Ecological Politics and Practices in Introduced Species Management

Submitted by Sarah Louise Crowley to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Biological Sciences, May 2017.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

(Signature) 

“If the country were open on its borders, new forms would certainly immigrate, and this also would seriously disturb the relations of some of the former inhabitants.

Let it be remembered how powerful the influence of a single introduced tree or mammal has been shown to be.”

Charles Darwin
On the Origin of Species, 1859

Abstract

The surveillance and control of introduced species has become an increasingly important, yet often controversial, form of environmental management. I investigate why and how introduced species management is initiated; whether, why and how it is contested; and what relations and outcomes emerge 'in practice'. I examine how introduced species management is being done in the United Kingdom through detailed social scientific analyses of the processes, practices, and disputes involved in a series of management case studies.

First, I demonstrate how some established approaches to the design and delivery of management initiatives can render them conflict-prone, ineffective and potentially unjust. Then, examining a dispute surrounding a state-initiated eradication of monk parakeets (*Myiopsitta monachus*), I show why and how 'parakeet protectors' opposed the initiative. I identify the significance of divergent evaluations of the risks posed by introduced wildlife; personal and community attachments between people and parakeets; and campaigners' dissatisfaction with central government's approach to the issue. By following the story of an unauthorised (re)introduction of Eurasian beavers (*Castor fiber*) to England, I show how a diverse collective has, at least temporarily, been united and empowered by a shared understanding of beavers as 'belonging' in the UK. I consider how nonhuman citizenship is socio-politically negotiated, and how the beavers have become enrolled in a 'wild experiment'. Finally, through a multi-sited study of grey squirrel (*Sciurus carolinensis*) control initiatives, I find important variations in management practitioners' approaches to killing squirrels, and identify several 'modes of killing' that comprise different primary motivations, moral principles, ultimate aims, and practical methods.

I identify multiple ways in which people respond and relate to introduced wildlife, and demonstrate how this multiplicity produces both socio-political tensions and accords. Furthermore, throughout this thesis I make a series of propositions for re-configuring the management of introduced species in ways that explicitly incorporate inclusive, constructive, and context-appropriate socio-political deliberations into its design and implementation.

Acknowledgements

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Tables and Figures

Author's declaration for co-authored manuscripts

Chapters 2, 4, 5, 6, and 7 have been published or written for publication as co-authored academic papers. For Chapters 2 and 5, I developed the focus of the papers with RM and SH. I then collated, reviewed and synthesised relevant literature. For Chapters 5, 6, and 7, I selected case studies and designed research methodologies with RM and SH. I conducted all fieldwork, interviews, transcription and analyses. I wrote all five manuscripts, then amended and revised them in response to comments, suggestions and advice from SH and RM

Chapter 1

INTRODUCTION

Chapter 1: Introduction

Understanding and addressing the challenges posed by introduced species is a problem that spans multiple academic fields. It is also an increasingly important, and increasingly contested, component of environmental management, conservation, politics and law. Here, I employ a series of contemporary case studies to investigate the ecological politics and practices of managing introduced wildlife in the United Kingdom (UK).

This thesis is structured as a series of self-contained academic papers, each of which has its own introductory section. This more general introduction situates my research (a) in relation to existing academic literatures on introduced species, and (b) in its specific context of wildlife management in the UK. I open with an overview of the applied academic field of invasion science, which is currently the principal domain of academic enquiry into the processes and consequences of species introductions. I then consider how and why some of the assumptions, tenets and recommendations of invasion science have been challenged and contested. Given that several of these disputes relate to the language employed within and beyond invasion science, I provide a clarification and justification of the terminology employed in this thesis. I also discuss how academics in the social sciences have alternatively approached and investigated introduced species and their management, and outline some of the gaps and misalignments – both among academic fields, and between academia, policy and practice – that provide the impetus for this research. I identify 'ecological politics' as an area of interdisciplinary convergence, and highlight the potential for research in this vein to inform approaches to introduced species management that are both ecologically and politically attentive. Finally, I outline the drivers and aims of my research, and provide a chapter-by-chapter outline of this thesis.

Invasion science

Invasion science has risen to prominence over the past half-century as an academic research field that, broadly speaking, investigates the drivers and effects of organisms colonising new biogeographic areas (Richardson *et al.* 2011). The general term 'science' indicates recent efforts to expand the scope of

the field from its roots in ecology to encompass a range of other disciplines including conservation biology, geography, agricultural sciences, economics and, less often, other social sciences and humanities (Vaz *et al.* 2017). Contemporary invasion science is associated with a relatively consistent narrative that presents human-generated "invasions by alien species [as] a growing threat to biodiversity, ecosystem services, regional economies, and public health" (Ricciardi *et al.* 2017, p1). In this first section, I provide a brief history of invasion science, and then consider why and how some of the key assumptions and assertions of this relatively young 'discipline' have been challenged.

The ecology of invasions

Natural historians, and particularly botanists, have taken an interest in the geographic origins and movements of different species from at least the early nineteenth century (Chew 2006). However, dedicated studies of interactions between extant and introduced species did not emerge until the nascent field of ecology, or 'scientific natural history', developed in the twentieth century (Kingsland 2004). Existing knowledge on the topic was famously synthesised as 'invasion ecology' in Charles Elton's *The Ecology of Invasions by Animals and Plants* (Elton 1958). Invasion ecology is the scientific study of "the causes and consequences of the introduction of organisms to areas outside their native range" (Richardson *et al.* 2011, p414). Its practitioners are interested in both the behaviour of populations introduced to new environments, and their interactions with recipient ecosystems. Discussion of the scientific contributions made by this now-flourishing research field is beyond the scope of this thesis (but see Sax *et al.* 2007; Richardson 2011). It is worth noting, however, the extent and variety of ecological interactions identified between introduced 'neobiota' and recipient ecologies. Interspecies interactions include resource competition; predator-prey associations; disease transmission (including both existing and novel pathogens) and hybridisation (Simberloff 2013a). Introduced species can also alter ecosystem structure and function, including via the dramatically-named 'invasional meltdown' (Simberloff and Holle 1999), in which numerous introductions facilitate one another's success, causing extensive changes to species compositions and interactions.

Introduced species, then, can cause a wide range of ecological changes and disturbances, commonly referred to as 'ecological' or 'environmental' impacts. These are differentiated from 'economic' and 'social' impacts, which describe the effects of native species on human activities, societies, and health (Larson *et al.* 2011). Policy-oriented definitions of invasive species often refer explicitly to introduced species' impacts on human lives and livelihoods (see 'Terminology', below), and indeed, most early practical management efforts were initiated in response to problems caused by introduced agricultural pests and pathogens (Simberloff *et al.* 2013). However, in most contemporary configurations of biological invasions, ecological impacts take centre stage. This is largely because, like the related applied sciences of conservation biology and restoration ecology, invasion ecology emerged from the mid-twentieth century in response to growing concern, at least in post-industrial societies, about the impacts of human activities (including industrialisation, urbanisation, and globalisation) on biotic and abiotic environments (Meine *et al.* 2006). The response included the development of environmental and conservation movements, a mixture of political, scientific and practical work that, since the 1980s, has largely been encompassed under the moniker of 'biodiversity conservation' (Takacs 1996). The development of invasion science formed part of this response. Indeed, it is largely an applied science, driven by deep concern about some of the most dramatic ecological impacts of species introductions: extinctions of native or endemic island species by introduced predators (e.g. Wiles *et al.* 2003), displacement of extant species by introduced competitors (e.g. Gurnell *et al.* 2004) or cascade effects on ecosystems by introduced 'transformer' species or ecosystem engineers (e.g. Binimelis *et al.* 2007; Pejchar and Mooney 2009; Limburg *et al.* 2010). Invasion science therefore instigates, implements and applies research that aims not only to understand and predict invasion processes, but also to halt and/or reverse environmental disturbances caused by introduced species. These conservation-oriented endeavours have joined preceding efforts to manage the economic and social impacts of introduced pathogens, pests and other 'problem species' to produce invasive / introduced species management (ISM). This term encompasses a broad array of activities in environmental policy and practice, and is implemented at multiple geographic and political scales, from rodent eradications on oceanic islands to international policy and trade agreements. These endeavours are all, however, unified by a

common aim: to address the complex and multifaceted problems that can arise from species introductions.

Invasion science is an increasingly diverse research field, and is by no means homogeneous in its philosophy or approach. However, several key principles and recommendations arising from mainstream invasion ecology have been influential in informing international and regional legislation, regulation, and practice. Most notably, in 2002, following consideration of a commissioned scientific report on the issue, parties to the Convention on Biological Diversity adopted a decision to develop national programmes for responding to 'invasive alien species', and provided fifteen guiding principles for signatories (CBD Decision VI/23, 2002). These include recommendations for border controls and quarantines; monitoring of and (ecological) research on present or potentially arriving species; and the 'three stage hierarchical approach' to management (prevent introductions; rapidly eradicate new arrivals; control established populations). Efforts to implement this guidance have, however, been questioned and challenged on a range of grounds, including concerns about the relationship between biosecurity and trade protectionism (Higgins and Dibden 2011; Maye *et al.* 2012), the risk assessment processes by which species are classified as invasive (Strubbe *et al.* 2011; Vanderhoeven *et al.* 2017), and the rationales, methods and ethics of eradication and control projects.

Critiques and controversies in invasion science

Public controversies surrounding ISM have repeatedly arisen since the emergence of invasion science and, in line with the field's growth in reach and influence, appear to have increased over recent years (see Chapter 2). There have also, however, been academic critiques – from philosophers, social scientists, and from natural scientists – of some of the tenets, rationales and rhetorical strategies that underpin the dominant narrative of invasion science. These critiques have revolved around three key areas of disagreement. First, there is an enduring debate about the significance of a species' origin in determining (a) whether it is invasive and (b) whether it should be subject to management. In 2011, a letter in *Nature* entitled 'Don't Judge Species by Their Origins' (Davis *et al.* 2011) joined a series of previous critiques (see Brown and Sax 2004; Sagoff 2005; Warren 2007; Richardson *et al.* 2008; Schlaepfer *et al.*

2011) that had raised concerns about the use of ‘non-native’ or ‘alien’ as “a proxy for harmfulness” (Van Der Wal *et al.* 2015, p349), and/or the use of species indigeneity as a guiding principle for conservation decision-making. There is also persistent concern about discursive overlaps between the terminologies of invasive species and xenophobia (Brown and Sax 2004; O’Brien 2006; Keulartz and van der Weele 2008). In response, Richardson and Ricciardi (2013) and Simberloff (2015) have argued that it is recognition of the impacts of introductions, not species origins *per se*, that provoke alarm about non-native species.

A second criticism levelled at invasion science is that the impacts of invasive species have been overstated (Brown and Sax 2004; Gurevitch and Padilla 2004; Goodenough 2010; Davis *et al.* 2011), or at least, their complexities and ambiguities downplayed, to ‘sound the alarm’ (Foster and Sandberg 2004) to policymakers and publics. Debates about impacts are often played out in lists of examples, either of instances where species introductions have had dramatic and irreversible consequences, or cases where their presence has thus far had little observable effect. However, given the vast diversity of species and contexts evoked in these discussions, these examples are often unsuitable for comparison, and – as is regularly noted – assessments as to whether impacts are negative or benign are never value-free. Nevertheless, it is generally agreed, on the one hand, that “some species introduced by humans have driven extinctions and undermined important ecological services” (Davis *et al.* 2011, p153); and, on the other, that “most introduced species are not yet known to cause significant harm” (Simberloff 2015, p3).

However, the potential ‘lag effects’ of invasions (delays between a species’ introduction and its spread/impact) has led some invasion scientists to conclude that it would be “foolhardy to wait for an impact to be recognised before acting” (Simberloff 2015, p3), thereby returning them to the conclusion that all introduced species must, at least partially, be judged on their origins. Others, however, have (to varying degrees) reconciled themselves with the implications of continuing biotic exchange, and suggest that “the existence of novel ecosystems must be

recognised and their future management debated" (Mascaro *et al.* 2013, p55).[1] There are also alternative ecological paradigms that emphasis the fluidity, dynamism, and disequilibrium of biotic communities, and reject the concept of stable, geo-spatially restricted and 'balanced' ecosystems that inevitably suffer from disturbances and invasions (Zimmerer 2000; Wallington 2005; Mori 2011). There is a final point of contention, then, about whether (a) introduced populations should always be subject to management, and ecosystems restored to historical trajectories; or, (b) some altered ecosystems should be accepted, and potentially even embraced, as part of alternative understandings of biodiversity that do not require ecologies to be either native or 'natural' to be considered valuable (Ewel and Putz 2004; Hobbs *et al.* 2009; Kueffer and Kaiser-Bunbury 2014).

