Qualitative data were analysed using grounded theory line coding [54] to draw conclusions from the data.

3. Results

3.1. Local Records from Birdwatchers

3.1.1. The Sheffield Area Case Study

Local and regional bird reports for the Sheffield area and immediate surroundings were reviewed to provide a baseline insight. The earliest comprehensive account of birds in the Sheffield area (1974) was edited by Smith [55] and makes no reference to records or sightings of parakeets. Hornbuckle and Herringshaw's report in (1985) [56] was a much fuller volume on the area but also lacked any records. However, the more recent *Breeding Birds of the Sheffield Area* (2013) [57] provides records from the period from 2003 to 2008 and confirms one record of their breeding and one possible record. It also provides a first record for the region in 1974 (see the North Derbyshire records presented below) and very occasional records up to the mid-1990s. Since 1995, parakeets were recorded in low numbers annually, and since 2001 there were between three and eight records per year. There were

no further breeding records until 2008. With an increase of 696% over the period from 1995 to 2008, the authors suggested that ring-necked parakeet was likely to become a regular part of the region's avifauna in the years to come. For Derbyshire itself, the definitive work by Frost [58] (1978) had no parakeet records, but the work of Frost and Shaw (2013) [59] provides significant updates. The first Derbyshire record was at Shardlow in 1973, with four additional single records from the 1970s. They state that, "....this brightly coloured and noisy bird has been reported with increasing regularity," with a total of 101 records over the period: 5 in the 1970s; 23 in the 1980s; 23 in the 1990s; and 61 in 2000–2011. The largest flock recorded comprised eight birds, the first breeding was confirmed in 2002/2003 and 2004, at Hollingwood, and two juveniles were reported. It was suggested that the birds had been deliberately released. By 2021, however, the numbers reported in the Derbyshire Ornithological Society (DOS) Bulletin [60] in various records noted winter flocks of up to twenty-six birds. The DOS annual *Derbyshire Bird Reports* provide useful insights into the trends, such as Garton's report (2024) [61] on the 2023 season. Interestingly, in 2023, there were no confirmed breeding records anywhere in the county, and overall, there were fewer records (81, down from 104 in 2022, 113 in 2021, and 230 in 2020). Small flocks were reported at numerous sites scattered across Derbyshire.

South of the main South Yorkshire study area, *Birds of Nottinghamshire* was edited by Dobbs in 1975 [62] and makes no reference to parakeets. By 2019, however [63], the situation had changed. A first record, a presumed escapee, was noted in January 1968 at West Bridgford, but there were no further records until the 1980s. Two birds were noted at Clumber Park in winter 1980, and again in 1981, followed by a "steady trickle" of records since then. Until 2019, there were no confirmed breeding records and in the forty-two sites reporting parakeets, the largest flocks only numbered seven birds.

Writing about Yorkshire, Mather (1986) [64] noted seventeen records in the county between 1975 and 1981, with nine at a coastal migration hotspot, Spurn Point. All these were assumed escapees from captivity. Occasional breeding was reported in West Yorkshire, and Wilson and Slack, in 1996 [65], noted the importance of documenting future records because of the possibility of feral, breeding populations becoming established. By the late 1990s, reports of parakeets were widespread enough to include Yorkshire. Rhodes (1988) [66] collated records east of the study area and again made no reference to parakeets. Across Yorkshire, the Yorkshire Naturalists' Union produces comprehensive annual accounts in the *Yorkshire Bird Report*. Taking 2017 [67] as an example, there were no parakeets reported. However, in 2020 [68], widespread breeding was noted, with estimated populations of *c*. 80 in Hartlepool and *c*. 60 in Stockton, but few across the east of the county. Sheffield was noted as a stronghold for the Yorkshire population, with Northern General, Norton Woodseats, and Graves Park as significant sites. Breeding was reported in Huddersfield, Halifax, Swillington near Leeds, Barnsley, Longley (Sheffield), and Graves Park (Sheffield). The Sheffield Bird Study Group's annual *Birds of the Sheffield Area* (2020) confirmed breeding at Mayfield Valley, Graves Park, Renishaw Park, and Wentworth in Rotherham.

3.1.2. The Greater London Case Study

For Greater London, Self [16] provides a definitive account of parakeet status and history. The first breeding was noted in 1930 in Epping Forest, seemingly a one-off, with no more records until the 1960s. The reason for the sudden upturn in reports of free-flying parakeets was the ban on bird importation being lifted and their subsequent escape from aviaries. By 1969, they were recorded in Croydon and Shirley, and a pair bred in 1971. In the early 1970s, they were found around Wraysbury, with up to ten birds being reported as roosting at Runneymede. These latter birds were escapees from a Sunbury-on Thames pet shop around 1970. Also in 1971, parakeets were breeding in Bromley and Esther, and a

small population was established. Further birds also escaped from an aviary at Syon Park following a window being broken by aircraft debris.

By the mid-1970s, parakeets were reported in the London region, Surrey, Essex, and Kent, and by late 1980, up to 110 were roosting in Beckenham. In 1982, parakeets bred around Shepperton Studios, probably triggering the 'urban myth' of their escape from the 1950s film set of *The African Queen* [4]. During the 1980s, some established populations reduced, and colonies became extinct. There were high counts of between 40 and 60 birds at Hither Green Cemetery and 51 at Wraysbury. At this time, 1984, ring-necked parakeet was added to the British List of breeding birds, with an overall population of around 1000 birds, almost all in south-east England. There was a temporary population in Manchester, but it did not survive long. The 1985 population at Shepperton numbered around 60, and a single bird was reported from Inner London (Battersea Park), 1986. Some communal roosts were growing, with 142 birds being reported at Wraysbury in December 1989.

The early 1990s population was still mostly in south London, with a few breeding reports north of the river at Osterley Park and Staines Moor. With a population numbering around 600, the birds were also moving eastward in areas like Havering. By 1992, the breeding population was estimated as at least 150 pairs, with the overall population increasing to around 1700 by 1994. At this time, the Elmbridge roost was adopted as a guide to longer-term population growth, with their numbers in December 1994, being about 697 and birds travelling over long distances. The Hither Green roost was now over 200 birds, with the wider population reached up to 3000 by 1997, including 1500 roosting at Hersham. Additionally, the south-west London population was growing.

By the new millennium, Self [14] observed that, over a thirty-year period, the situation had changed significantly, with parakeets now being widespread and often common residents across much of London. Long-lived, intelligent, and highly adaptable, with a population of 4000, including 3000 roosting at Hersham, parakeets frequently utilise bird-feeders. Interestingly they still did not occur significantly in north London and were generally absent from rural zones and central London. In the early 2000s, the Hersham roost doubled to 7000 birds, and the colonisation of central London was underway, with over 20 in Kensington Gardens and Hyde Park. Parakeets were also observed in Battersea Park, Regent's Park, and St James's Park. The felling of trees in the area caused the Hersham roost to be abandoned in 2006, with this shift leading to 6000 birds gathering at Stanwell. Numbers here dwindled as smaller satellite roosts established, making reliable counts difficult. At around 2010, the population was conservatively estimated to be around 10,000 and probably over-optimistically estimated to be about 30,000. Self [14] then suggested that the London population was the only significant gathering in Britain, aside from a small population (a few 100) in Ramsgate, Kent. However, as seen from the distribution maps and the citizen science project, the population in the Sheffield area was already growing substantially, increasing by 696% from 1995 to 2008. Presumably, this changing status had not yet triggered wider awareness of the emerging population.

3.1.3. Records from the Citizen Science Project

From around 2006 to 2025, appeals in local and regional newspapers, in magazines, on local radio, and on social media resulted in around a hundred reports, mostly from Sheffield and South Yorkshire but some from further north and east in Yorkshire and beyond. These are summarised in Table A1 in Appendix A, and provide context for the study. The records end around 2018–19 because of the rapid increase in regular sightings across south and east Sheffield of flocks of 20+ and of numerous breeding pairs in local parks and woodland. By 2020/2021, there was a winter roost of 100+ in modern landscape tree and shrub plantings in Sheffield's Lower Don Valley. By 2020, the reputation of the breeding populations in

Graves Park (Norton, Sheffield) was such that birdwatchers were travelling to view them from as far away as Derby to the south and Wakefield and Leeds to the north.

In Figures 4 and 5, records are presented as coloured squares, with each representing a 1-km^2 location, © Ian Rotherham.

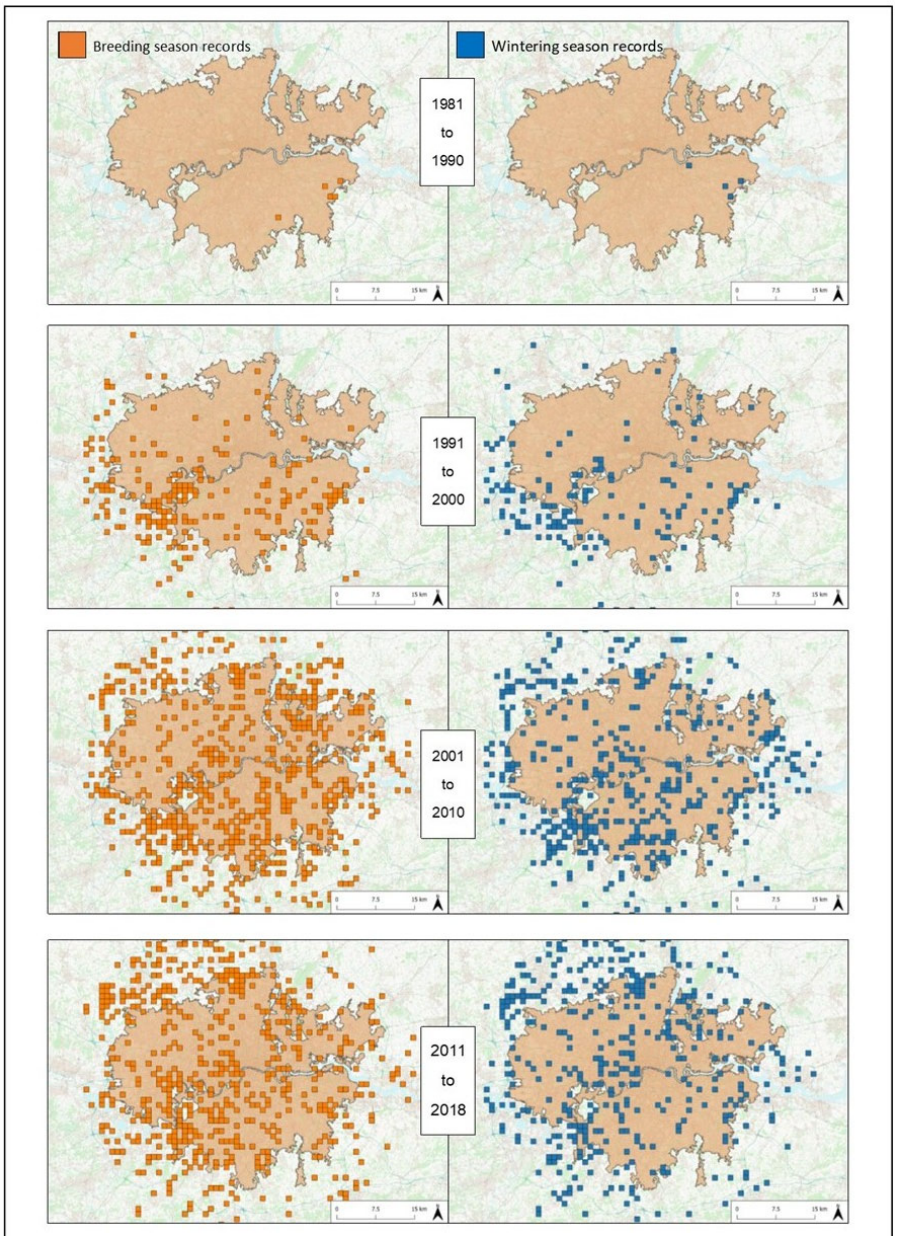


Figure 5. Records of ring-necked parakeets in Greater London. Records provided by Greenspace Information for Greater London Authority, December 2017. Contains Ordnance Survey data © Crown copyright and database right. Reproduced in QGIS 3.2.

The questionnaire was online for four weeks in December 2017 to generate responses for the survey and has continued to be passively available since that time (Watchman, 2018 [19]). The survey for this study period generated 422 responses, including 114 from the Sheffield region (29 conservation professionals and 71 members of the public) and 84 from the Greater London comparator area (42 conservation professionals and 58 members of the public). As might be expected, many of the public responses also indicated a high level of interest in nature and wildlife; therefore, this was neither a random selection nor necessarily representative of the wider public. For the Sheffield sample, around 75% of respondents described their area as urban, and for Greater London this rose to 89%. Figure 6

shows the frequency with which respondents encountered parakeets and highlights the big difference between the Sheffield area and Greater London, with sightings in the latter being observed by 40% of participants both weekly and daily. For the Sheffield area, this figure was around 8%. This difference was highly significant ($p < 0.001$).

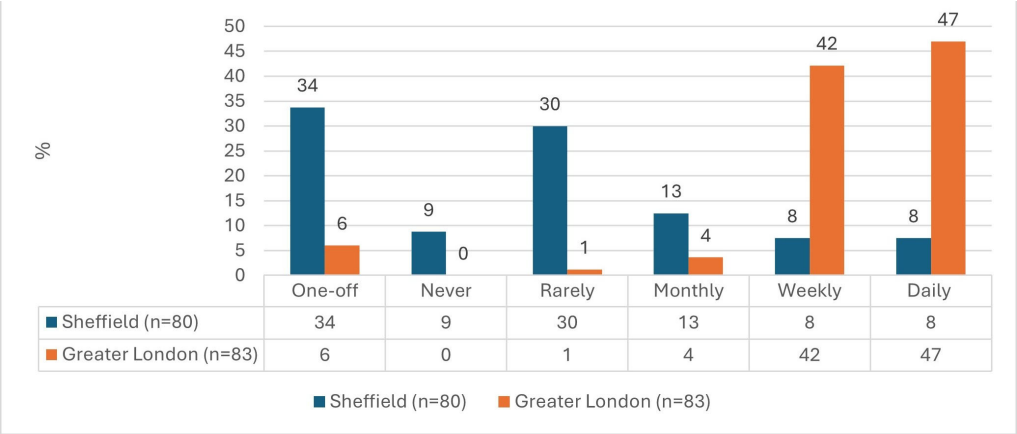


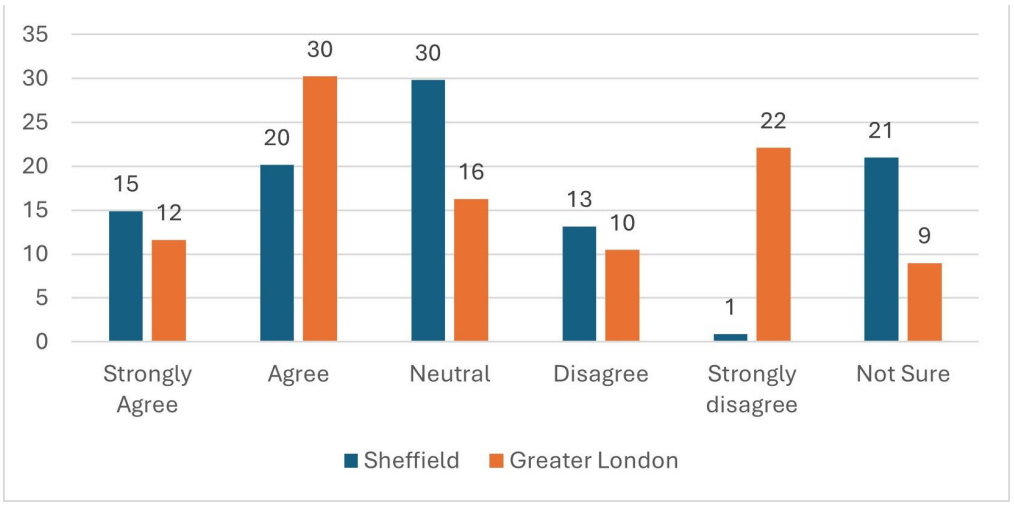
Figure 6. Frequency of parakeet encounters: how often respondents in Sheffield and Greater London see ring-necked parakeets.

Residents were asked how they regarded parakeets in their area—positively, negatively, or not at all.

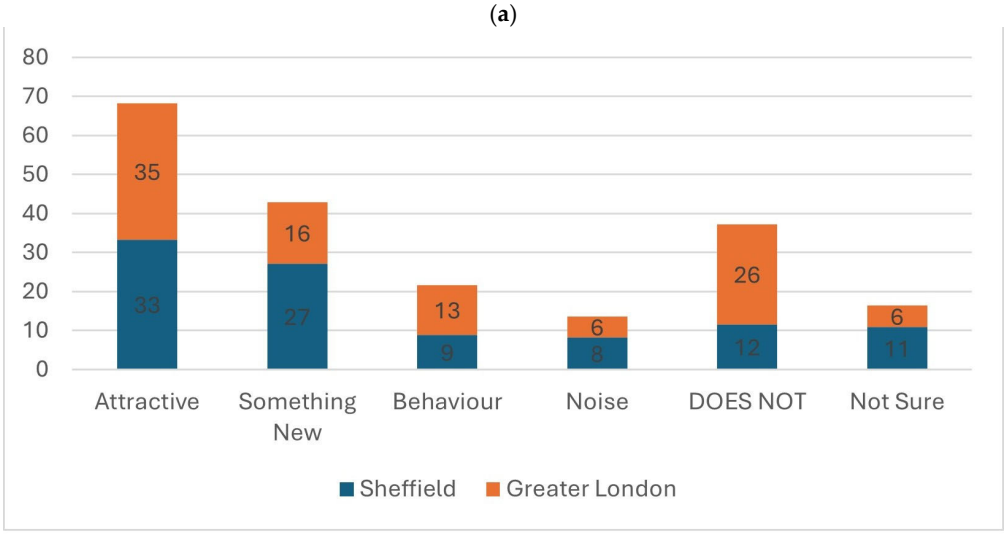
In both regions, around a third of people found parakeets attractive but nearly half (50% London and 41% Sheffield) were concerned about adverse impacts on native wildlife (Figure 7a,b). Noise impacts were higher in London, at 23%, compared with Sheffield, at 11%. Significantly, 35% of the Sheffield respondents were unsure about the impacts, whereas in London this reduced to only 8%. For both regions, conservation professionals were less positive about parakeet sightings than the public, and this difference was significant ($p < 0.05$).

Respondents commented on the statement that parakeets are attractive birds which enhance local avifauna (Figure 8). The results to this question showed strong differences between the study areas. Interestingly, 42% of London respondents felt parakeets were a positive addition (35% in Sheffield) but 32% disagreed or strongly disagreed (significant difference at $p < 0.001$). The latter response was markedly reduced for the Sheffield cohort, and 21% remained undecided.

Respondents were then asked whether parakeets have a negative impact on the local nature (Figure 7a,b); the findings are shown in Figure 8. Over half the London replies stated that parakeets had a negative impact, but in Sheffield agreement with this statement was only about a quarter of the total responses, with just 3% strongly agreeing with the statement. The differences were significant at $p < 0.001$. In Sheffield, 35% did not feel there was a negative impact and 30% were either neutral or disagreed. Interestingly, conservation professionals in the Sheffield area tended to agree that parakeets were negative (counter to public opinion; difference significant at $p < 0.001$). In Greater London, there was little difference in opinion between professionals and the public.