There is actually a great deal of middle-ground here, and the above positions are not mutually exclusive: it is entirely possible to be concerned about the consequences of introductions, and want to mitigate them, while also concluding that disturbances are not inevitably disastrous, and that 'novel ecosystems' can have value. However, this lively and important debate has been accompanied by a growing schism between vocal contributors from different 'sides'. Several prominent academics have, for example, expressed concern that the purported orthodoxy of invasion science (broadly, that introduced species represent a threat which requires management) is being publicly contested by a small number of 'contrarian' (Simberloff 2013b) scientists and other 'naysayers' (Richardson and Ricciardi 2013), and that this could cause policymakers and publics to be 'misled' into thinking that there is scientific controversy around invasive species (Simberloff 2015). The inference is that, although academic debate is important, it is "dangerous to carry on this discussion in public" (Robbins and Moore 2013, p6); accordingly, the publication of popular articles and books that recount and extend some of the 'contrarian' academic arguments and alternate theories (e.g. Marris 2013; Thompson 2014; Pearce 2015) has been of particular concern. Most recently, Russell and Blackburn (2016) have

[1] 'Novel ecosystem' is another disputed concept (Hobbs *et al.* 2009; Murcia *et al.* 2014; Simberloff 2015) but generally refers to ecosystems which differ from any historical organisation and have emerged in response to human activity, but do not rely on continued human management to persist (Mascaro *et al.* 2013).

claimed that these ‘contrarians’ (including, but not limited to, the authors of the popular works above), are engaging in ‘invasive species denialism’, akin to denialism of scientific consensus on climate change. I and others have challenged these divisive claims, though not all on the same grounds (Briggs 2017; Davis and Chew 2017; Crowley *et al.* 2017c [included as Appendix 1]; Tassin *et al.* 2017; see also Russell and Blackburn 2017).

Robbins and Moore (2013) propose that invasion science (along with other conservation-oriented sciences) is permeated with anxiety, not only about the ecological impacts of anthropogenic activity, but also about the responsibilities and roles of scientists, including how far they should advocate for certain ideals, policies and actions. Consequently, persistent academic debates surrounding the invasive species concept and its implications for management are entangled with disputes about whether scientists should be advocating for anything at all (see also Larson 2007; Young and Larson 2011). This mirrors longstanding deliberations about the role of advocacy in the social sciences (e.g. Milton 1996; Fuller and Kitchin 2004; Irvine 2008; Kellett 2009), but also indicates continuing, problematic efforts to keep the domains of ‘science’ and ‘politics’ separate (Latour 2004). I consider social scientific approaches to introduced species below. First, however, and given the importance and contestation of language in this field, I provide a clarification and justification of the terminology used in this thesis.

Terminology

Despite its widespread use, what the term ‘invasive species’ means, and to which organisms it should be applied, are still subject to a great deal of debate. Although I generally use the term ‘introduced’ to describe the wildlife populations at the centre of this thesis (see below), I do also use ‘invasive’, particularly in Chapters 2 and 5. The content of these chapters was written for ecological journals where ‘invasive species’ remains the favoured and most widely recognised term, despite disagreements about its definition (Boonman-Berson *et al.* 2014; Humair *et al.* 2014), and acknowledgement that it is not species, but populations, that ‘invade’ new areas (Simberloff *et al.* 2013). I avoid providing restrictive definitions in the papers themselves, but it is worth clarifying here that

I understand and treat invasive species as a 'cluster concept' (Gert 1995; Woods and Moriarty 2001). This recognises that (a) the term inconsistently refers to species or populations that meet one or more of several related but distinct criteria; (b) there is disagreement about which criteria are most pertinent; and (c) that species and populations can be referred to as 'invasive' without all the criteria being met. The key criteria that, together, compose the invasive species concept are outlined, with examples, in Figure 1.1.

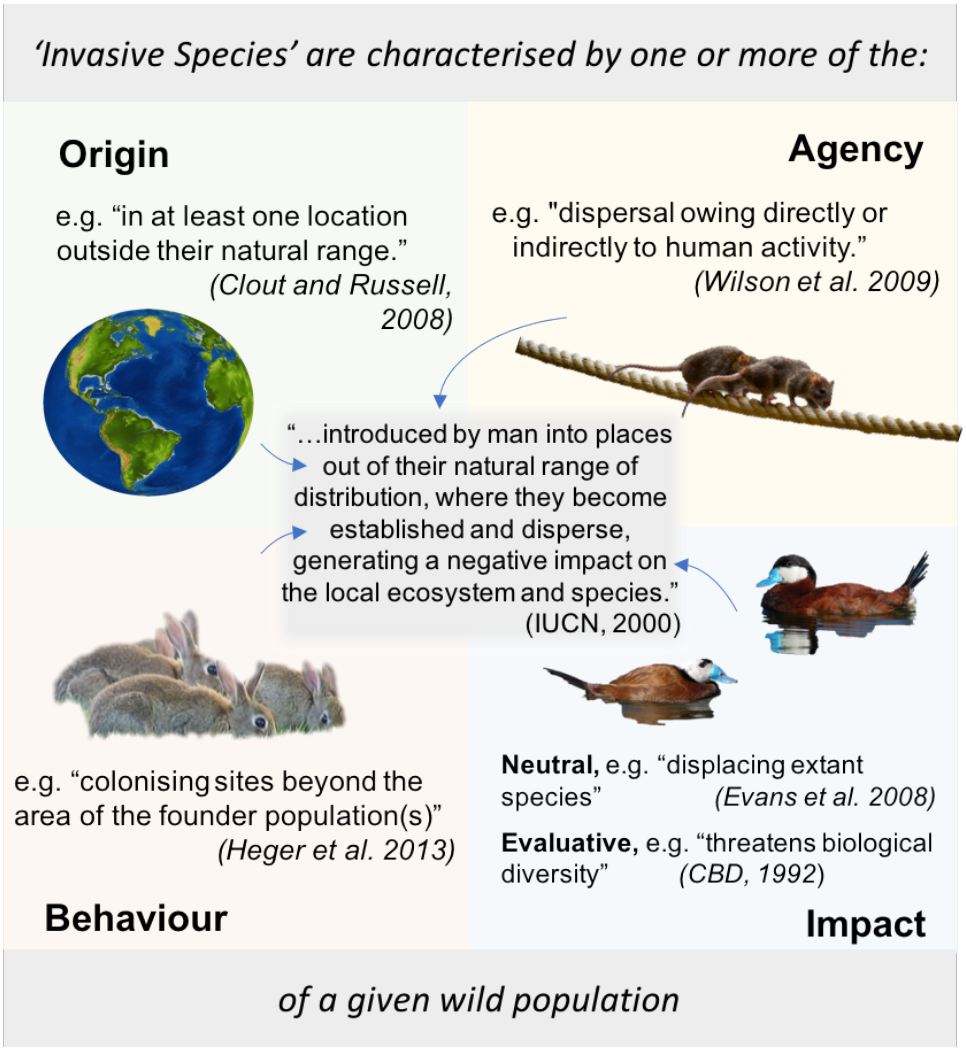

Figure 1.1. *Invasive species as a 'cluster concept'.*

Definitions of the term, and associated classifications of populations or species as 'invasive', depend on which and how many of the criteria identified above are included. Whereas these criteria all rely on studying and interpreting a species' natural history, biogeography, and relationship to humans, the 'impact' criterion can also be evaluative, involving judgements as to whether a species' effects in its new environs are net positive or negative.

More frequently, I employ the term 'introduced', by which I mean, "a population that arrives in a new area with intentional or accidental human assistance" (adapted from Simberloff *et al.* 2013). This term, though not without its problems,

has several advantages. It is comparatively neutral and uncluttered, without the militaristic or nativist implications of 'invasive'. It also does not rely on the distinction of 'native' from 'non-native' species;[2] require a species to demonstrate any given behaviour or effect in its new range to qualify; or rely on evaluative judgements of impact or harm. It does indicate, however, that a species has arrived in a new area (and may therefore affect or disturb the recipient socio-ecology), and enables a distinction between extant and 'incoming' wildlife.

'Introduced' also, however, accentuates the 'agency' of species colonisations. Many sources, and particularly policy documents, include human facilitation as a defining characteristic of a biological invasion. Indeed, biotic movements that are not obviously human-facilitated are often referred to as 'natural colonisations', with the implication that the organisms in question have moved independently (i.e. under their 'own' agency). This distinction is a simplistic, awkward and often arbitrary one. First, it unhelpfully replicates the questionable division of human activities from 'natural' processes.[3] Second, anthropogenic influences on biotic and abiotic environments are now so widespread and pervasive that it is difficult to draw lines between introductions that are facilitated by humans and those that are not. Finally, emphasising the mechanisms and pathways of individual species' movements might cause other potentially important factors in colonisation success (e.g. the 'invasibility' of the landscape, and the composition of extant ecological assemblages) to be overlooked.

Nevertheless, recognising and understanding the role(s) of human activity in species introductions and establishments is important. Species movements, colonisations and range-shifts have occurred at a 'baseline' rate throughout

[2] This is particularly important in Chapter 6, where the focal population of Eurasian beavers was variably represented as both 'native' and 'invasive' by different actors.

[3] The conceptual division of humans from 'nature' is problematic for several reasons. It continues and reinforces an outdated preoccupation with human exceptionalism and dominion that has arguably contributed to many contemporary environmental problems. It also belies complex interactions, interrelations and co-dependencies among the bodies, processes and assemblages that constitute both human and nonhuman ecologies. Finally, humans cast as external to 'nature' are left with two options, neither promising: nature becomes either a resource for people to use and consume, or its very existence is endangered by human users and consumers. In neither case are humans recognised as environmental inhabitants, both affecting and affected by their surroundings and encounters (Ingold 2000).

biogeographic history, but biotic exchanges – where multiple species arrive in new areas via the removal or overcoming of biogeographic barriers – are less common (Ricciardi 2007). The most recent of these biotic exchanges are closely associated with human migration, transport and trade. Notable 'phases' of human-mediated species movements have coincided with a period of increased global exploration and trade following the Middle Ages, and with the Industrial Revolution (Hulme 2009). Particularly, large numbers of species were translocated during the European colonial period, as migrants took familiar species with them to new lands (Crosby 2004), and 'acclimatisation associations' actively imported 'promising species' between nations seeking, for example, more productive crops and livestock, or new delicacies and exotic plants for cosmopolitan consumers (Borowy 2013). Technological and logistical advancements in the mid-twentieth century, and the growth in free trade with the advent of globalisation, have also been identified as drivers of accelerating biotic exchange (Hulme 2009). Most recently, anthropogenic climate change has been proposed as an increasingly significant, if indirect, human influence on species range-shifts and interactions (Burgiel and Muir 2010; Thomas and Ohlemüller 2010).

Understanding how and why people affect colonisation processes may be important for predicting and interpreting a population's behaviour and interactions in a new area; there can be quantitative and qualitative differences between the dispersal pathways of species that move with and without human facilitation (Wilson *et al.* 2009). For example, people might increase 'propagule pressure' by repeatedly introducing greater numbers of individuals to more places, increasing the likelihood of their establishment. The degree and form of human involvement in colonisations is also often pertinent to policy and management decisions. There is a widely-held view that people hold some responsibility for addressing the problems caused by wildlife they have introduced (Selge *et al.* 2011; Heger *et al.* 2013; and Chapter 7). Conversely, if a species has arrived without apparent human involvement, the right or responsibility of humans to intervene in so-called 'natural colonisation' processes may be subject to challenge. Consequently, even though distinguishing 'introduced' from 'colonist' species may not always be possible or appropriate, it

is significant in terms of wildlife management policy and practice, and was certainly relevant in all three management case studies in this thesis.

Introduced species in the social sciences and humanities

Human involvement, then, is often considered a defining feature of a 'biological' invasion. Indeed, species introductions are arguably social 'all the way down': humans cause them; are affected by them; respond to them (including with efforts to manage their spread and impacts); and disagree about how to respond to them (McNeely 2001, 2013). Nevertheless, there has been far less research on the human drivers of, and responses to, invasions and their management than on ecological processes and responses: Estévez *et al.* (2015) found that <1% of 15,915 papers returned by a literature search on biological invasions incorporated any form of 'social dimensions', and 93% of this subset has been published since 2000. Social research relating to introduced species and their management is growing, however. To date, this has been approached from three connected, but identifiably distinct directions (Figure 1.2), with slightly different motivations and aims.