(**a**)



(**b**)

Figure 7. (**a**) Opinions on the impacts of parakeets: Is the ring-necked parakeet an attractive bird that complements our natural environment? Responses shown as %. (**b**) Opinions on the impacts of parakeets: How does the ring-necked parakeet complement our natural environment?

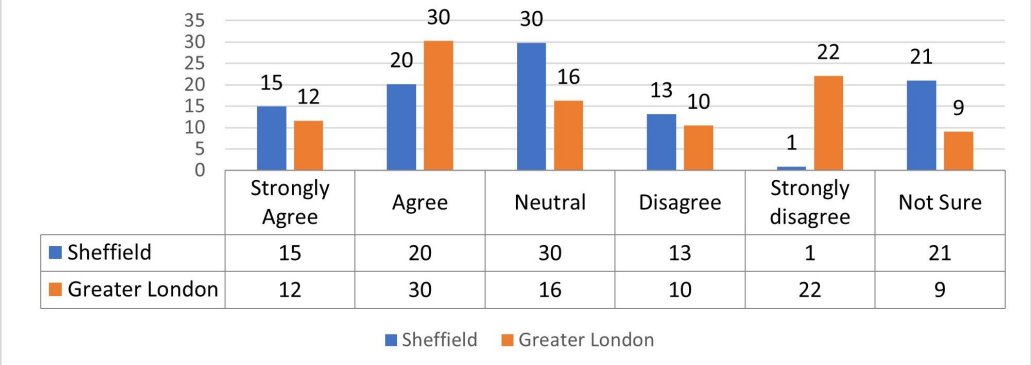


Figure 8. Opinions on whether parakeets are a positive addition to the local avifauna: Parakeets are attractive birds that enhance our natural environment. Responses shown as %.

Figure 9 presents opinions of whether parakeets adversely affect local avifauna.

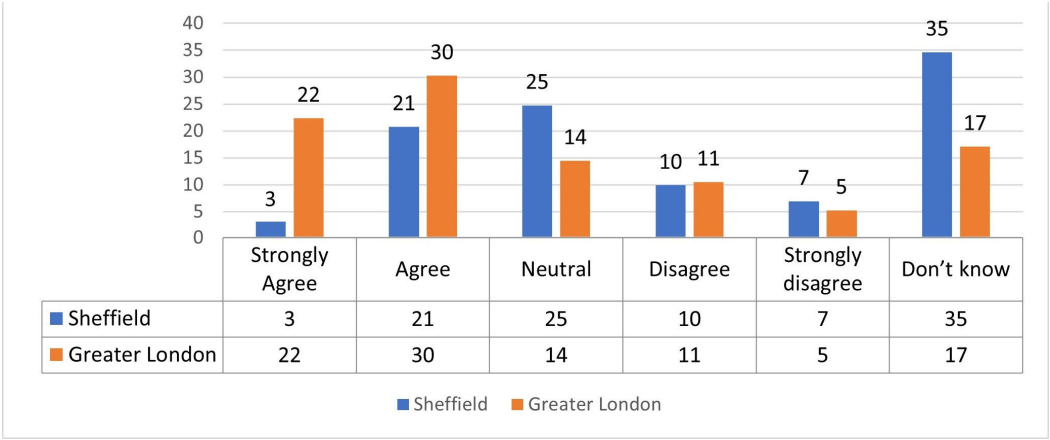


Figure 9. Opinions on whether parakeets have negative impacts on local avifauna: Parakeets have negative effects on local nature. Responses shown as %.

Figure 10 displays information indicating a very significant difference between attitudes of concern towards the parakeets and the expansion of their population. Greater concern was shown from Greater London, with respondents being significantly more likely to strongly agree that they are concerned about the expansion of parakeet population than those in Sheffield ($p < 0.05$). In Sheffield, conservation professionals were more inclined to be concerned about parakeet expansion than the public (significant at $p < 0.001$). The attitudes of conservation professionals and the public in Greater London were not significantly different.

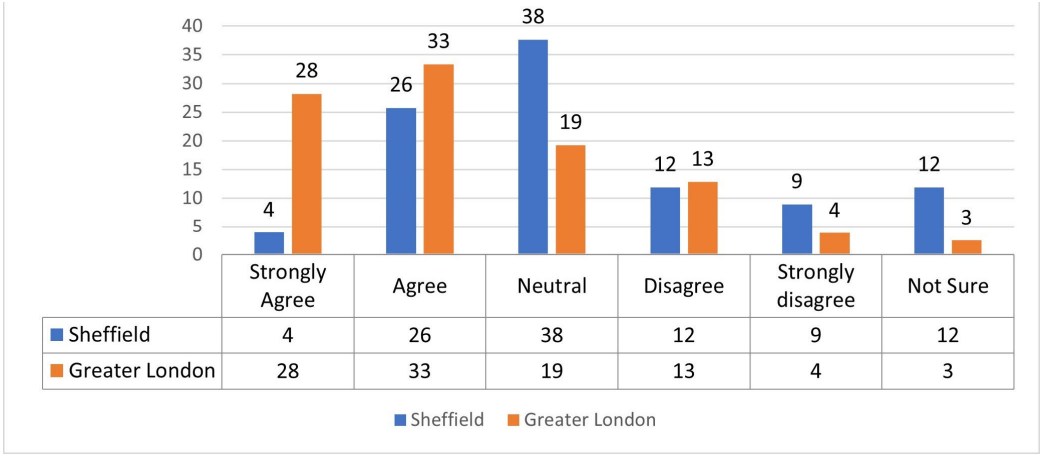


Figure 10. Level of concern about increasing numbers and spread of parakeets. Responses shown as %.

In both Sheffield and Greater London, there was a positive correlation between respondents who enjoyed seeing parakeets and those who felt they were a positive addition to the local avifauna (Sheffield: 0.723; Greater London: 0.877).

Indeed, many respondents commented in very positive ways, e.g., in Sheffield, "*Fine, be nice to see them more*" and in Greater London, "*Perfectly happy. . .*" However, there was also a significant negative correlation between the enhancement of local avifauna and concern about negative effects they might have (Sheffield: −0.454; Greater London: GL: −0.738). There were also very negative statements, e.g., in Sheffield, "*Very negative*", and Greater London, "*I think they are vermin and should be culled immediately.*"

Concerns regarding the impacts of the parakeet population's expansion were evident in both regions but Greater London showed this more strongly, with positive correlations: Sheffield: 0.453; Greater London: 0.740. A respondent from Sheffield worried about

parakeets displacing native wildlife: "*I find them attractive but am concerned they may have a 'grey squirrel' effect.*" A Greater London resident was concerned "*..... about the rapid recent increase.*" Other comments from Sheffield included: "*Quite like seeing them. . .*" and "*Conflicted—I'm really not sure.*" Responses from Greater London included "*Intrigued but neither positive nor negative*" and "*Ambivalent as a joy watching them, but it is a guilty pleasure.*"

Figure 11 presents responses about the levels of concern over non-native species generally. There was no significant difference between the two study regions. Overall levels of concern were around 70% to 80%; however, in both, conservation professionals were significantly more worried than the public ($p < 0.05$).

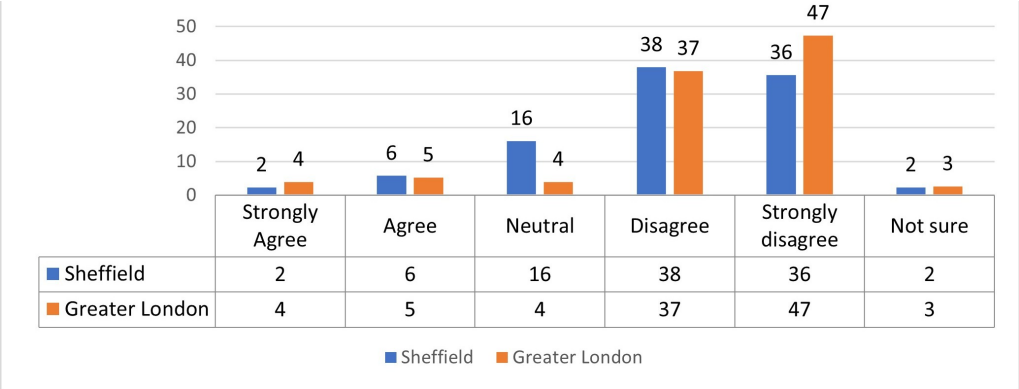


Figure 11. Respondents' level of concern over invasive non-native species: I have little concern about invasive non-native species. Responses shown as %.

Feedback on the issue of invasive non-native species generated three main assertions:

(1) The need to recognise 'menacing' and 'detrimental' impacts of these species on ecosystems. Sheffield: "*I might be able to walk up the valley and see the beautiful native red squirrel. Unfortunately, because of the impact of the non-native grey squirrel, I can no longer do that.*" Greater London: "*They should all be eradicated especially this species. New Zealand has realized this; we should follow suit before it is too late.*"

(2) Species should be 'judged' on their merits on a case-by-case basis in relation to their potential negative impacts to native wildlife. Sheffield: "*If damaging to species—plants or animals then I feel invasive, non-native wildlife would need to be controlled.*" Greater London: "*I feel if they are detrimental to our native wildlife then something should be done.*"

(3) Change is inevitable and part of a dynamic and evolving ecosystem. Sheffield: "*As the world changes, it is harder to control—crayfish, harlequin ladybirds, grey squirrels. . . they are all here and 'part of the landscape' that I have grown up with.*" Greater London: "*No problem with it. What right do we have to decide what lives or dies?*"

A final point expressed was the need to increase public education and awareness.

Following from the levels of concern about non-natives was the issue of control if deemed necessary. Figure 12 presents feedback on this. There were significant differences ($p < 0.05$) in attitude towards control measures for invasive non-natives between the two study areas. Greater London feedback from conservation professionals was strongly in favour of controls compared to the Sheffield area (significant at $p < 0.001$). The public showed no significant difference between the two areas. Overall feedback in Greater London showed strong support for control measures.

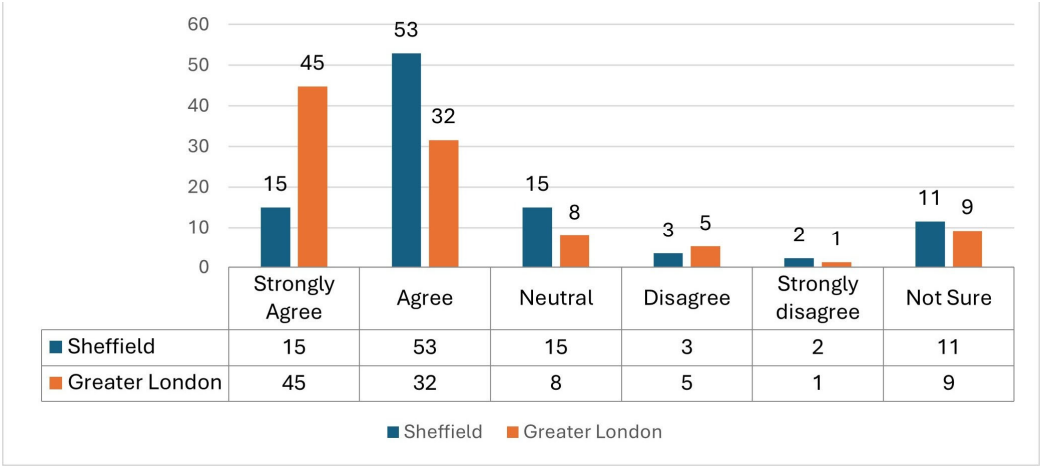


Figure 12. Responses to the possible control or management of invasive non-native species: Invasive non-native species should be controlled or managed. Responses shown as %.

Taking the issue of control further, Figure 13 shows feedback on culling as a control intervention. Here, there was a very significant ($p < 0.001$) difference between the two areas; Greater London was far more accepting of possible culls.

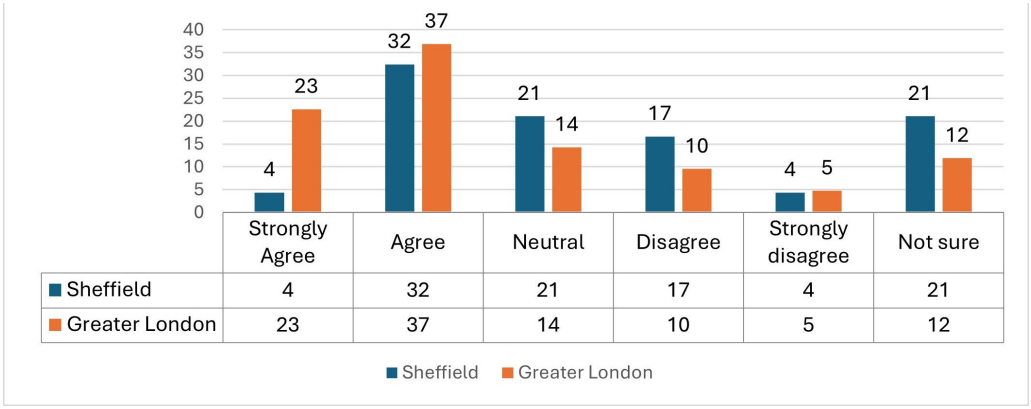


Figure 13. Culling as a method of control: Culling is an acceptable method of control. Responses shown as %.

If invasive species such as parakeet are deemed to require control, and if culls are an acceptable method, there is the question of who pays. Feedback on this question is presented in Figure 14. Responses from Greater London were significantly more inclined to strongly agree ($p < 0.05$) that such costs were a necessary expense.

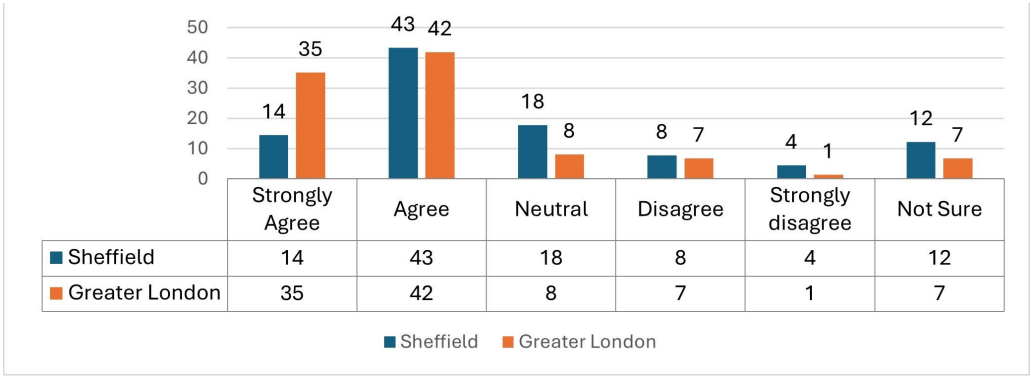


Figure 14. Funding invasive non-native species management: £1.7 billion per year to manage invasive non-native wildlife is a necessary expense to protect our environment. Responses shown as %.

When asked about the funding to control parakeets, significant differences were, again, found between regions ($p < 0.05$). Figure 15 presents clear differences between the extremes of agreement on this topic, and secondary testing revealed that Greater London respondents were more inclined to strongly agree with the need for funding than respondents in Sheffield ($p < 0.05$). A significant difference was observed between experts in Sheffield and Greater London and the public about the need for financing for parakeet control, with those in Greater London advocating a greater need for funds ($p < 0.05$). Figure 15 shows findings concerning the funding of possible parakeet controls; feedback from Greater London shows significantly ($p < 0.05$) stronger acceptance than Sheffield.

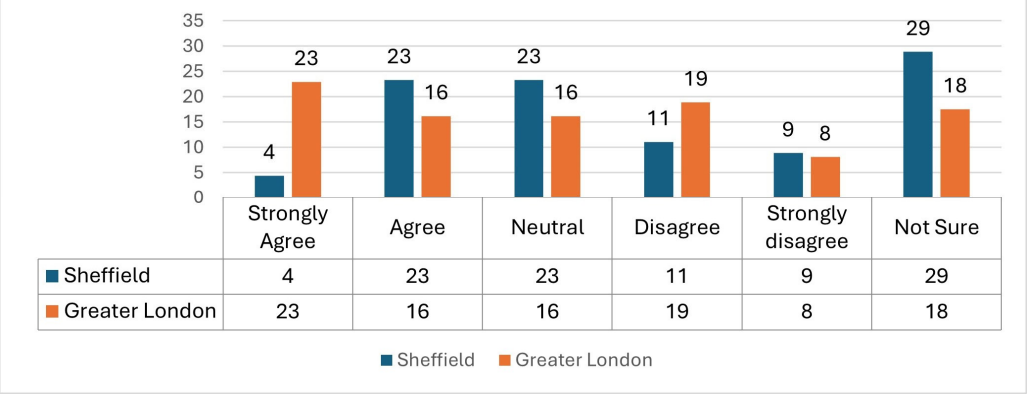


Figure 15. Funds to control parakeets: Funds should be made available to control the ring-necked parakeet. Responses shown as %.

Respondents who considered there to be a need for the control of invasive non-native species showed positive correlations with acceptance of culls (Sheffield: 0.337; Greater London: 0.652). It was suggested there should be measured, case-by-case judgements about individual species, with any culling performed humanely. Furthermore, other options like biological control should be investigated before active removal is undertaken. In some cases, culling was accepted, e.g., in Greater London—"*Needs to be done to reduce damage to the environment*"—but with regret, e.g., in Sheffield—"*I think it is sad that culling is necessary.*"

There was a strong correlation between people who were unconcerned about invasive non-native species and preparedness to support controls (Sheffield: −0.311; Greater London: −0.686). The potential for 'new ecologies' to be formed in dynamically changing environments was noted, along with the need to accept ecosystem changes, which should be left to find a balance. Sheffield: "*It's barbaric to interfere in general. The reasons for such actions should be an absolute necessity and only when risk to other wildlife has been proven*" and "*The world is eternally evolving… just as we are too.*" Greater London: "*Leave them alone.*" Interestingly, the findings indicate that many respondents view parakeets as part of a new ecology. Furthermore, they suggest that, where possible, they should be treated as a new recombinant ecology and integrated into our ecosystems. Where this is not possible, then humane methods should be employed but with reference to sound scientific justification for their proposed management.

Interestingly, whilst responses to the popular media survey were mostly positive towards seeing and recording this exotic addition to local avifauna, some of the later comments showed awareness of issues. In particular, members of the public with prior exposure to parakeets in London expressed concerns about potential impacts on indigenous bird populations.

4. Discussion

4.1. Issues, Perceptions, and Establishment

Perceptions of invasive non-native species were studied using different techniques to characterise stakeholders, including those involved with species management, and the wider public [30]. In this research, unselective respondent participation was achieved through social media and the snowball methodology [51], with transformed data representing conservation professionals and the public. This is essentially a preliminary study raising issues about population increases, public and professional perceptions, and the acceptability of possible control interventions. It tests the hypothesis that the level of exposure to an attractive and exotic, invasive, non-native species affects stakeholders' responses. The structure of the questionnaire and the themes which emerged broadly matched the key elements of the conceptual framework developed by Shackleton et al. [8].