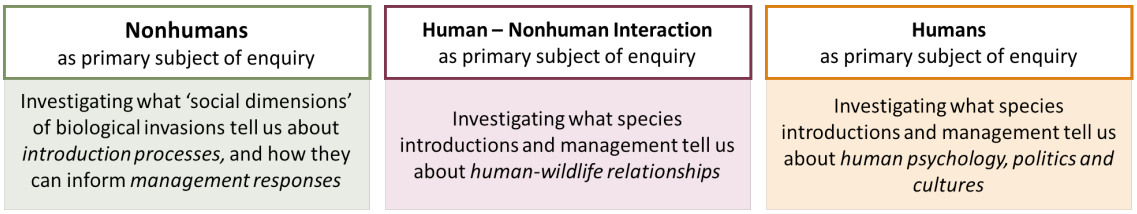

Figure 1.2. *Social research relating to introduced / invasive species and their management: three approaches.*

First, 'human' or 'social dimensions' research is borne from recognition that understanding and addressing the challenges of 'biological' invasions also requires a thorough understanding of relevant human social behaviours and responses. Conducted both within and outside academia, much of this research aims to gauge and compare knowledges, beliefs, values and attitudes of various 'stakeholders' and publics towards introduced species and their management. Data generated through surveys, focus groups and interviews is normally analysed in relation to demographics, interest group affiliations, and/or (different kinds of) knowledge about introduced species and their impacts. Social dimensions research has revealed important insights into how publics and

special interest groups differentially perceive 'the problem' of invasive species. Several investigations by researchers at the University of Aberdeen have identified, for example, that lay publics, invasion scientists, and conservation volunteers all emphasise ('harmful') impacts, the role of humans, and abundance (rather than origin) when judging the 'invasiveness' of a species (Selge and Fischer 2011; Selge *et al.* 2011; Van Der Wal *et al.* 2015). Public surveys have investigated societal attitudes towards introduced species and their management in Australia and New Zealand, identifying demographic, contextual (e.g. species- and location- dependent) and temporal patterns and trends (Fitzgerald *et al.* 2007; Russell 2014). More focused studies, targeting interest groups or resident communities, have identified variations in attitudes to different kinds and degrees of management, with associated implications for decision-making (García-Llorente *et al.* 2008; Schüttler *et al.* 2011; Sharp *et al.* 2011). These studies aim to organise and make sense of some of the complex factors that influence people's responses to both newly arrived species and related environmental management proposals. 'Social dimensions' work is also, however, often intended to inform policy-makers, practitioners, and natural scientists working in applied fields, about social factors likely to affect (and potentially upset) invasive species management efforts. Thus, introduced species or invasion processes are often the primary subject of enquiry, but this research may be expanded to encompass human influences and responses (i.e. the 'social dimensions' of invasions and management).

In contrast, where nonhuman organisms (and especially animals) have been encountered in the social sciences and humanities, they have traditionally been treated as a 'conceptual device' through which to better understand people and cultures (Buller 2014). Anthropologist Lévi-Strauss (1962) proposed that animals are 'good to think with': they serve as metaphors, and as 'mirrors and windows' (Mullin 1999) against which humans consider and compare themselves. Human responses to introduced species have therefore been employed to examine how people construct ideas about 'otherness' and belonging; for example, how rhetorical links have been made between introduced species and human immigrants (Fine and Christoforides 1991; Coates 2005) and foreign cultures (Agyeman and Spooner 1997; Coates 2013) and, conversely, how floral and faunal indigeneity becomes rhetorically associated with political and/or 'eco'-

nationalism (Smith 1999; Comaroff and Comaroff 2001; Franklin 2006; van Sittert 2007).

This research is connected to a second body of work which investigates nonhumans not only as metaphorical or rhetorical tools for discussing and debating human politics, but as subjects of social research themselves, or "figures in our cultural spaces" (Buller 2014, p313). This work investigates socio-cultural constructions, classifications and representations of nonhumans, including how conceptual boundaries between 'animal' and 'human' spaces and categories are demarcated and maintained, and how species are conceptualised as 'belonging' or 'transgressive' (Douglas 1966; Wolch and Emel 1998; Philo and Wilbert 2000). Introduced species, and social constructions of 'invasiveness', have provided fruitful ground for research in this vein. In addition to consideration of introduced species as 'matter out of place' in 'Western' societies (Milton 2000; Mulcock and Trigger 2008; Peace 2009), scholars have traced conceptual variations between indigenous and settler-descendent cultures (Trigger 2008; Bhattacharyya and Larson 2014), resident and 'external' communities (Rikoon 2006; Jeffery 2014), and geo-political regions (Milton 2011). Similarly, a few studies (including my own earlier work) have explored how cultural configurations of introduced species change over time, and in relation to broader technological, scientific, and socio-political developments (Bough 2006; Smout 2013; Crowley 2014).

A third approach has developed in conversation with, and in response to critique of, the above bodies of work and their exclusive or dominant focus on deconstructing, and sometimes challenging dominant socio-cultural representations of nonhumans. 'Animal Turns' in the social sciences and humanities have affected disciplines from philosophy to film studies (Buller 2014), enabling a proliferation of research that aims to 'bring the animals back in' (Wolch and Emel 1995) by investigating human-animal continuity, companionship, conflict and co-existence.[4] A raft of recent research therefore

[4] A full discussion of these cross-disciplinary 'animal turns' would be tangential here, but there are several useful overviews of developments in geography (Johnston 2008; Lorimer and Srinivasan 2013; Buller 2014, 2015, 2016), the interdisciplinary and associated fields of (human)-animal studies (Waldau 2013; Marvin and McHugh 2014)

aims to take nonhumans seriously (Johnston 2008) as living research, political, and ethical subjects. Often focusing on 'beastly places' (Philo and Wilbert 2000) of encounter "with actual 'critters'" (Buller 2014, p313), this research considers how human and nonhuman lives interact with and impact one another, rather than simply how humans interpret and represent 'flat', archetypal nonhumans (see also Haraway 2008). Much of this work is theoretically and methodologically influenced by the development of 'relational' thinking, in which "reality does not precede the mundane practices in which we interact with it, but is rather shaped by those practices" (Mol 1999, p75). Scholars pursuing 'more-than-human' (Whatmore 2006) and 'multinatural' (Bingham and Hinchliffe 2008; Lorimer 2012) geographies argue that nonhumans are not simply essential forms 'out there' that can be described and counted (a traditional natural scientific approach); nor, however, are they constructed 'in here' by cognition or culture (a traditional social scientific approach). Rather, "non-human organisms of all kinds are seen as co-creators – with humans, and even with non-organic things – of worlds that are forever under construction" (Benediktsson 2015, p143). That is, the worlds of humans and nonhumans are formed in continuous relation with one another (see also Whatmore 2002; Hinchliffe 2007; Lorimer 2015). Rejecting 'nature/culture' and 'human/nonhuman' binaries, these approaches also highlight the vitality, indeterminacy and, mobility of nonhuman life (Hinchliffe and Whatmore 2006; Braun 2008; N. Clark 2013).

Robbins (2004) formed an early link between relational thinking and 'biological' invasions, proposing that invasive species can be understood as just one part of situated, 'power-laden' networks of human and nonhuman actors. Several studies have demonstrated the roles that lively, introduced nonhumans – including trees (Lien and Davison 2010), fish (Franklin 2011; Lien and Law 2011), and pigs (Meurk 2014) – play in shaping events, identities, and relationships. Everts (2015), examining plant eradication initiatives in Germany, further shows how "invasive life has the capacity to produce human communities" (p951). Some of this research builds on existing understandings of how human societies construct categories and representations of introduced species. Lavau (2011), van Dooren (2011) and J. L. Clark (2015) – respectively drawing on case studies

and anthrozoology (Hurn 2010, 2015), and the explicitly normative critical animal studies (Taylor and Twine 2014).

of Australian fish, predation of penguins by introduced foxes, and a raft of marine organisms brought to Californian shores by a tsunami – have all explored how existing cultural and ethical taxonomies of what 'belongs', and what does not, inform peoples' material responses to new arrivals and established colonists. It is not just nonhumans, of course, who are affected by these interactions: Atchison and Head (2013) and Atchison *et al.* (2016) identify some of the motivations, risks and satisfactions involved when humans eradicate the 'bodies' of invasive plants and kill introduced carp, and Wanderer (2014) and van Dooren (2015) discuss the 'violent-care' of conservation practices that involve killing introduced animals. Relational thinking has also been applied at larger socio-political scales: Ginn (2008) has employed it to develop a critique of eco-nationalist politics and orderings in New Zealand, and N. Clark (2002, 2013) and Barker (2010) have both examined relations between humans, species movements, and regional/international policies and frameworks for 'biosecurity' (which includes, but is not limited to, securing spaces and ecologies against biological invasions). By breaking out of disciplinary grooves to consider influences and interactions that might be missed by traditional research approaches, this work has the potential to overcome the continuing division of academic labour between the 'natural' and 'social' sciences. Relational analyses enable both conventional paradigms and entrenched divisions to be shaken up and reinterpreted, and therefore provide the theoretical and empirical grounding for productive new research directions. Also, and importantly in relation to environmental management, this research has demonstrated the value and, arguably, the necessity of reorienting 'invasion science' from a sub-discipline of ecology to a problem-oriented, multi-disciplinary field that is better able to articulate and attend to the socio-ecological feedbacks and dynamics that both produce and mitigate 'biological' invasions (Vaz *et al.* 2017).

Misalignments and gaps: introduced species in academia, policy and practice

Philosophers and social scientists are increasingly exploring the value and potential of approaches that seek to replace the dualisms of nature/society and ecology/politics with relational thinking. Meanwhile, in the natural sciences, there is growing interest in 'socio-ecological systems' (Mace 2014), where 'social' and 'ecological' systems are understood to be at least connected, if not necessarily co-constituted (*cf.* relational interpretations). Furthermore, the advent of the

'Anthropocene', and the supposition that most, if not all, ecosystems are now in some way affected by human activities, has been accompanied by growth in natural scientific interest in biotic responses to climate change, urban ecologies, and (as noted above) 'novel ecosystems' (see also Lorimer 2015). However, most policy and conservation approaches to introduced species still focus on monitoring and managing 'invasive species' – rather than 'invasive networks' (Robbins 2001, 2004) of humans and nonhumans – and popular understandings of both introduced species and biodiversity continue to render humans external and threatening to 'natural' systems (Fischer and Young 2007; Selge and Fischer 2011; Van Der Wal *et al.* 2015).

Despite some convergences, therefore, there are still areas where natural and social scientists are 'talking past' one another. Whereas social researchers have produced important critiques of the language and practices of invasion science and management, these are often abstract and desk-based, and comparatively little research has engaged with, and helped evaluate or inform, specific empirical problems and disputes posed by introductions, impacts, and management of introduced species. Meanwhile, extensive natural scientific research has been conducted into (potential and established) colonists and their ecological interactions. However, invasion ecologists remain disinclined, for a range of reasons, to examine and address the political dimensions and implications of both their science (including its communication) and the environmental management practices they recommend. There is consequently a clear need for greater, less suspicious interdisciplinary engagement, in which social scientists move on from ideology critiques and in among 'the mess' (Law 2004b) of environmental politics and management, and natural scientists recognise and interrogate the normative and socio-political aspects of their work.