Data for the two study areas, (Sheffield and South Yorkshire and Greater London), were used to create time-sliced distribution maps showing the contrasting spatial expansion of parakeets across these regions. The literature review indicated three key variables influencing the expansion and success of parakeets in areas with successful establishment:

1. Firstly, the probability of their entering the ecosystem should be considered. Human population density may directly influence this through higher pet ownership in more densely populated areas. This translates into a greater chance of accidental release or escape of pets [26,69].
2. Secondly, whilst parakeets are inherently adaptable, flexible foragers, an abundant food supply throughout the year from enthusiastic, nature-loving humans, is an enormous advantage. Parakeets are known to use bird-feeders mostly in the breeding season and during the winter. This enables higher breeding densities of birds to be established and maintained [47]. Especially during the breeding season, food availability may limit spread into more rural areas.
3. Thirdly, Strubbe and Matthysen [70], showed the abundance of parakeets to be highest in suburban and urban forests, with the proportion of breeding birds correlated with the density of potential nest sites. Parakeets require a suitable breeding habitat, such as the cavities provided by older trees in forests, woods, gardens, and city parks.

4.2. Novelty and Attractiveness

The study found that many respondents from both Sheffield and Greater London viewed the parakeets as attractive. This, together with the novel attributes perceived by local people, is associated with pleasure in seeing these spectacular, exotic birds. This would not otherwise be experienced except on long-distance touristic travels. The ring-necked parakeet falls into the category of an attractive and locally unique bird but one which divides opinions and generates varying attitudes and perceptions. With the Sheffield population, for example, birdwatchers travel fifty miles or more to see them.

This power of an attractive, novel species influences how people respond to presence in both locations. The emergence of parakeet admirers mirrors reactions to some other non-native invasive species; for example, grey squirrels (*Sciurus carolinensis*). This species was deliberately released from North America as an attractive addition to British wildlife, with attempted introduction occurring as early as 1876 at Henbury Park, Cheshire. There are records of grey squirrels as early as 1828 [9], with consequent establishment and 'naturalisation' noted. Between 1937 and 1945, its range expansion was about 2000 square miles a year [71]. Whilst many land managers, especially foresters, regard grey squirrels as vermin, others, including some environmental managers, view them as 'cute' [48]. Ring-necked parakeets elicit similar extremes of reaction although they have not yet matched grey squirrel in terms of colonisation. As with many invasive non-native species, there are

other factors involved, such as their being potential vectors of pests and diseases, but this was not a focus of the current study.

The survey shows how responses change with time, abundance, and hence, exposure. In Greater London, parakeets are more abundant and widely naturalised. Fewer people described them as 'something new', with the bird becoming a familiar part of the regional avifauna over time. Another example of acceptance of a non-native bird that is now superabundant is the spread of common pheasant (*Phasianus colchicus* L.) in Britain [72]. For instance, a study in Jersey by Rice [24] showed how common pheasant, whilst having perceived negative impacts on the local flora and fauna, was viewed positively, adding to the appeal of the countryside. Others view the huge exotic biomass of introduced pheasants in Britain as highly detrimental [24], but around half the residents thought the species should be legally protected. In the Sheffield region, ring-necked parakeet is a more recent, far less abundant coloniser, with local residents considering it as 'something new' and exotic.

4.3. Parakeet Impacts

Feedback from Sheffield indicated that local people were unsure of the negative impacts or whether parakeets enhanced the natural environment. This was also indicated by the popular media survey. Views on this and related topics were more ambivalent than those from the London-based sample. Greater London opinions were expressed more confidently, presumably reflecting greater exposure. As might be expected, Bemner and Park [73] found that those with previous knowledge or those working with conservation organisations were more aware of non-native species than the public. Other studies [48] found those working in environmental projects to be more inclined to see 'attractiveness' or 'charisma' as poor judgement criteria.

Awareness and exposure combined may influence attitudes and concerns regarding parakeets. This study showed a that large proportion of respondents were concerned about parakeets affecting native wildlife, and the existing research suggests potential impacts throughout the introduced range. These include nest competition with other cavity-dwelling birds like nuthatch (*Sitta europaea*) [44,45]. A Spanish study by Hernández-Brito et al. [74] showed 81% declines in greater noctule bat (*Nyctylus lasiopterus* Schreber) over fourteen years, with ring-necked parakeet favouring similar tree cavities for nesting to those used by roosting and breeding noctules. Over the study period, parakeet nests increased by twenty times and ring-necked parakeets were very aggressive towards noctules in cavities, with encounters often resulting in noctule death. Overall, the results indicated significant impacts through the displacement of native species. However, whilst the findings support some detrimental effects of ring-necked parakeets, ascertaining specific impacts can be difficult [74], with some being assumed rather than evidenced.

The attitudes of people in Sheffield and Greater London towards invasive non-native species were similar across the range of respondents to the online survey. Although concerns were expressed, many individuals were cautious with regard to particular impacts. For example, regarding concerns about parakeets affecting agriculture and orchards, Strubbe and Matthysen [45] noted that they largely avoid these areas, especially during breeding season. Concerns regarding their further expansion and economic impacts need to be carefully considered before making judgements. Strubbe and Matthysen [70,75] applied detailed population modelling to assess this. Stakeholder feedback from the present study reflects respondents' views that invasive, non-native species should be assessed on a case-by-case basis before actions to intervene with controls. The survey showed a range of attitudes towards control methods, varying from strong support for control through to acceptance of biological change, along with the prevention of and adaptation to invasions.

Some stakeholders in both Sheffield and Greater London agreed with control measures for invasive non-native species. However, the responses from Sheffield were less strong than those from Greater London regarding the possible methods. Both groups noted the possible biological control of some pest species, providing positive support regarding the reduction in target species but opposition because of the unknown consequences [76]. Various methods suggested by respondents included sterilisation to reduce birth rate, poisoning, and consideration of ways to adapt the environment to prevent initial settlement.

It is noted that monk parakeets (*Myiopsitta monachus* Boddaert) (small, green, South American parrots) were successfully controlled in Britain [21,77,78]. This was another species imported during the twentieth-century exotic pet trade and established in the wild. However, the behaviour and associated issues differ markedly between the two species. Unlike cavity-nesting ring-necked parakeets, this parrot builds large communal nests of twigs, often on electrical utility structures, risking electrical overheating and fire hazards. By the late 1980s and 1990s, several colonies were wild at various locations, mostly in south-east England. In 2009, the English governmental wildlife agency, Natural England, added feral parakeets to the 'general licence', the list of wild species that can be lawfully culled without specific permission [79]. Feral monk parakeets (*Myiopsitta monachus*) were also added to the licence. In 2011, following recommendations from the Non-native Species Programme Board (the government's advisory body) that steps be taken to prevent further population increases in monk parakeets, the UK undertook a 'rapid response' programme. This mixed shooting with trapping to relocate and rehome the birds. There was already an established practice based on work in the USA, which employed nest destruction and efforts to impose reproductive control, along with modifications to possible nest-sites to discourage nesting [77]. However, in England, this action triggered major campaigns and lobbying from local residents who did not view these exotic parrots as a threat and felt they should be left alone [21]. These sentiments mirrored many of those expressed in the present survey of Sheffield and Greater London.

4.4. Acceptance of Controls and Culls

In March 2021, the Department for Environment, Food and Rural Affairs stated there was no general UK cull planned for ring-necked parakeets [80]. Campaigners lobbying on behalf of the feral populations raised issues of excessive costs to remove small numbers of a bird with a limited apparent impact on native wildlife. Furthermore, if these birds needed to be removed, then why was the pet-shop trade still able to import them in the first place? Respondents from both Sheffield and Greater London expressed concerns about the use of ineffective strategies to control or remove invasive, non-native species. It was noted that prevention was better than cure, although culling can be effective. However, the latter is highly controversial, especially in urban residential locations where the actions are highly visible. The survey indicated strong views on culling were held by stakeholders in both Sheffield and Greater London, but where parakeet populations were higher, there was more acceptance. There was a clear connection between respondents concerned about invasive, non-native species generally and tolerance of parakeet culls.

Dunn et al. [22] found many people, unaware of their negative impacts, liked exotic species such as grey squirrel and disapproved of control methods like culling. This applied to many feral species culls, including small-scale (e.g., monk parakeet (*Myiopsitta monachus* Boddaert)) and large-scale (e.g., ruddy duck (*Oxyura jamaicensis* Gmelin)) populations. This survey indicates similar responses for ring-necked parakeets.

Nevertheless, the survey suggests that when the public has greater exposure to potentially disruptive, feral species, their acceptance of controls may increase to mirror those of conservation professionals. Whilst levels of concern over parakeets may not yet have

reached that threshold in the UK, the Greater London situation shows that public and professionals are more closely allied, with some stakeholders advocating controls. By contrast, Sheffield, where parakeets are fewer in number and still considered novel, had less support for controls.

Attitudes to potential controls mix issues of perceptions and ethics with economics. In Sheffield, the survey showed less acceptance of spending large sums (an estimated GBP 1.7 billion per year) to manage non-native, invasive species [20]. Greater London responses indicated stronger agreement that these costs were necessary, but even here there were serious doubts. Some respondents believed strongly that management was ineffective and ethical issues regarding public spending meant that, particularly in times of austerity, funding should prioritise social services like schools and health care. Sheffield responses were similar but less strongly held, and less supportive of the need for control. Respondents suggested alternative strategies, like habitat management to favour threatened species (red squirrel, for instance), as opposed to culling invaders [81]. A final issue was the suggestion that preventing initial colonisation was better than culling established populations. Furthermore, using robust tools to identify and prioritise the management of invasive, non-native species was noted as especially important. This is even more true if interventions are to be supported by the wider public [82]. With localised populations established nationally, ring-necked parakeets are highly visible and easily observed. In this sense, they might fit the potentially successful eradication programmes proposed by Booy et al. [82]. However, a risk assessment would need to consider cost and effectiveness together with the likelihood of public outrage [44,74]. In any serious consideration of potential control programmes, feedback from public and professionals indicates the need for good, reliable information that is logically presented, together with effective, cost-effective proposals. Even with all these in place, public feedback suggests significant opposition to interventions such as culling. The case studies indicate such controls would be most unpopular in areas where the birds are in the earlier stages of establishment. However, in regions where high populations are already established, many people will have grown to accept these exotic birds as part of the 'natural' recombinant avifauna [13,83].