There are also disconnects between research, policy and practice. Although scientific data and publications are used to assess the relative risks of species introductions, policy-makers are also tasked with evaluating the environmental, economic and social implications of management measures against those of invasions (Boonman-Berson *et al.* 2014; and Chapter 5). A misalignment between the emphases of scientific research and information requirements of management practitioners (the 'knowing-doing' or 'research-implementation'

gap) has also, therefore, been identified as a problem (Bayliss *et al.* 2013; Matzek *et al.* 2013); most invasion science focuses on understanding the processes and enumerating the impacts of invasions, rather than developing or evaluating management alternatives (Hulme 2006; Esler *et al.* 2010). Even where research is available, environmental managers may be unaware of it (Gozlan *et al.* 2013) and/or make decisions based on different kinds of knowledge, including personal experience (Matzek *et al.* 2013) and/or contextual information about specific problems. Outlining important differences in the way invasive populations are conceptualised and responded to in science, policy and wildlife management Boonman-Berson *et al.* (2014) conclude that:

> "current preoccupations…with collecting data to decide the origin or nativeness of species and their possible impact do not match well with the needs of wildlife management… We contend that it is important to more fully address the question, in science as well as in policy, of how humans and animals cohabit and live together in practice… The management of invasives cannot be an ecological affair only, but also has to include the dynamic and situated interactions between humans and (individual) animals." (p211)

Ecological politics

I have outlined, in this introduction, a shift in (some areas of) social scientific thinking that aims to better attend to the roles of nonhumans in shaping environments and relations. I have also indicated a shift in the interests of invasion scientists towards the 'human dimensions' of species introductions and invasion, and growing consternation about the way in which 'the science' of introduced species is presented to non-academic publics. In other words, there has been a convergence of interest, among social researchers, on the 'more-than-human' components of their study systems, and a similar convergence, among natural scientists (including invasion scientists) on the 'more-than-ecological' components of theirs. The two are drawn together in 'lively political ecologies', or (given that political ecology refers to a broader field with a slightly different history and focus)[5] studies of 'ecological politics' (Hinchliffe *et al.* 2005;

[5] The 'classic', structuralist incarnation of political ecology was conceived in the context of developing countries, explaining environmental disturbances in terms of their connectedness to broader political and economic systems (McCarthy 2005). Sociologists Rikoon (2006) and Norgaard (2007) have taken classic political ecology approaches to understanding controversies in ISM. This approach has been criticised, however, for a tendency to render dynamic assemblages as static economic and political

Lorimer 2010a; Collard 2012; Barua 2014). That is, politics with the nonhumans in, or ecology with the politics in. This research conceptualises humans and nonhumans as heterogeneous, active inhabitants of shared environments, and is therefore able not only to examine how ecology is politicised, but also to tell us something about the roles nonhumans play in co-producing landscapes and events (Barua 2014; Turner 2015). It provides an alternate means of understanding human-nonhuman relations that is capable of decentring humans as the sole agents of political and environmental change, and revealing how nonhumans can resist (or indeed, facilitate) human organisational and governance regimes. Lively political ecologies also have political implications: identifying nonhuman influence and agency arguably demands a reconsideration of political practices towards those that are better suited to taking nonhumans into account (Hinchliffe *et al.* 2005). Research investigating 'ecological politics' is therefore related to Latour's normative proposal for practising 'ecologised politics', which involves not only identifying and discussing, but also actively attending to ongoing and 'emergent' relations between humans, nonhumans and other entities, in his "progressive composition of a common world" (Latour 2004, p47).

I have also highlighted, here, two of the challenges currently facing academic research into ISM, which my research aims to address. First, there is some concern and reticence about recognising and approaching ISM as a socio-political, rather than simply 'scientific' endeavour, partly because this opens it up to controversy and contestation. Second, there is a great deal of relatively abstract discussion about biological invasions as a concept and large-scale phenomenon, and comparatively less consideration of how introduced species are responded to 'in practice' (Lien and Law 2011), including the material practices of management: checking boots and boats for hitchhikers, pulling plants, and killing animals (but see a recent increase of social research beginning to correct this, e.g. Atchison and Head 2013; Meurk 2014; Wanderer 2014; J. L. Clark 2015; Atchison *et al.* 2016).

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structures and for prioritising politics at the expense of ecology (Walker 2005). This approach can therefore render "the nonhuman world as a mute and stable background to the real business of politics" (Hinchliffe 2008, p89).

Managing introduced wildlife in the United Kingdom

In keeping with most commentary on 'the problem' of invasive species, I have so far discussed species introductions at an international scale. However, most management strategies and projects are implemented at national or regional level, and in practice management is often performed at smaller scales again: monitoring specific introduction pathways or borders, or targeting spatially localised populations. A clarification of the scope of this thesis is provided in Chapter 3. Here, I introduce some of the broader ecological, political and socio-cultural context that informs ISM in the UK.

Native and introduced species in the United Kingdom

Since the end of the Last Glacial Period, 'natural' history in the United Kingdom has been shaped by successive colonisations, invasions and expansions of human societies. There are currently ~1,875 species in the UK identified as non-native and established (mostly terrestrial plants), and there has been a significant rise in species establishments over the last 400 years (Roy *et al.* 2012), associated with British exploration, colonialism, expansionism, and industrialisation. The same period also saw, however, continued human 'subjugation' of wildlife through selective breeding, the elimination of unwanted species, and land-use change, resulting in a landscape "largely devoid" of predators who would compete with human hunters and eat domestic animals, and a remarkably safe countryside with "accessible, appropriated and unthreateningly recognisable" nature (Buller 2004, p132). The contemporary flora and fauna of the British Isles is therefore a mixture of 'native' species (those arriving before the loss of the land-bridge connecting Britain to continental Europe), 'naturalised'[6] species (such as the European hare *Lepus europaeus* and fallow deer *Dama dama*, likely introduced by the Romans and Normans respectively, but widely regarded as native: Yalden 2010), and identifiably 'exotic' or 'non-native' species, often those introduced within the past 100-200 years. However, despite hosting a plethora of introduced species, the British Isles lack

[6] Technically, 'naturalised' means introduced species that have established a self-sustaining population, but it is often used to refer to those that have been established for such a time that the time and mechanism of their arrival is unknown.

many common European species that either never arrived, or have been extirpated.

Governing introduced wildlife in twentieth-century Britain

The Nature Conservancy[7] – a national agency for nature conservation in Britain – was founded in 1949. Its establishment is often attributed to the work and advocacy of several prominent ecologists, including Arthur Tansley (who famously developed the ecosystem concept) (Bocking 2012). Tansley believed that "English character and culture were bound up with landscape" (Livingstone 1995, p368), that the diverse, distinctive rural landscapes of Britain (e.g. moorland, woodland, farmland) represented centuries of harmonious relations between humans and nature, and that these landscapes required conservation (Bocking 2012). However, this did not amount to leaving them alone, but conducting planned, ecologically informed management. Conservation and the ecological sciences developed in tandem during the twentieth century; knowledge about nature enabled it to be classified and objectified, which in turn enabled nascent conservationists to predict, direct and control environmental change (Livingstone 1995; Adams 1997). Applied ecology provided knowledge that could underpin increasingly complex environmental management. Consequently, scientifically-informed 'conservation by interference' became standard practice in Britain, and arguably remains so (Henderson 1992; Adams 1997; Lorimer 2015; and *cf*. the American ideology of wilderness preservation: Cronon 1995).

The development of nature conservation coincided with the development of scientifically-informed, and sometimes state-supported, control of nuisance wildlife. Pest control formed an important part of the work of the UK Government's agricultural departments in the first half of the 20th century, and ministers based many of their management strategies on the work and advice of ecologists, including Charles Elton (who, in addition to this and his work on invasive species, also helped form the Nature Conservancy) (Sheail 2004). Some of the pests disrupting food production were introduced species, including brown rats (*Rattus norvegicus*) and rabbits (*Oryctolagus cuniculus*). The UK

[7] Later the Nature Conservancy Council (NCC).

Government invested heavily in attempted eradications of several nuisance species, including the successful removal of muskrats (*Ondatra zibethicus*) and the ultimately unsuccessful Pests Act (1953), which was intended to eradicate rabbits via Government-sponsored 'rabbit clearance societies' (Sheail 2004). Despite Elton's budding interest in invasion ecology, introduced species were largely targeted because of their agricultural (rather than ecological) impacts. This is apparent when the concerted efforts to eradicate muskrats are compared against the Government response to introduced American mink *(Neovison vison).* Mink became established despite their eradication being 'universally sought' (or at least, widely accepted). However, mink farming also brought economic benefits, and as there was (a) scientific uncertainty surrounding the ecological impacts of wild mink; (b) little economically significant agricultural impact; and (c) political uncertainty as to whether mink control was a government responsibility, state investment in mink eradication was less than forthcoming (Sheail 2004).

Government policy and management responses to introduced pests, then, have developed in association with, and been informed by, modern ecological science. However, until recently the state had no formal strategy, and invested little resource, into managing introduced species for conservation purposes.

Contemporary introduced species management

Environmental management in the UK is currently devolved to its constituent nations, each of which has its own statutory conservation body; the Nature Conservancy's current successor is Natural England, accompanied by Scottish Natural Heritage, Natural Resources Wales and the Northern Ireland Environment Agency. Legislation addressing introduced species is incorporated primarily under the Wildlife and Countryside Act (WCA) (1981) in England and Wales, and in the Wildlife (Northern Ireland) Order 1985. Scotland has since implemented the Wildlife and Natural Environment (Scotland) Act 2011. In England, Wales, and Northern Ireland, it is illegal to release into the wild any species that is neither 'ordinarily resident' nor a 'regular visitor' to Britain in a wild state, or any species listed on Schedule 9 of their respective regulations (mostly established introduced species). In Scotland, it is illegal to release any species 'outwith its native range'.

In 1992, on becoming a party to the Convention on Biological Diversity (CBD), the UK agreed to take more concerted action, and: "as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" (Article 8(h), CBD, 1992). The UK Government subsequently produced a policy review, which recommended a coordinated approach to managing non-native species, and the adoption of the CBD-recommended three-stage hierarchical approach to management (Defra 2003). Since its 2005 establishment, the GB Non-Native Species (GBNNS) Coordinating Mechanism[8] has:

(a) produced a catalogue of non-native species in Great Britain;
(b) developed detailed procedures for assessing the potential negative impacts of established and prospective non-native species, and conducted >60 risk assessments;
(c) developed 'rapid response' contingency plans for the arrival of high-risk species such as the Asian hornet (*Vespa velutina*);
(d) initiated eradication efforts targeting ruddy ducks (*Oxyura jamaicensis*) and the freshwater fish topmouth gudgeon (*Pseudorasbora parva*); and
(e) implemented biological control programmes for the problematic plants Japanese knotweed (*Fallopia japonica*) and Himalayan balsam (*Impatiens glandulifera*) (Defra *et al.* 2015).

There have also been several developments in introduced species law and policy surrounding introduced species since I began this project in 2013. Three are particularly relevant to the content of this thesis. First, the introduction of the Infrastructure Act (2015) provided Government and its agencies with powers of access to private land for the purposes of controlling invasive species under 'Species Control Agreements/Orders'.[9] Second, new European legislation came into force on 1 January 2015 that requires member states to take action to manage introduced species 'of [European] Union concern' (EC 1143/2014).

[8] Further information about the working of the GBNNS mechanism are provided in Chapter 4. The cross-border equivalent for Ireland and Northern Ireland is Invasive Species Ireland (see Stokes *et al.,* 2006).

[9] This brought legislation in England and Wales in line with similar powers already introduced in Scotland by the Wildlife and Natural Environment (Scotland) Act (2011).

Finally, an updated national strategy for non-native species was published that recommends continuation of existing work, but places increased emphasis on 'horizon scanning', preventative measures and rapid response mechanisms (Defra *et al.* 2015). The GBNNS mechanism does not, however, cover human or plant pathogens, nor does it cover the management of formerly resident species (e.g. those classified as native, but not currently present); the Government does, however, have powers of access to control any 'not ordinarily resident' species under the Infrastructure Act (2015).

Controversy and conflict in wildlife management

Despite their foundation in conservation-oriented statutory instruments such as the CBD, and alignment with scientifically-informed policy and management recommendations, some efforts to manage introduced species in the UK have been controversial. Notably, the GBNNS mechanism's flagship, supranational ruddy duck eradication project, implemented to halt the species' expansion and further hybridisation with white-headed ducks (*Oxyura leucocephala*) in Spain (Henderson and Robertson 2007), was challenged by animal protection organisations and some birdwatching communities (Milton 2000).[10] In Chapter 2 I discuss conflict in invasive species management in greater detail, and provide a case study of another controversial eradication effort in the UK (targeting hedgehogs introduced to the Scottish islands of Uist).

More broadly, however, it is worth highlighting that, as Tansley recognised, there are enduring connections between "animals, place, landscape and British national culture" (Cassidy 2017, p6). Multiple wildlife species – and particularly vertebrates – have become entangled with socio-cultural meaning, connected both with the region and social histories, communities and classes: notable examples are badgers (*Meles meles)* (Cassidy 2012), foxes (*Vulpes vulpes)* (Marvin 2000; Woods 2000), otters (*Lutra lutra*) (Syse 2014), red squirrels (*Sciurus vulgaris*) (Lurz 2014; Coates 2015) and wild birds (especially passerines) (Moss 2013). However, wildlife of all kinds is multivalent, and the

[10] This project's rationale – of retaining the white-headed duck's genetic distinctiveness – has also been discussed by academics as treading a difficult line between conservation and 'naturalistic eugenics' (Macdonald *et al.* 2007; Rotherham and Lambert 2013).

use, protection, and/or extermination of wild animals – introduced or not – is regularly, and sometimes hotly and publicly, contested (Marshall *et al.* 2007; Redpath *et al.* 2013; Linnell *et al.* 2015).

In Britain, in addition to chronic conflicts surrounding management of badgers and/or cattle to tackle bovine tuberculosis (Cassidy 2017), hunting with dogs (May 2016), and predator control (Marshall *et al.* 2007), there are also emerging contestations surrounding human control of and/or coexistence with animals inhabiting or colonising 'novel' ecologies (e.g. urban foxes and gulls: Cassidy and Mills 2012; Belant 1997), and potential recoveries and reintroductions of formerly abundant/resident species (Seddon 2010; Corlett 2016; and Chapter 6). The case studies discussed in this thesis have therefore arisen against a background of (a) widespread public interest in, and concern for, wildlife and (b) contentious wildlife management issues, both of which affect how introduced populations are responded to and managed.

The thesis

Research objectives

In this thesis, I aim to apply contemporary social research methodologies to develop understanding of how introduced species management is being done in the UK. I aim to produce 'lively' political ecologies of a series of case studies, which consider (i) why and how introduced species management is initiated; (ii) whether, why and how it is contested; and (iii) what relations and outcomes emerge 'in practice'. My research is therefore situated at an interface of:

(a) social scientific work examining both (largely discursive) environmental politics and material, situated interactions between humans and wildlife; and
(b) applied, policy-relevant research which aims to inform the development of introduced species management as a viable, effective, and socially legitimate form of socio-ecological governance.

As my thesis is structured as multiple, discrete academic papers, it is not my objective to make a single central claim or argument. Rather, I aim to make

several connected but distinct research contributions, based on a series of thematic cases, that are interesting and relevant to both social and natural scientific audiences, and informative for policy and management planning. I also aim to apply and, where possible, contribute to theoretical understandings of ecological politics (especially in Chapter 6) and human-wildlife interactions (Chapters 4 and 7). More explicitly, my aim is to empirically investigate introduced species management by engaging directly with its advocates, opponents and practitioners, and provide novel insights into the politics and practices of this emerging arena of human-wildlife interaction and environmental governance.

Structure

Following this general introduction, Chapter 2 provides a more focused overview of social controversies and conflicts surrounding invasive species management. Based on a review of international case studies, and drawing on theory from conflict studies, I discuss why and how social disagreements surrounding the appropriate management of introduced species have developed into destructive conflicts, and propose that certain approaches to management can increase the likelihood of disputes escalating.

After an overview of my methodological approach in Chapter 3, my first case study examines in detail one such management dispute, which arose surrounding the attempted eradication of introduced monk parakeets (*Myiopsitta monachus*) from two urban regions in south-east England. Chapter 4 focuses on the motivations and work of self-styled 'parakeet protectors': residents of both areas who campaigned against the government-initiated eradication project, and have significantly delayed its success. I identify three important issues within the dispute: differences in the way campaigners and government interpreted and presented the impacts and risk of monk parakeet introductions in other parts of the world; the importance of human 'attachments' to charismatic introduced species; and the significance of management process, including both the Government's approach to the eradication project, and its response to residents' concerns. I argue that controversy surrounding monk parakeet management might readily have been foreseen, but that current policies and procedures for initiating management projects have no mechanism for assessing or responding

to people's concerns. Chapter 5 articulates a more theoretically-informed and policy-oriented version of this argument, and specifically proposes that Social Impact Assessment (SIA) – a means of assessing and incorporating social considerations as part of management planning – might be usefully adapted and applied to ISM.

My second case study moves from discussing pre-management planning to consider how British governing authorities and interested publics respond to the discovery of a (re)introduced species. The Eurasian beaver (*Castor fiber*) is a 'former resident' species, but has been absent from England for several hundred years. In 2014, however, a family of beavers were photographed on a river in Devon. In Chapter 6, I trace the development of this case from the first reported sightings to its eventual 'resolution' in the implementation of the River Otter Beaver Trial. I examine how the UK Government and a range of interested parties responded to the presence of beavers, and demonstrate how the collective power of those who – for a multiplicity of reasons – argued that beavers 'belong' in Britain was sufficient to force the Government to rescind its plans to remove the population. Instead, the 'River Otter Beaver Trial', a formal means of monitoring and managing the existing population, was established. The chapter concludes with a discussion of the risks and opportunities of treating this trial as a 'wild experiment' (Lorimer and Driessen 2014; Lorimer 2015).

The final case study shifts away from the politics of conflict to the practices of managing Eastern grey squirrels (*Sciurus carolinensis*) throughout Britain. In contrast to the previous case studies, which involved acute contests about specific populations and management initiatives, this paper is interested in the ongoing management of an established introduced species, the continued success of which has created a range of challenging environmental, economic and socio-political problems in Britain. In Chapter 7 I focus on why and how management practitioners kill (or, sometimes, avoid killing) squirrels. I identify three primary 'modes' in which grey squirrels are killed, and discuss the different motivations, aims, ethics and material practices of these modes in relation to the three primary 'projects' of grey squirrel control: red squirrel conservation projects, woodland protection and routine or ad-hoc removal of 'vermin' and/or 'invasives'. Highlighting tensions and accords between these co-existing 'modes of killing', I

identify the potential value, for management planning, of explicitly articulating and deliberating about multiple rationales and aims of killing wildlife.

The thesis concludes with a discussion (Chapter 8) identifying the key themes and contributions of this research to socio-ecological literatures surrounding human relations with wildlife, and its potential application to the development of policies, projects and practices of introduced species management.

Chapter 2

CONFLICT IN INVASIVE SPECIES MANAGEMENT

Chapter 2: Conflict in Invasive Species Management

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Abstract

As invasive species management becomes more ambitious in scope and scale, projects are increasingly challenged by disputes and conflicts among people, which can produce undesirable environmental and social outcomes. Here, we examine when and how conflicts have arisen from invasive species management, and consider why some management approaches may be more prone to conflict than others. Insufficient appreciation of sociopolitical context, non-existent or perfunctory public and community engagement, and unidirectional communications can all foster 'destructive' conflict. We propose that approaches to conflict in invasive species management might be transformed by anticipating disagreements, attending more carefully to the social-ecological contexts of management, adopting more inclusive engagement mechanisms, and fostering more open, responsive communication. Conflicts may be unavoidable, but they can be anticipated and need not be destructive.

Introduction

Invasive species management (ISM) encompasses a broad range of activities in environmental policy and practice, including preventing introductions of non-native species, containing or eradicating new arrivals, and mitigating the impacts of established populations (Simberloff *et al.* 2013). ISM is an important tool for biodiversity conservation but is also implemented to protect economic interests; ecosystem services; and animal, plant, and human health. The diverse drivers and the methods used in ISM are unified by a common goal: to prevent or mitigate the multifaceted problems that arise from human-mediated introductions of non-native species.

As globalized transport and environmental change increasingly facilitate biological invasions, demands and obligations to manage invasive species grow. Signatories to the Convention on Biological Diversity are expected to make concerted efforts to identify and manage biological invasions by 2020 (Aichi Target 9; SCBD 2014). Concurrently, species introductions are projected to rise (Tittensor *et al.* 2014). ISM therefore remains an important field of environmental and ecological research, policy, and practice. In some regions, management projects are becoming progressively more ambitious, propelled by technological advances and a growing wealth of experience. This momentum is particularly evident on oceanic islands where conservation-oriented eradication projects continue to expand in number and scale (Glen *et al.* 2013); the most ambitious of these aims to eradicate introduced predators from New Zealand (Russell *et al.* 2015).

Despite its growth and successes, ISM can also be controversial, regularly stimulating debates about achievability, efficiency, social fairness, and ethical implications. ISM often involves contentious strategies and methods, including restriction of personal and trade freedoms, extensive use of chemical and biological control agents, and large-scale culling of sentient and/or valued species. More numerous and ambitious management projects inevitably intersect with a wider variety of human communities, interests, and values, and managers are now regularly challenged by social disagreements, some of which intensify into destructive conflicts (Estévez *et al.* 2015).

ISM is therefore also an emerging arena of social conflict. It serves as a focal point for longstanding disagreements, and sometimes ignites new debates. The diverse drivers and outcomes of ISM produce conflicts with unusual configurations and alignments of issues, values, and actors: environmental organizations collaborate with agricultural industries to control invasive pests; hunters and animal-rights activists attempt to protect introduced game species; and conservation organizations find themselves at odds with animal welfare organizations, who might otherwise be their natural allies.

Despite their comparative novelty and idiosyncrasies, ISM conflicts can be identified as a sub-category of 'environmental conflict', a term that also encompasses social conflicts surrounding natural resources, environmental hazards, and biodiversity conservation. Those interested in understanding and addressing ISM conflicts can therefore learn from existing research on environmental conflicts. Recent work has, for example, explored ways to map and manage existing, often well-established, conservation conflicts (Redpath *et al.* 2013; Madden and McQuinn 2014). However, by examining when and how conflicts have emerged in response to ISM, we should also be able to better anticipate them, and potentially prevent their escalation or entrenchment. In other words, understanding ISM conflicts can be informative for ISM practices, because it enables management projects to be designed and implemented in ways that make them less susceptible to conflict in the first place.

We briefly consider what conflicts are, how they emerge, and what makes them destructive. We review the literature to examine the drivers, events, and outcomes of a range of social conflicts surrounding ISM. We have deliberately studied contested cases to explore patterns of conflict development and escalation and have not sought out the many conflict-free projects. We found that some common ISM strategies were inadequately equipped to recognize or address social disagreement, and in certain cases have actually exacerbated nascent conflicts. We outline some key principles that managers might follow to reconfigure ISM practices, to render them less conflict-prone, and we identify tools and strategies that could help. We are not suggesting wholesale replacement of current strategies, many of which have achieved success. Rather, we aim to adjust and extend the existing management repertoire.

Conflict: concepts and processes

Social conflicts are relationships of disagreement that arise between individuals and groups who express seemingly incompatible beliefs, values, or goals. Conflict is inherent in societies and can serve a valuable purpose, for instance by highlighting social injustices (Norgaard 2007) or ethical issues (Lynn 2012). However, when conflicts escalate or endure over long periods they can become destructive (see below).

All conflicts involve unique configurations of actors, issues, and events, but people engaged in conflict often behave in relatively predictable ways. This has enabled researchers to identify patterns in how conflicts change over time: a useful visualization of this is the 'conflict curve' (Figure 2.1). Two key, related processes exacerbate conflicts. *Polarisation* occurs when disagreements become framed in oppositional, often binary, terms. Reducing complex debates to simple 'for or against' positions implies that parties are on opposing sides in a win-or-lose game (Redpath *et al.* 2013), and can mask areas of agreement by assuming that these positions are mutually exclusive (Minteer and Collins 2005). Media attention can contribute to polarization as journalists seek to construct a compelling story and present both 'sides' of an issue, even when those sides are unevenly or unclearly drawn (Baumann and Siebert 1993).

Escalation describes an increase in conflict intensity and complexity, where growing numbers of issues and people become entangled in a debate. As people establish and defend their positions, a positive feedback loop of claims and counter-claims accumulates, making it difficult to identify, let alone address, the original or most pertinent issues. In Bellingen, Australia, a dispute developed over a proposal to remove introduced camphor laurel trees (*Cinnamomum camphora*) from the town center (Macleay 2013). Once opposing positions had been established, "justification…end[ed] up as a kind of exercise in distraction" (Macleay 2013, p5), producing a confusing mass of arguments about aesthetics, ecological risk, heritage, tourism, health, environmental ideologies, and political biases. Escalating conflicts can develop their own momentum to the point that winning, or hurting opponents, becomes more important than resolution, or even the original problem (Burgess and Burgess 1996).