4.5. Future Scenarios and Citizen Science

Habitat and environmental suitability may limit the spread of these birds. In more northerly regions, relatively low summer temperatures depress breeding success but climate change with global warming shifts the balance to favour parakeets. Winter food availability in rural areas may be problematic, but in cities, abundant bird-feeders solve this problem, with birds quickly adapting to peanut-holders and fruit left on trees, and in woods, parks, and gardens, and even taking green acorns before they ripen. For ring-necked parakeets, the availability of tree-hole nesting cavities may prove a limiting factor in some areas. However, in Greater London, the city's famous parks provide abundant nesting sites and Sheffield, for example, has over eighty ancient woods with suitable habitat. Mature beech trees with rot-holes are especially favoured.

Citizen science research indicated how many people in Sheffield and across the wider study area are amazed and excited to see parakeets. This includes the relatively recent arrival and likely nesting of Alexandrine parakeets (*Psittacula eupatria* L.) (Figure 16). The study also helps demonstrate how citizen science recording of an exotic, very apparent bird species can provide useful insights into colonisation. Many reported sites and sightings were overlooked by expert bird recordings. Interestingly, the results up until 2025 still included new reports of individual birds or small flocks at sites across the region and, for the first time, some negative views from concerned local citizens. The most strongly voiced worries were by correspondents with prior experience of abundant parakeets in Greater

London. Clearly, the experience of large flocks of parakeets carried through to perceptions when citizens relocated to Sheffield with its growing parakeet numbers. Concerns generally related to perceived impacts on smaller birds that share garden feeders. There are relatively few direct observations of aggression, although the compendium by Self for London [16] noted a green woodpecker (*Picus viridis* L.) that was ejected from its nest-hole by ring-necked parakeets. In Graves Park, Sheffield, another exotic invasive species, the grey squirrel (*Sciurus carolinensis*), was observed robbing a nest-hole of young parakeets despite vociferous displays by the parent birds.

Figure 16. Alexandrine parakeet © Ian Rotherham.

5. Conclusions

Both online surveys and citizen science engagement through popular media proved effective in generating relevant data and other information on parakeet invasion. Furthermore, the citizen science study generated new information (both current and historical) which was missed by formal bird recordings. This approach can help provide records of the progress of invasion, but also generate qualitative insight into views, opinions, and reactions to the species and its presence.

There were significant differences between levels of concern about invasive, non-native species, particularly parakeets, between the two regions. Whilst most people in both areas felt these were interesting, attractive birds, more people in Greater London regarded them as a problem. They were also more open to the implementation of active control measures if necessary. Like many other non-native species, parakeets generate different responses within the community, and most people seem to like them. As might be expected, professionals in conservation fields were more aware of likely or potential ecological problems and issues than the public and supported controls. The responses regarding the more recently established population in the Sheffield region often showed excitement at the arrival of these spectacular, intelligent, exotic birds (Figure 17), and respondents were more inclined to tolerance. In Greater London, whilst most respondents felt these were attractive, interesting birds, with parakeets being present over a wide area and in high numbers, there was greater concern about their adverse impacts. It is suggested that these regional differences relating to the degree of establishment may close over time. In the Sheffield region, ring-necked parakeets have only really become a visible presence in the last twenty years. They have been recorded since the 1980s but remained very rare, perhaps limited by low summer temperatures. In London, establishment has been on-going since the late 1960s and, in some places, they are now superabundant.

Figure 17. Parakeet roost in Sheffield, February 2023 © Andy Deighton.

Respondents from the local public in the two regions expressed concerns about impacts on native wildlife, with opinions varying from individuals accepting and enjoying parakeets to those happy to see them removed. Professional conservationists and members of conservation groups were generally less tolerant of the birds and more favourably inclined towards controls. In Greater London, public and professional views were more closely aligned, whereas in Sheffield the public remained largely unconvinced by the need for controls or eradication. The original suggestion that there might be a shift in opinions and tolerance of control measures with increasing numbers and greater exposure to contact seems confirmed.

However, even if controls were deemed necessary, issues of acceptability, ethics, economics, and effectiveness were raised in both regions. It was also suggested that better education was important if the public were to be more effectively engaged in debates about invasive non-native species. It seems, at present, that there is widespread ignorance of the species and the issues. Looking at the example of a visible species such as the parakeet, many members of the public like them and may continue to do so even when counter arguments are presented. This is similar to how people respond to invasive animals such as grey squirrel and plants like Himalayan balsam. Finally, these feral populations are primarily urban birds, and previous research has indicated that urban communities often welcome attractive, entertaining, spectacular exotic species. Furthermore, they dislike culling.

Author Contributions: Conceptualization, I.D.R.; Methodology, I.D.R.; Validation, I.D.R.; Formal analysis, I.D.R. and M.J.W.; Investigation, I.D.R. and M.J.W.; Resources, I.D.R.; Data curation, I.D.R.; Writing—original draft, I.D.R.; Writing—review & editing, I.D.R.; Supervision, I.D.R.; Project administration, I.D.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data are available on request or via FigShare.

Acknowledgments: Numerous colleagues and community volunteers have assisted and provided comments and data. The recording centres, as noted, provided historic and current datasets.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Reports of ring-necked parakeets from the Sheffield-based citizen science survey.

c. 1990	Aviary in Sheffield 5 near Longley Park	African ring-necked parakeets escaped from aviary.
1980s–1991	* Moor Lane, Bishopthorpe, York	Small flock in gardens with fruit trees
1999	Carterknowle Road, Sheffield	One sat on television aerial
1999	* Nidderdale, North Yorkshire	Up to 4 visiting garden to feed [one with an eye infection died]
2005-9	* Cottingham, East Yorkshire	Several flying in area and roosting around St Mary's Church
2006-9	Near Park Road, Hartlepool	Small colony recorded
2007	Chesterfield	
2007	* Little Ribston near Wetherby	1 visiting garden feeders
2007	Meersbrook, Sheffield	2–3
2007	Heeley, Sheffield	Single
2008	Heeley, Sheffield	Single
2008	Ecclesfield, Sheffield	2
2008	Beighton, Sheffield	
2008-9	* Armley, Leeds	Regular sightings
2009	Heeley, Sheffield	Single
2009	Fulwood, Sheffield	Several feeding on peanuts
2009	Botanical Gardens, Sheffield	Several
2009	Beighton, Sheffield	Regularly seen
2009	Broom, Rotherham	
2009	Wybourn, Sheffield	
2009	Wincobank, Sheffield	In garden overlooking Woolley Wood
2009	On television aerial, Woodseats, Sheffield	1
2009	Hunter's Bar, Sheffield	Several
2009	Garden feeder in Woodseats, Sheffield	
2009	Flying over garden in Woodseats, Sheffield	2
2009	Woodseats, Sheffield	2–3 in garden
2009	Ecclesfield, Sheffield	Regular sightings
2009	Millhouses, Sheffield	Regular and feeding in garden
2009	Millhouses, Sheffield	Regular sightings
2009	Walton Lane, Sandal nr Wakefield	1 in garden
2009	* Temple Newsam, Leeds	1 feeding in garden
2009	* north Hull	1 in garden feeding on fat-balls
2009	* Little Ribston near Wetherby	1 visiting garden feeders
2009	Yeadon nr Leeds	1 in tree near garden
2009	South Milford, Leeds	1 feeding regularly in garden
2010	Meersbrook, Sheffield	Singles
2010	Greasborough, South Yorkshire	Several
2010	Whiston, Rotherham	In garden feeding on suet cake and sunflower seed
2010	Nether Edge, Sheffield	2 feeding on peanuts in garden
2013	Dore, Sheffield	2–3 feeding in garden
2015	Handsworth, Sheffield	Bowden Housteads Wood
2015	Handsworth, Sheffield	1 in garden
2015	Warminster Road, Sheffield	2 or more in and around gardens
2015	Nether Edge, Sheffield	In garden
2015	Warminster Road, Sheffield	
2015	Warminster Road/Ketton Avenue, Sheffield	Regular sightings
2016	Nether Edge & Woodseats Allotments, Sheffield	Single Alexandrine parakeet for several months
2016	Ketton Avenue, Sheffield	Flying over garden
2016	Graves Park/Norton, Sheffield	Regularly seen over a wide area and visiting garden feeders
2017	Bradway/Abbeydale/Ecclesall, Sheffield	Regularly seen over a wide area and visiting garden feeders
2017	Woodseats, Sheffield	Regularly seen and visiting garden feeders
2017	Graves Park/Norton, Sheffield	Regularly seen over a wide area and visiting garden feeders
2017	Dronfield, Derbyshire	Flocks of up to 20 reported
2017	Millhouses, Sheffield	Flocks of up to 20 reported
2017-2019	Graves Park/Norton area, Sheffield	Frequent records and flocks of up to 10–15
2020 and later	Fulwood & Graves Park	A pair flew through garden and then seen elsewhere
2020	Ossett, West Yorkshire	Seen and heard in the area
2021	Shirtcliff, Sheffield	Birds reported from the woods
2022	Bracken Hill, Burncross, Sheffield	Pair feeding regularly in garden in winter
2023	Woods at Northern General Hospital, Sheffield	Hundreds in the woods on Barnsley Road
2023	Woods at Northern General Hospital, Sheffield	I work at the Northern General Hospital and there are hundreds in the woods on Barnsley Road. I love trying to spot them, they usually sit right at the top of the trees and make a very distinctive squawk!! Best to spot them from the driveway inside the hospital, walking on the road towards the Clock Tower. February 2023