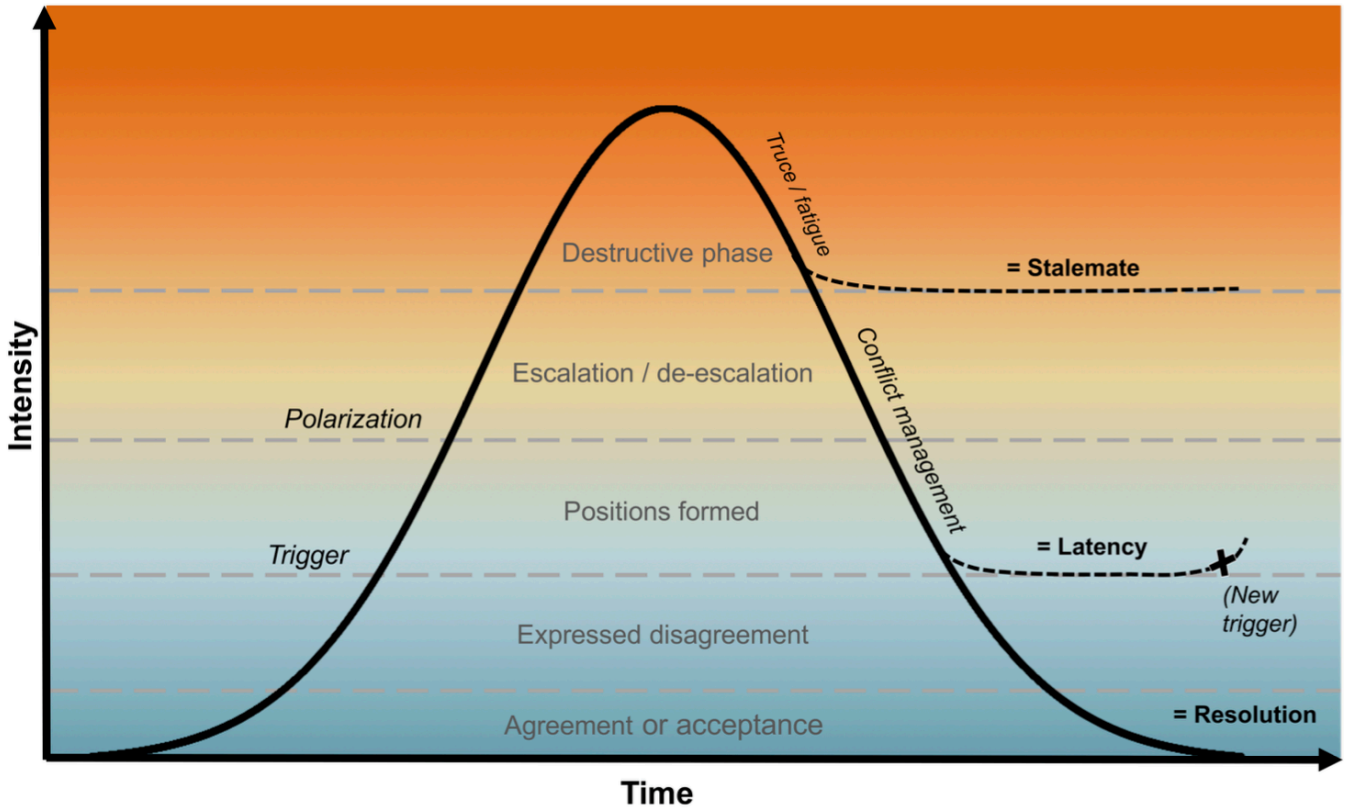

Figure 2.1 The conflict curve: visualising conflict processes and outcomes.

This diagram charts the hypothetical course of a dispute or conflict over time. There are three elements: stage of conflict development (central text), key processes (italicised text) and outcomes (bold text). Conflict management is indicated here as a de-escalation process, but can also be used pre-escalation, as an intervention strategy. Adapted from Svanström and Weissmann (2005).

Escalated conflicts are self-perpetuating; hostile relationships become the norm, tractability and opportunities for constructive dialogue are reduced, and 'the opposition' become stereotyped and misrepresented (White *et al.* 2009). These conflicts are destructive because they produce both damaging outcomes (sometimes including direct aggression) and damaged relationships (Putnam and Wondolleck 2002). Such intensity can rarely be sustained, so conflict simmers at low intensity (stalemate), while remaining unresolved, or enters recurring cycles of latency and escalation (Panel 2.1 and Figure 2.2). Rather than culminating in clear resolutions or 'victories', conflicts often produce ambiguous outcomes and uneasy compromises. Some conflicts can be successfully settled through mediation or the judicial system. However, when applied to intractable, complex, and/or escalated conflicts, mediation or adjudication can become ineffective, or at best temporary: like placing "a Band-Aid over a gaping wound" (Burgess and Burgess 1996, p306). Indeed, attempting to resolve complex conflicts through simple arbitration can actually exacerbate them (Madden and McQuinn 2014).

Enduring and/or escalated conflicts are clearly problematic: they don't help solve the problems created by biological invasions, but drain resources and damage relationships, producing anxiety, antagonism and distrust. Our contention here is that although conflicts cannot (and in some cases should not) be entirely avoided, how they are approached and responded to matters, and their destructive potential might be minimised by better management of the tensions and disagreements that foreshadow escalation. We therefore need to identify why destructive conflicts have arisen from ISM, and whether and how management practices have contributed to this process.

Factors affecting conflict development

Management context

ISM does not take place in a sociopolitical or ecological vacuum. Although in academic and policy circles, biological invasions are often discussed in terms of theoretical principles, risks, and calculations, in practice they occur in specific places and ecosystems inhabited by and connected to diverse human and ecological communities. Ecologists and managers regularly assess and include ecological complexity and uncertainty in the design of management projects, but

human social complexity, and the sociopolitical and historical contexts in which management is delivered, often receives less explicit examination.

Perceptions of introduced species and the risks they pose vary between communities and cultural groups (Estévez *et al.* 2015). Managers are sometimes required to account for this variation in planning and decision making: in New Zealand, for example, management strategies must pay particular regard to Maori concerns (Kapa 2003), including their kaitiakitanga (guardianship responsibilities) to introduced species such as kiore (*Rattus exulans*). However, perceptions and values also vary within communities and cultural groups, and are subject to change (Crowley 2014). Personal, community, and cultural attachments to introduced species can develop relatively quickly: in Chicago, monk parakeets (*Myiopsitta monachus*) introduced <50 years ago have come to symbolize the resilience and diversity of the city's human inhabitants, and efforts to control these birds have inspired strong opposition (Pruett-Jones *et al.* 2011). These associations often develop in relation to charismatic taxa, but can also be produced through human interactions with insects, plants, and landscapes (Buhs 2002; Dickie *et al.* 2013). However, such attachments may not become evident until the species or landscape in question is perceived to be threatened. Consequently, the depth of feeling and strength of opposition incited by management proposals can come as a surprise to their proponents.

In 1990, the US National Park Service (NPS) planned to remove a population of horses (*Equus ferus caballus*) from the Ozark National Scenic Riverways in Missouri. The proposed management plan was based on general laws and principles about introduced species, but for some citizens the Ozark horses had become closely linked to community identity and history, symbolizing a (romanticized) ranching lifestyle characterized by freedom and self-determination (Figure 2.3) (Rikoon 2006). The resulting management dispute also developed in the context of relatively recent transfers of land stewardship, as the Ozarks moved from open rangeland to centralized governance (under the NPS). Consequently, the horses also came to symbolize the marginalization felt by residents of an area increasingly protected from human activity. ISM projects justified by simplified environmental ideologies or unqualified first principles (e.g.

introduced species are always undesirable) can therefore be poorly attuned to the complex social landscapes in which they operate (Prévot-Julliard *et al.* 2011).

Conflicts also arise in relation to broader sociopolitical issues that may not initially seem relevant. Case studies from post-colonial nations, for example, highlight the variable access of indigenous communities to meaningful representation in ISM deliberations (Kapa 2003; Norgaard 2007). A second conflict surrounding horse management persists in the Chilcotin region of British Columbia, Canada, and is entangled with ~200 years of political power struggles between First Nation Tsilhqot'in peoples and European settler-descendants, who make competing claims about land and environmental stewardship. Horse management in this region now tends to be initiated for conservation purposes; yet contemporary calls for management resonate uncomfortably with historical attempts, by settlers and governments, to disempower First Nations communities by controlling their valuable wild horse populations (Bhattacharyya and Larson 2014).

Figure 2.2. An Australian wild horse or 'brumby'.

Free-roaming horses have been the focus of multiple management conflicts, including in Australia, New Zealand, and North America. These conflicts often involve disagreements about the ecological impacts of horses, their cultural heritage value, and the welfare implications of various management strategies. Photo © Darinka Maja.

Histories of contested or ineffective management also influence how new ISM proposals are received. Socially, economically, and environmentally costly management failures can erode confidence in future projects (Evans *et al.* 2008), instill distrust in managing authorities (Kahn *et al.* 1990), or affect community perceptions of the risks posed by management (Norgaard 2007). The origin, reputation, and perceived legitimacy of managers are also important, influencing whether they are perceived as biased (Warner and Kinslow 2013) or interloping outsiders.

How people respond to ISM, then, is affected by histories, geographies, politics, knowledge, values, and attachments that are sometimes overlooked when initiatives are planned, and that can trigger bitter disputes. Conflicts arise as manifestations of difference and disagreement; their subsequent course and outcomes are affected by the ways in which these disagreements are approached and managed.

Approaches to management

The public education approach (Callon 1999) to ISM involves top-down decision making, often by centralized authorities. The general pattern is that (ecological or environmental) experts define the problem, evaluate evidence and management options, and advise decision makers, who must then persuade 'the public' (i.e. anyone who is neither expert nor decision maker) to accept their decision, its justification, and its supporting evidence. However, this approach is poorly equipped to recognize and address differences in social values and risk perceptions (Lute and Gore 2014). It can also trigger and rapidly polarize management conflicts. The shooting of >600 horses in an Australian national park, for instance, received immediate and widespread public criticism, and resulted in a reactive ban on aerial culling (Chapple 2005). Deciding, announcing, and defending (Hinchliffe 2007) management plans reinforces them, so that regardless of complexity, uncertainty, or how decisions were reached, interested parties must declare either for or against the proposal. In continually defending their chosen strategy against opposition, managers can also initiate the positive feedback loop that drives conflict escalation.

Increasingly, and often in an effort to move away from the public education model, ISM incorporates some form of consultation. This normally involves the same first steps as the education model (expert assessment, etc.), but decision makers then ask different interest groups for their opinions about possible management options. But if not carefully managed, consultation can produce or exacerbate conflicts, especially if people feel inadequately represented and/or disempowered by the process. For example, a rodent eradication program for Lord Howe Island (Australia) has been repeatedly delayed by technical and social challenges (Wilkinson and Priddel 2011). Island citizens raised concerns about potential ecological and economic impacts of management, but some also opposed the project on principle, because they felt excluded from initial planning and decision-making processes (Lord Howe Island Community Liaison Group 2013).

Consultations can also be counterproductive if interested parties are nominally included but have little genuine power in decision making. Perfunctory consultations, that seek out concerns but do not act on them, can produce this 'internal exclusion'. Mackenzie and Larson (2010) examined a dispute surrounding the Canadian Food Inspection Agency's efforts to halt emerald ash borer (*Agrilus planipennis*) invasions by cutting down ash trees (*Fraxinus spp*) throughout a buffer zone. Landowners' dissatisfaction with the consultation process, the authors argued, made them less likely to work constructively with managing authorities, and intensified conflict. Although landowners were invited to public meetings, some were unwilling to engage in a consultation they considered unfair and exclusive, because the most important decision – that the trees would be removed – had already been made.

Interested parties who lack, or lose, formal power to affect management decisions may seek alternative means of achieving their goals, which can drive conflict escalation by promoting segregation and antagonistic interactions. In the case described above, aggrieved parties joined forces to increase their collective power (Mackenzie and Larson 2010). Others recruit more powerful allies, or generate publicity for their cause through news and social media. In Hawaii, dedicated activists capitalized on the inherent uncertainties of invasion science, and prevailing distrust in government and scientific authorities, to build a

damaging publicity campaign against biocontrol for strawberry guava (*Psidium cattleianum*) (Warner and Kinslow 2013).

Some protesters resort to legal action, as illustrated by two acrimonious ISM disputes: the failed eradication of grey squirrels (*Sciurus carolinensis*) in Italy (Genovesi and Bertolino 2001) and successful eradication of black rats (*Rattus rattus*) from Anacapa Island, California (Howald *et al.* 2005). In both cases, activists identified where eradication projects might conflict with existing environmental and animal protection laws and used judicial systems to delay management. More subtle forms of protest include denying land access to managers and non-reporting of target species, though these resulted in only minor delays for the UK's ruddy duck (*Oxyura jamaicensis*) eradication program (Cranswick and Hall 2011).

Communicating management

The framing and content of communications about invasive species influence perceptions of both biological invasion as a phenomenon and specific management initiatives (Hart and Larson 2014). Although the extent and power of this influence is unclear, the drive to persuade people to accept ISM encourages communication strategies that emphasize positive, or more palatable, project aims (e.g. “Save the Seabirds!” rather than “Kill the Rats!”). However, where ‘educational’ messages are incomplete – or disingenuous – they are liable to be contested by those concerned about what has been omitted, such as the severe animal welfare implications and potential non-target effects of rodenticides.