Table A1. *Cont.*

2023	Fleets Dam [The Fleets], Barnsley	Seen regularly
2023	Hutcliffe Wood Crematorium, Sheffield	Recorded regularly
2023	Graves Park, Sheffield	Grey squirrel predating parakeet nest in beech tree
2023	Graves Park, Sheffield	Successful breeding reported
2024	Fulwood, Sheffield	Up to 5 feeding in garden late summer, 6 in winter
2024	Northern General Hospital, Sheffield	4 feeding in woodland
2024	Beauchief, Sheffield	Up to 4 feeding on peanuts and sunflower hearts
2024	Graves Park, Sheffield	Good views of parakeets eating acorns.
2024	Graves Park, Sheffield	Up to 4 Alexandrine parakeets including prospecting a nest site
2024	Norton, Sheffield	Up to 4 Alexandrine parakeets, 2 males, 2 females, on garden feeders
2025	Bolsover, North Derbyshire	I read with interest and dismay your recent article in Bolsover Magazine 25 headed 'An Explosion of Parakeets'. Experienced them in Kew Gardens, London.
2025	Beauchief, Sheffield	Moved from London and concerned about negative impacts of parakeets in numbers.
2025	Carr Lodge Park, Horbury, nr Wakefield	Pair reported for the first time in 20 years in 2024.
2025	Beauchief, Sheffield	Several in garden and local woods – first in over 20 years.
2025	Ecclesfield, north Sheffield	First seen in 2023; up to 12 in garden 2024. Aggressive to smaller birds.
2025	Denby Dale, Huddersfield	One visiting garden feeders.

By 2020 across a wide area of south, west, and east Sheffield, numbers of sightings rose to the point that the citizen science recording was no longer feasible or useful. Additional records and comments were still collated. * Away from core Sheffield district.

References

1. McCarthy, M. Britain's naturalised parrot now officially a pest. *The Independent*, 30 September 2009.
2. Moss, S. Parakeets flee the scrum. *The Guardian*, 18 October 2006; p. G2.
3. Butler, C.J.; Cresswell, W.; Perrins, C. The breeding biology of Rose-ringed Parakeets *Psittacula krameri* in England during a period of rapid population expansion. *Bird Study* **2013**, *60*, 527–532. [CrossRef]
4. Hunt, N.; Mitchell, T. *The Parakeeting of London*; Paradise Road: London, UK, 2019.
5. Pithon, J.A.; Dytham, C. Determination of the origin of British feral Rose-ringed Parakeets. *Br. Birds* **2001**, *94*, 74–79.
6. Cramp, S. (Ed.) *The Birds of the Western Palearctic*; Oxford University Press: Oxford, UK, 1988; Volume 5.
7. Selge, S.; Fischer, A.; van der Wal, R. Public and professional views on invasive non-native species—A qualitative social scientific investigation. *Biol. Conserv.* **2011**, *144*, 3089–3097. [CrossRef]
8. Shackleton, R.; Richardson, D.M.; Shackleton, C.H.L.; Bennett, B.; Crowley, S.L.; Dehnen-Schmutz, K.; Estevez, R.; Fischer, A.; Kueffer, C.; Kull, C.A.; et al. Explaining people's perceptions of invasive alien species: A conceptual framework. *J. Environ. Manag.* **2019**, *229*, 10–26. [CrossRef]
9. Rotherham, I.D. Exotic and Alien Species in a Changing World. *ECOS* **2009**, *30*, 42–49.
10. Rotherham, I.D. Chapter 15: History and Perception in animal and plant invasions—the case of acclimatisation and wild gardeners. In *Invasive and Introduced Plants and Animals: Human Perceptions, Attitudes and Approaches to Management*; Rotherham, I.D., Lambert, R., Eds.; EARTHSCAN: London, UK, 2011; pp. 233–248.
11. Rotherham, I.D.; Lambert, R.A. (Eds.) Good science, good history and pragmatism: Managing the way ahead. In *Invasive and Introduced Plants and Animals: Human Perceptions, Attitudes and Approaches to Management*; EARTHSCAN: London, UK, 2011; pp. 355–366.
12. Rotherham, I.D.; Lambert, R.A. (Eds.) *Invasive and Introduced Plants and Animals: Human Perceptions, Attitudes and Approaches to Management*; EARTHSCAN: London, UK, 2011.
13. Rotherham, I.D. *Recombinant Ecology—A Hybrid Future*? Springer Briefs; Springer: Dordrecht, The Netherlands, 2017.
14. Sharp, R.L.; Larson, L.R.; Green, G.T. Factors influencing public preferences for invasive alien species management. *Biol. Conserv.* **2011**, *144*, 2097–2104. [CrossRef]
15. Tayleur, J. Little Green Aliens? *BTO News*, November–December 2008; pp. 16–17.
16. Self, A. *The Birds of London*; Bloomsbury Publishing: London, UK, 2014.
17. Crowley, S.L.; Hinchliffe, S.; Mcdonald, R.A. The parakeet protectors: Understanding opposition to introduced species management. *J. Environ. Manag.* **2017**, *229*, 120–132. [CrossRef]
18. Rotherham, I.D.; Boardman, S. Who says the public only love red squirrels? *ECOS* **2006**, *27*, 28–35.
19. Watchman, M.J. The Ring-Necked Parakeet in Sheffield: Perceptions of a Non-Native Species. Master's Dissertation, Sheffield Hallam University, Sheffield, UK, 2018. Unpublished.
20. Williams, F.; Eschen, R.; Harris, A.; Djeddour, D.; Pratt, C.; Shaw, R.S.; Varia, S.; Lamontagne-Godwin, J.; Thomas, S.E.; Murphy, S.T. *The Economic Cost of Invasive Non-Native Species on Great Britain*; CABI: Oxford, UK, 2010.

21. Brock, C.; Richardson, S. The Monk Parakeet (*Myiopsitta monachus*): An Argument Against Eradication of the Feral of This Species in the UK. 2011. Available online: https://hertsmere.moderngov.co.uk/documents/s15039/Appendix%20B.pdf (accessed on 8 June 2025).
22. Dunn, M.; Marzano, M.; Forster, J.; Gill, R.M.A. Public attitudes towards "pest" management: Perceptions on squirrel management strategies in the UK. *Biol. Conserv.* **2018**, *222*, 52–63. [CrossRef]
23. Milfont, T.L.; Duckitt, J. The Environmental Attitudes Inventory: A valid and reliable measure to assess the structure of environmental attitudes. *J. Environ. Psychol.* **2010**, *30*, 80–94. [CrossRef]
24. Rice, C.N. Abundance, Impacts and Resident Perceptions of Non-Native Common Pheasants (*Phasianus colchicus*) in Jersey, UK Channel Islands. Master's Thesis, University of Kent, Canterbury, UK, 2016; *Unpublished*.
25. Toland, E.; Warwick, C.; Arena, P.C. Pet Hate: Exotic pet-keeping is on the rise despite decades of initiatives aimed at reducing the trade of exotic and rare animals. *Biologist* **2012**, *59*, 14–18.
26. Ancillotto, L.; Strubbe, D.; Menchetti, M.; Mori, E. An overlooked invader? ecological niche, invasion success and range dynamics of the alexandrine parakeet in the invaded range. *Biol. Invasions* **2016**, *18*, 583–595. [CrossRef]
27. Robertson, P.; Adriaens, T.; Caizergues, A.; Cranswick, P.; Devos, K.; Gutiérrez-Expósito, C.; Henderson, I.; Hughes, B.; Mill, A.C.; Smith, G. Towards the European eradication of the North American Ruddy Duck. *Biol. Invasions* **2015**, *17*, 9–12. [CrossRef]
28. Rotherham, I.D. Alien Plants and the Human Touch. *J. Pract. Ecol. Conserv. Spec. Ser.* **2005**, *4*, 63–76.
29. Cocker, M.; Mabey, R. *Birds Britannica*; Chatto & Windus: London, UK, 2005.
30. García-Llorente, M.; Martín-López, B.; González, J.A.; Alcorlo, P.; Montes, C. Social perceptions of the impacts and benefits of invasive alien species: Implications for management. *Biol. Conserv.* **2008**, *141*, 2969–2983. [CrossRef]
31. Jeschke, J.M.; Bacher, S.; Blackburn, T.M.; Dick, J.T.A.; Essl, F.; Evans, T.; Gaertner, M.; Hulme, P.E.; Kühn, I.; Mrugała, A.; et al. Defining the impact of Non-Native species. *Conserv. Biol.* **2014**, *28*, 1188–1194. [CrossRef]
32. Pimentel, D.; Zuniga, R.; Morrison, D. Update on the environmental and economic costs associated with alien-invasive species in the United States. *Ecol. Econ.* **2005**, *52*, 273–288. [CrossRef]
33. Vitousek, P.D.; Antonio, C.; Loope, L.; Westbrooks, R. Biological invasions as global environmental change. *Am. Sci.* **1996**, *84*, 468.
34. Manchester, S.J.; Bullock, J.M. The impacts of non-native species on UK biodiversity and the effectiveness of control. *J. Appl. Ecol.* **2000**, *37*, 845–864. [CrossRef]
35. Jaeger, H.; Kowarik, I.; Tye, A. Destruction without extinction: Long-term impacts of an invasive tree species on Galapagos highland vegetation. *J. Ecol.* **2009**, *97*, 1252–1263. [CrossRef]
36. Didham, R.K.; Tylianakis, J.M.; Hutchison, M.A.; Ewers, R.M.; Gemmell, N.J. Are invasive species the drivers of ecological change? *Trends Ecol. Evol.* **2005**, *20*, 470–474. [CrossRef] [PubMed]
37. Sagoff, M. Do non-native species threaten the natural environment? *J. Agric. Environ. Ethics* **2005**, *18*, 215–236. [CrossRef]
38. Long, J.L. *Introduced Birds of the World*; David & Charles: Newton Abbot, UK, 1981.
39. Lever, C. *The Naturalized Animals of the British Isles*; Hutchinson & Co. (Publishers Ltd.): London, UK, 1977.
40. Lever, C. *The Naturalized Animals of Britain and Ireland*; New Holland: London, UK, 2009.
41. Pithon, J.; Dytham, C. Census of the British Ring-Necked Parakeet *Psittacula krameri* population by simultaneous counts of roosts. *Bird Study* **1999**, *46*, 112–115. [CrossRef]
42. Pithon, J.; Dytham, C. Distribution and population development of introduced Ring-Necked Parakeet *Psittacula krameri* in Britain between 1983 and 1998. *Bird Study* **2002**, *49*, 110–117. [CrossRef]
43. Frith, M. As British as curry? Hot and bothered over parakeets. *ECOS* **2010**, *31*, 11–15.
44. Peck, H.L.; Pringle, H.E.; Marshall, H.H.; Owens, I.P.; Lord, A.M. Experimental evidence of impacts of an invasive parakeet on foraging behavior of native birds. *Behav. Ecol.* **2014**, *25*, 582–590. [CrossRef]
45. Strubbe, D.; Matthysen, E. Invasive Ring-necked Parakeets *Psittacula krameri* in Belgium: Habitat selection and impact on native birds. *Ecography* **2007**, *30*, 578–588. [CrossRef]
46. Tayleur, J.R. A comparison of the establishment, expansion and potential impacts of two introduced parakeets in the United Kingdom. In *Proceedings of the Conference: The Impacts of Non-Native Species*; British Ornithologists' Union: Peterborough, UK, 2010; pp. 1–12.
47. Clergeau, P.; Vergnes, A. Bird feeders may sustain feral Rose-ringed Parakeets *Psittacula krameri* in temperate Europe. *Wildl. Biol.* **2011**, *17*, 248–252. [CrossRef]
48. Fischer, A.; Selge, S.; Van Der Wal, R.; Larson, B. The public and professionals reason similarly about the management of non-native invasive species: A quantitative investigation of the relationship between beliefs and attitudes. *PLoS ONE* **2014**, *9*, e105495. [CrossRef]
49. Tweddle, J.C.; Robinson, L.D.; Pocock, M.J.O.; Roy, H.E. *Guide to Citizen Science: Developing, Implementing and Evaluating Citizen Science to Study Biodiversity and the Environment in the UK*; Natural History Museum and NERC Centre for Ecology & Hydrology for UK-EOF: London, UK, 2012.
50. Bryman, A.; Bell, E. *Business Research Methods*, 3rd ed.; Oxford University Press: Oxford, UK, 2011.