Where communication is solely intended to inform, it is harder for managers to respond constructively to concerns. A Californian communications campaign about the control (using aerially distributed pheromones) of light brown apple moth (*Epiphyas postvittana*; Figure 2.3a) was criticized for its unidirectional message: “they keep insisting that the problem…[was] communications…that they didn't get their message across well…They got their message across fine. We just didn't agree” (‘health and environment community’ participant in Zalom *et al.* 2013, p23).

Figure 2.3 The light brown apple moth in California.

(a) Management strategies for introduced invertebrate pests such as the light brown apple moth (Epiphyas postvittana) that involve aerial distribution of pheromones have met with strong opposition in the US. (b) This placard refers to one such management program targeting this insect in California, in 2008.
Photos: (a) © Kevin Krejci; (b) © Donald Hobern.

Anticipating and responding to conflict

In this section, we consider how alternative and/or complementary approaches could, by anticipating and carefully responding to disagreements, help lessen the likelihood of destructive conflict. These alternative approaches, with examples of their use in ISM, are summarized in Table 2.1.

Attending to context

As escalated or long-standing conflicts can damage both management outcomes and social cohesion, managers need to work in ways that enable cooperation and constructive debate and that do not risk igniting or reigniting destructive conflicts. Biological invasions are by definition novel, diverse in form and effects, and often unexpected. So, although the principles of ISM might be linear and streamlined (i.e. prevention, containment, eradication, control: Simberloff *et al.* 2013), in practice, managers must work in relation to “messy” and dynamic politics and ecologies (Boonman-Berson *et al.* 2014). Managers therefore need to be attentive to social, as well as ecological, contexts. Clearly, researchers and

managers cannot be expected to resolve wider social inequities or historical injustices alone, but they can make themselves aware of how ISM interacts with, or is fostered by, local, national, and even international histories and politics. Managers could therefore benefit from performing dedicated, pre-project reviews of past initiatives conducted in the same region, or targeting the same species, to identify potential issues. They might also make concerted efforts to understand the specific social contexts within which they are set to operate, through early engagement with interested and affected communities. Explicit integration of social considerations (e.g. using social feasibility or impact assessments; Table 2.1), could improve understanding of socioecological settings, allow identification of interested parties and their concerns, and provide opportunities for developing context-appropriate management options (Crowley *et al.* 2017a).[1]

Inclusive engagement

Attentiveness to socioecological context is the first step to reducing conflict. The second is being able to work fairly and effectively within that context. If differences in interests, ethics, and values are treated as supplementary to the technical, scientific considerations of management, and are ignored or suppressed as a result, conflicts will continue to emerge. Deliberative models of engagement, as opposed to public education or simple consultation models, generally involve organized collaborations between expert and lay participants to develop and constructively evaluate a range of management options. They could be more flexible and innovative than consultations that rely on appraising a single, pre-defined project (Martin 2012). Liu *et al.* (2011) have tested quantitative, deliberative approaches to decision making, using a 'citizens' jury' to evaluate management options for the European house borer (*Hylotrupes bajulus*) in Australia. Other methods are more qualitative or strategy focused, using focus groups or interviews to explore community values and concerns (Table 2.1). While potentially enabling a wider range of views to be expressed, deliberative models must nevertheless pay attention to procedures (e.g. how participants are selected for inclusion or exclusion). More radically, co-management strategies aim to reorient ISM toward a collective approach to knowledge production, problem definition, and project development (Armitage *et al.* 2009; Moon *et al.*

[1] See Chapter 5.

2015). For instance, Kakadu National Park (Australia) is co-managed through careful negotiation of 'Western' and Aboriginal values (Robinson *et al.* 2005). Even where conflict is unlikely to arise, reconfiguring public engagement in ISM could produce more democratic, 'socially robust' (Nowotny 2003) management practices that are largely endorsed by citizens – particularly important where public resources are at stake – and facilitate positive relationships between managing authorities and interested publics.

Opening up communications

A direct consequence of the public education approach to management is that communications about ISM can be partisan and unidirectional. The obvious remedy to the latter is to adopt communication strategies that promote dialogue and are able to respond to concerns. Even relatively simple measures, such as including contact details in press releases or supplying regularly updated 'FAQs', can improve managers' capacity to understand and address concerns (Morrison *et al.* 2011). Clearly, there is a need for messages – describing both the problems associated with biological invasions and the potential benefits of ISM – to be shared. However, and perhaps counterintuitively, communications about controversial projects may be better received if they are resolutely open about the less positive aspects of ISM. There are ways of framing management that acknowledge its inherent risks and ethical challenges, while not necessarily rendering it undesirable (Keulartz and van der Weele 2008; Larson 2010). This frank approach risks inviting debate, and possibly objections, that might not otherwise arise. But it also allows challenges to be voiced and potentially addressed, which is arguably preferable to a defensive response, and could in the longer term increase trust in experts and managing authorities (Stirling 2010).

More broadly, we suggest that ISM could benefit from greater openness (Stirling 2008) in relation to wider society. There remains a drive to educate citizens about 'the problem' of invasive species. However, unidirectional, sometimes didactic, strategies rely on a singular, simplified understanding of invasions that does not recognize variations in how different people understand and interpret the problem, or whether they see a problem at all (Selge *et al.* 2011). In practice, the implications of biological invasions are invariably complex and uncertain. Openness means finding better ways to express and manage these ambiguities,

rather than simplifying them (Stirling 2010), and explicit recognition that ISM is rarely (if ever) an apolitical enterprise.

Conclusions

Disagreements about ISM are inevitable and are likely to become more frequent. Recognizing this allows, and perhaps even requires, managing authorities to adopt an anticipatory rather than reactive approach to conflict. We have identified a selection of established practices, common to many ISM projects, that can engender destructive conflicts. Inattentiveness to the complex socioecological contexts of management can cause important issues to be overlooked or delegitimized, inspiring tension and opposition. Tensions can be exacerbated by management approaches that exclude interested parties from meaningful participation in planning and delivery. Furthermore, the way in which management initiatives are communicated can affect both how they are received and managers' ability to respond to concerns. There are no simple solutions, and we have therefore avoided championing a single approach or tool. Instead, we propose that the incidence and severity of conflicts could be minimized by following three key principles to carefully reconfigure certain practices within ISM: greater, explicit attention to the sociopolitical contexts of management; early, inclusive, public engagement; and open, responsive communication strategies. Disagreements about invasive species may be inevitable, but destructive conflicts about their management are not.

Table 2.1 Principles, tools and strategies to anticipate and respond to conflicts in invasive species management

Factors affecting conflict development	*Key management principle*	*Alternative tools and strategies*	*Examples and evidence*
Context			
a) Socio-ecological complexity **b) Variation in values, attitudes and perceptions** **c) Existing socio-political issues** **d) Legacies of conflict or failure**	Explicit attention to socio-ecological considerations and contexts	Reviews of previous management initiatives to identify potential opportunities / challenges Conduct preliminary, participatory social assessments focusing on particular management context	Plant eradications in the Galapagos (Gardener *et al.* 2010) Rodent eradications on oceanic islands (Campbell *et al.* 2015) Invasive species management in urban areas (van Ham *et al.* 2013) Wild horse management in Oceania (Nimmo and Miller 2007) Socio-cultural values assessment (Context 2015) Social impact assessment (Estévez *et al.* 2013) Public attitude assessments (Schüttler *et al.* 2011) Community perception and preference evaluations (Vaarzon-Morel and Edwards 2012; Santo *et al.* 2015)
Approach			
a) **Public education** b) **Perfunctory consultation** c) **Internal exclusion**	Inclusive public and community engagement	Deliberative or democratic approaches to ISM planning and delivery	Multi-criteria decision analysis (Liu *et al.* 2011) Structured decision making (Liu *et al.* 2012; La Morgia *et al.* 2016) Co-management (Robinson *et al.* 2005)
Communication			
a) Direction (unidirectional / dialogic) **b) Message and tone**	Open and responsive communication	Seek feedback and respond constructively Honest messages	Unidirectional *vs* dialogic communication in invertebrate eradication efforts, California (Zalom *et al.* 2013) Role of language and framing in communications (Gobster 2005; Hart and Larson 2014; Ernwein and Fall 2015)

Panel 1: Removing European hedgehogs from Scottish islands

European hedgehogs (*Erinaceus europaeus*) were introduced to the Scottish island of South Uist in 1974 to control garden pests. However, research in the 1990s identified hedgehog consumption of eggs as an important factor affecting the decline of wading shorebirds on the Uists (Jackson and Green 2000). In 2003, the statutory nature conservation organization, Scottish Natural Heritage (SNH), launched the 'Uist Wader Project': a trapping and euthanasia program aiming to locally eradicate hedgehogs. But hedgehogs are a popular icon of British wildlife, and are believed to be in national decline. The project inspired widespread criticism and opposition, particularly in the news media (Webb and Raffaelli 2008). A consultation was held, but some felt that this was largely perfunctory: one attendee (a respected mammal biologist) said, "the 'discussion' to which we had been summoned was actually just an announcement. We were simply informed that the animals would be caught and killed" (Warwick 2012, p115). A coalition of conservation and animal welfare NGOs formed 'Uist Hedgehog Rescue' (UHR) and argued that hedgehogs should be captured and translocated to the Scottish mainland, a proposal SNH initially rejected on welfare grounds.

For 5 years, each hedgehog-trapping season inspired renewed protest (Figure 2.4) and media interest, and UHR ran a capture and translocation operation alongside the SNH project. Pro-hedgehog campaigners objected to the way they were portrayed to and by the media – stereotyped as potentially violent animal rights activists (Warwick 2012). The alleged intimidation of SNH management staff by one activist did nothing to improve relations, and communications between opposing parties broke down. In 2007, UHR researchers asked a third party to submit new evidence to SNH on their behalf, relating to survival rates of translocated hedgehogs. SNH and UHR began collaborating on a joint translocation effort, but in 2010 there remained no statistically significant evidence that the work was improving wader populations. The project was subsequently reconstituted as 'Uist Wader Research', with UHR enrolled as stakeholders. A 2015 report provided further evidence of hedgehog impacts, and recommended a third incarnation of the initiative ('Uist Wader Recovery'), again aiming for local eradication, but this time by translocation. The new strategy focuses on the ultimate conservation aim of wader recovery – rather than number

of hedgehogs removed – and is more mindful of the sociocultural context and implications of hedgehog management. This case illustrates the delays, frustrations, and antagonisms that ISM conflicts can incur.

Figure 2.4 Protestors demonstrate their opposition to the lethal control of European hedgehogs (Erinaceus europaeus) on the Islands of Uist, Scotland.
Photo © Hugh Warwick.

Chapter 3

METHODOLOGY

Chapter 3: Methodology

I open this chapter with a concise overview of my methodological approach to this project, and to knowledge production more broadly. I then clarify the scope of my empirical work and how I selected cases, outline the specific methods I employed to investigate the case studies presented in Chapters 4 and 6, and explain the slightly different approach I adopted for Chapter 7. I summarise the overarching data generation and analytic methods employed across all three cases; further details are provided within the respective chapters. I conclude with a discussion of the key ethical issues encountered in this research, how I worked to address them, and a consideration of my position and responsibilities as a researcher studying contentious wildlife management projects.

Methodological approach and influences

It is important for social (and arguably all) researchers to clarify their approach to knowledge production and rationale for adopting particular research methods. In this section, therefore, I provide some of the key reasons for my use of qualitative case studies, and my approach to generating and analysing data.

My methodology has developed in response to several important philosophical ideas about what the world is, and what we can know about it. As discussed in Chapter 1, I have been particularly influenced by a growing body of work that understands the world as 'relational'. This concept of reality has implications not just for how the world and its constitutive elements are understood and described, but also how it is explored and investigated (i.e. researched). Relational philosophies and research methodologies have been developed across multiple disciplines, though often in correspondence with one another. Here, I highlight some key concepts that have informed my choice of methods and how I present this work.