51. Biernacki, P.; Waldorf, D. Snowball sampling: Problems and techniques of chain referral sampling. *Sociol. Methods Res.* **1981**, *10*, 141–163. [CrossRef]
52. Joshi, A.; Kale, S.; Chandel, S.; Pal, D.K. Likert Scale: Explored and Explained. *Br. J. Appl. Sci. Technol.* **2015**, *7*, 396–403. [CrossRef]
53. Svensson, E. Guidelines to statistical evaluation of data from rating scales and questionnaires. *J. Rehabil. Med.* **2001**, *33*, 47–48. [CrossRef] [PubMed]
54. Saldaña, J. *The Coding Manual for Qualitative Researchers*, 3rd ed.; SAGE: Los Angeles, CA, USA, 2016.
55. Smith, A.H.V. (Ed.) *Birds of the Sheffield Area*; Sheffield City Museums & Sorby Natural History Society: Sheffield, UK, 1974.
56. Hornbuckle, J.; Herringshaw, D. (Eds.) *Birds of the Sheffield Area including the North-East Peak District*; Sheffield Bird Study Group & Sheffield City Libraries: Sheffield, UK, 1985.
57. Wood, D.; Hill, R. (Eds.) *Breeding Birds of the Sheffield Area including the North-East Peak District*; Sheffield Bird Study Group: Sheffield, UK, 2013.
58. Frost, R.A. *Birds of Derbyshire*; Moorland Publishing Company: Buxton, UK, 1978.
59. Frost, R.; Shaw, S. (Eds.) *The Birds of Derbyshire*; Liverpool University Press: Liverpool, UK, 2013.
60. Beevers, M. Monthly records. In *Bulletin*; Derbyshire Ornithological Society: Derby, UK, 2021.
61. Garton, S. (Ed.) *Derbyshire Bird Report 2023*; Derbyshire Ornithological Society: Derby, UK, 2024.
62. Dobbs, A. (Ed.) *The Birds of Nottinghamshire Past and Present*; David & Charles: Newton Abbot, UK, 1975.
63. Reece, J.; Crouch, N.; Parkin, D.; du Feu, C.; Ellis, B. *The Birds of Nottinghamshire*; Liverpool University Press: Liverpool, UK, 2019.
64. Mather, J.R. *The Birds of Yorkshire*; Croom Helm: London, UK, 1986.
65. Wilson, A.; Slack, R. *Rare and Scarce Birds in Yorkshire*; Biddles Ltd.: Guildford, UK, 1996.
66. Rhodes, R.J. *Birds in the Doncaster District*; Doncaster and District Ornithological Society: Doncaster, UK, 1988.
67. Dobbs, G. *Yorkshire Bird Report 2017*; Yorkshire Naturalists' Union: York, UK, 2018.
68. Dobbs, G. *Yorkshire Bird Report 2018/19*; Yorkshire Naturalists' Union: York, UK, 2020.
69. Fraticelli, F. The Rose-ringed Parakeet *Psittacula krameri* in an urban park: Demographic trend, interspecific relationships and feeding preferences (Rome, central Italy). *Avocetta* **2010**, *38*, 23–28.
70. Strubbe, D.; Matthysen, E. Establishment success of invasive ring-necked and monk parakeets in Europe. *J. Biogeogr.* **2009**, *36*, 2264–2278. [CrossRef]
71. Keller, R.P.; Cadotte, M.W.; Sandiford, G. *Invasive Species in a Globalized World: Ecological, Social, and Legal Perspectives on Policy*; University of Chicago Press: Chicago, IL, USA, 2014.
72. Blackburn, T.M.; Gaston, K.J. Contribution of non-native galliforms to annual variation in biomass of British birds. *Biol. Invasions* **2021**, *23*, 1549–1562. [CrossRef]
73. Bremner, A.; Park, K. Public Attitudes to the Management of Invasive Non-Native Species in Scotland. *Biol. Conserv.* **2007**, *139*, 306–314. [CrossRef]
74. Hernández-Brito, D.; Carrete, M.; Ibáñez, C.; Juste, J.; Tella, J.L. Nest-site competition and killing by invasive parakeets cause the decline of a threatened bat population. *R. Soc. Open Sci.* **2018**, *5*, 172477. [CrossRef]
75. Strubbe, D.; Matthysen, E.; Graham, C.H. Assessing the potential impact of invasive ring-necked parakeets *Psittacula krameri* on native nuthatches *Sitta europeae* in Belgium. *J. Appl. Ecol.* **2010**, *47*, 549–557. [CrossRef]
76. Seastedt, T.R. Biological control of invasive plant species: A reassessment for the Anthropocene. *New Phytol.* **2015**, *205*, 490–502. [CrossRef]
77. Avery, M.; Shiels, A. Monk and Rose-Ringed Parakeets. In *Ecology and Management of Terrestrial Vertebrate Invasive Species in the United States*; Pitt, W.C., Beasley, J.C., Witmer, G.W., Eds.; CRC Press: Boca Raton, FL, USA; Taylor & Francis: Boca Raton, FL, USA, 2018; pp. 333–357.
78. Carrington, D. Eradication efforts bring UK's monk parakeet numbers down to last 50. *The Guardian*, 24 September 2014.
79. Wild Birds: Licence to Kill or Take for Conservation Purposes (GL4). Available online: https://www.gov.uk/government/publications/wild-birds-licence-to-kill-or-take-for-conservation-purposes-gl40 (accessed on 30 January 2022).
80. Tigwell, R. Defra Is Not Planning Ring-Necked Parakeet Cull. *SW Londoner*, 11 March 2021. Available online: https://www.swlondoner.co.uk/news/11032021-defra-is-not-planning-ring-necked-parakeet-cull/ (accessed on 2 January 2022).
81. Lurz, P.W.W.; Garson, P.J.; Rushton, S.P. The ecology of squirrels in spruce dominated plantations: Implications for forest management. *For. Ecol. Manag.* **1995**, *79*, 79–90. [CrossRef]
82. Booy, O.; Mill, A.; Roy, H.; Hiley, A.; Moore, N.; Robertson, P.; Baker, S.; Brazier, M.; Bue, M.; Bullock, R.; et al. Risk management to prioritise the eradication of new and emerging invasive non-native species. *Biol. Invasions* **2017**, *19*, 2401–2417. [CrossRef]
83. Hobbs, R.J.; Higgs, E.S.; Hall, C. *Novel Ecosystems: Intervening in the New Ecological World Order*; Wiley-Blackwell: Oxford, UK, 2013.