First, I build on the insights and propositions of a number of influential scholars who have convincingly challenged (in slightly different ways) the 'modern' but enduring dualisms of nature/society and subjective/objective knowledge (Haraway 1991; Latour 1993). Instead, hybrid 'socionatures', 'nature-cultures', or

(my preferred term) socio-ecologies are understood as co-constituted by 'networks of associations' between actors (which may be human or nonhuman). This work has been expanded by geographers of the 'more than human' who have (a) highlighted important differences between animate and inanimate nonhumans, and subsequently (b) 'revitalised' relational networks by emphasising the agential and affective capacity of living, embodied nonhuman organisms (see my discussion of 'lively' political ecologies in Chapter 1). In my understanding, then, human and nonhuman worlds are formed in continuous relation with their environments, and each other (Ingold 2000, 2005; Tsing 2013). Consequently, I do not approach introduced species management (ISM) as an interaction between 'the (human) social' and 'the natural', but as a phenomenon that emerges 'always and already' entangled in webs of socioecological relations. I am therefore conducting research that is empirical and situated, "linked to the contexts in which it is created" (Nightingale 2003, p77) and which – though endeavouring to build reliable, symmetrical accounts – does not make claims to universality or objectivity (Haraway 1988). Instead, I take an open-ended approach to enquiry, starting with a situation and 'following' issues, actors and stories to build understanding and explanations as to how and why ISM has been, and is being, done.

Second, relational approaches share a concern for movement and process, as things and environments formed through their relations must also always be immanent and 'in-the-making' (Latour 1999; Johnston 2008). Philosophically, this is significant in that it identifies all things and phenomena as having 'histories' by which they reached their current configuration, but also that things have the potential to change, and become different (Hinchliffe 2007). Methodologically, this proposition has led to my interest in investigating the processes and practices (including negotiations, influences, interactions, associations, detachments and actions) that generate the events, alliances and oppositions observed in my case studies. In this, my work diverges from the majority of 'social dimensions' research in invasion science, which tends to classify and enumerate positions, opponents and 'votes' for various management alternatives. My orientation toward exploring (both discursive and material) practices is similarly informed by relational, 'material-semiotic' research approaches that focus not on what things and people are, nor what they mean, but what they *do*. In other words, these

theoretically-informed methodologies investigate the world as it is 'performed' (Braun 2008; Hobbs 2011; Lavau 2011; Lien and Law 2011; Clark 2013).

My research approach has also been influenced by my training in anthropology, and particularly by my experience and familiarity with in-depth qualitative enquiries into human-nature relations. My methods have also, therefore, been influenced by anthropological methodologies including situational analysis and 'ethnographic' case studies (Milton 2002; Satterfield 2002; Hurn 2011; Meurk 2011; Tsing 2011, 2015). Particularly, Milton's (2002) explication of the role of emotions in human-environment relations, and Satterfield's (2002) extensive, balanced investigation and writing of an environmental conflict, have informed my approach to asking questions and analysing texts.

Finally, my approach has been informed by my academic background (and continued interest) in ethology and ecology, and associated enthusiasm for methodologies that draw 'natural' and 'social' research into conversation and collaboration, rather than reinforcing disciplinary divisions. Although I do not employ traditional bioscience research methods here, all three of my 'social' analyses have been accompanied by thorough investigations of academic (mostly natural scientific) literature relating to my three 'study species', in order for me to attend to their characteristics, capabilities, and potential effects in each case. Furthermore, though interpreted and deployed in a variety of ways, empirical case studies constitute a recognisable and important research method across multiple disciplines and, despite occasional challenges to their validity and generalisability (often based on misunderstandings: Flyvbjerg 2006), they can therefore serve as productive 'common ground' for interdisciplinary engagements.

Scope of empirical work

In Chapters 1 and 2 I identify that 'the problem' of ISM is, first, extremely broad in scope, encompassing organisms from algae to horses, and sites from oceanic islands to urban centres. Second, ISM is 'messy', involving divergent knowledges, values and aims; economic, political and technical restraints; and considerable complexity and uncertainty. The flattening or reduction of such a

complex collective of problems into a single 'phenomenon' of invasive species (and their management) can therefore fail to sufficiently (a) recognise and consider extensive environmental (including socio-political and biogeographical) heterogeneity, and/or (b) reflect and inform contextually situated management decisions and practices.

In recognition of this, and for philosophical (see above) and pragmatic reasons (including timeframe, capacity and accessibility constraints), my empirical research focused on investigating specific, contemporary ISM projects and practices in the United Kingdom. Although the UK is neither socio-culturally nor ecologically homogeneous, it constitutes a discernible geopolitical unit, comprising four nations and multiple islands, which (mostly) share both resident fauna and politico-legal arrangements for wildlife management. ISM is implemented in the UK by government agencies, civil society organisations, volunteer groups and private individuals. The UK Government is still developing its statutory approach to ISM, and several of its early initiatives have been subject to socio-political challenge and contestation. The UK therefore offers a diversity of potential case studies through which to examine how ISM is negotiated and performed.

My empirical research also focused on direct management (eradication/removal, monitoring, and/or control) of introduced vertebrates. Vertebrates may have a higher chance of establishing in new environments than plants (Clout and Russell 2008; White *et al.* 2008), and do not need to reach high population densities to have significant impacts on existing ecosystems (Veitch and Clout 2002). It could be, however, that vertebrates and their impacts are simply more obvious than invasions of other organisms, and so are over-reported. Regardless, they are regularly subject to management: Genovesi (2011) identified vertebrates as the target of 94.6% of 1,119 reported eradication attempts (noting, however, that plant and invertebrate eradications often go unreported). Vertebrate management also appears to inspire more public interest and concern than ISM targeting other taxa (Estévez *et al.* 2015). Although this greater degree of attention could be associated with a range of possible factors (sentience, rights, aesthetics, cultural significance, and/or other factors) vertebrate management projects evidently bring forth unsettled matters and engage diverse communities

and publics with the politics and practices ISM. They therefore provide a useful 'way in' for exploring how and why ISM is instigated and contested.

Selecting case studies

In the following chapters I examine a series of management cases in depth, attending to nuanced, contextual factors as well as the influence of politico-legal, ethical and ecological edicts and principles. Although I did not primarily select cases with the intention of directly comparing them, there are some interesting commonalities and contrasts, which I discuss in Chapter 8.

Several factors informed my case selection. As is evident from Chapter 2, a key focus of the initial stages of my research was contested incidences of ISM, and subsequent socio-political conflicts. The conflict that developed surrounding the attempted eradication of monk parakeets (*Myiopsitta monachus*) from the UK in 2011 therefore provided a convenient starting point, particularly given that public opposition had effectively stalled the project. Although the attempted eradication of monk parakeets was still not completed when I studied the case (2014-2015), most key events had taken place in 2011. This was therefore a retrospective study, and I was also interested in studying a management dispute that was contemporaneous with my research period. Of course, I had no control over whether or what kind of controversies might arise, but in January 2014 (four months into my candidacy) Eurasian beavers (*Castor fiber*) were discovered on the River Otter in Devon. As I followed media reports indicating a developing dispute, I identified several interesting similarities between the issues surrounding management of the 'formerly resident' beavers and the definitively exotic monk parakeets I had been studying. I therefore broadened my focus from 'non-native' introductions to include the (re)introduced Devon beavers.

The third case study was chosen for slightly different reasons. Having examined the concerns and activities of monk parakeet 'protectors', and the process and outcomes of the Devon beaver debate, I was interested in moving away from an explicit focus on conflict and opposition to consider what motivated people to support and engage in ISM. I also shifted my focus from short-term 'rapid response' removals targeting recently introduced populations to the long-term

management of a well-established species. Grey squirrels (*Sciurus carolinensis*) are regularly held up as the quintessential example of an invasive vertebrate in Britain, and their widespread, ongoing management provided a contrasting and accessible case study. Rather than socio-political disagreement and contestation, I chose to investigate the motivations, aims and practices of squirrel control, and particularly lethal methods (as a prominent but challenging component of ISM). I also took a slightly different methodological approach to this case study: whereas the monk parakeet and beaver disputes could be bracketed relatively neatly in space and time[1], squirrel management is ongoing and diffuse. I therefore conducted a multi-sited study across four regions employing different management aims and strategies, which were chosen for their diversity and (more explicitly, here) to enable comparisons.

Data generation and analysis

Conducting case study research requires an inductive, open-ended approach toward data generation, and often benefits from (and sometimes demands) collection and cross-referencing of multiple sources. Information and insights about the 'hows' and 'whys' of cases can be drawn from texts, solicited through speech, observed in practice, and/or developed through reflection.

Assembling cases

My methodological approach to the case studies in Chapters 4 and 6 was similar and in this section I outline my data generation methods for both. The monk parakeet management dispute was a 'historical' case study. As such, most information regarding its development existed only as written documentation, and primarily media reports. In all three cases, I collected media articles in a three-step process. I first performed keyword searches (e.g. Devon AND beavers) of local, national and (for the first case study) international media reports in LexisNexis®, then cross-referenced these against Google News searches for the same keywords in the same period. Finally, I performed the same keyword search

[1] This bracketing is not intended to demarcate each case as a discrete event, and indeed, I followed several lines of enquiry that both preceded and followed the events discussed here. Rather, the beginning and end-points provide a focus for analysis and discussion.

again on the web archives of all major national newspapers, and relevant regional and local papers. I gathered additional documents (e.g. strategies and species risk assessments) and transcripts (e.g. of parliamentary questions) from government and organisational websites, or requested them directly.

To identify potential participants, I used both purposive and snowball sampling (Bernard 2011); more information about participants is provided below and in Chapters 4, 6 and 7.[2] Interviews were semi-structured, based on a schedule of key topics and questions (an example is provided as Appendix 2), but with the flexibility for participants to expand or introduce other issues. I digitally audio-recorded interviews, with a few exceptions (when conditions were not conducive to recording, or meetings were impromptu). On these occasions, I made notes both during and following discussions. I fully transcribed all recorded interviews, and this formed part of my analytic process (see below).

That the parakeet eradication had been strongly contested was actually beneficial for identifying potential participants, as the resulting media reports provided the names of several central actors, who I then contacted directly. I also interviewed representatives from organisations that had either been directly involved in (e.g. local councils), or had commented on the case (e.g. the RSPB), and three civil servants. I was, however, not permitted to ask civil servants about the specifics of cases, which limited the value of these meetings. I therefore had access to a greater variety and depth of information from the campaigners' 'side', but nevertheless attempted to examine the debate symmetrically in my analysis. Public distrust of the UK Government also worked to my advantage here and in the beaver case, as several Environmental Information Regulation releases containing internal state correspondence were published, providing me with useful insights into internal deliberations. Finally, I spent time learning about monk parakeet behaviour, ecology, distribution, impacts and management by reviewing relevant academic literature. This enabled me to critically examine both campaigner and government claims about this species, and led me to discover a

[2] It is worth clarifying here that my 'sample' of participants is not intended to be representative of particular interest groups or the national population. Rather, I use 'theoretical sampling' (Crang and Cook 2007), whereby participants are approached based on their involvement or concern with my cases and research questions.

series of prior management disputes in the USA that, as discussed in Chapter 4, also had some bearing on the UK case.

My approach to the beaver dispute was slightly different, although the methods and materials (gathering documentation and interviewing) were broadly similar. However, this case continued to unfold as I carried out my research, and I was unable to predict what sort of story I would end up telling. Consequently, whereas in the parakeet case I gathered information to the point of saturation,[3] here I worked iteratively, continually revisiting my accumulating materials and notes as I gathered emerging information. For example, I conducted a follow-up interview with one key actor towards the 'end' of the dispute, to revisit their position in light of developments and explore some of the issues that had arisen since our earlier meeting. I was also unavoidably a participant in this case; I was present at meetings and drop-in sessions, and became familiar with/to several key actors.[4] I was consequently able to enrich my formal analysis with participant observation (the practice of 'attending' to what is happening, and what people are saying and doing: Ingold 2014) in consultation events and beaver-tracking walks (with informants and alone). However, I was also aware that my apparent (albeit loose and research-oriented) connections to government agencies and invested organisations could affect how those opposed to the developing beaver reintroduction trial would receive me, and I therefore made concerted efforts to seek out diverse informants and stress my 'neutral' affiliation with an academic institution.

Studying material practices

I began investigating grey squirrel management – a collection of projects and practices, rather than a series of events – through desk-based research. I mapped out a 'squirrel management landscape', considering the main drivers of management, key institutions and actors, and the 'arenas' in which it took place.

[3] The point at which I had encountered the range of narratives, claims and arguments likely to be made in relation to the case (Crang and Cook 2007).

[4] I was made acutely aware of my potential influence on unfolding events when one informant decided, when responding to a question about her role as a campaigner, that she should organise more advocacy events.

I then sent enquiries to potential gatekeeper informants[5] throughout the UK and, through a combination of opportunity and design, selected four case study regions to carry out my research. A key aim of this final study was to move from a reliance on accounts and representations of management – which was less of a drawback in the previous cases, where many of the practices of contestation were discursive – and towards an engagement with the material practices of squirrel control (Lien and Law 2011). I therefore requested that participants meet me 'in the field' (sometimes literally) of their work, so that I might conduct 'go-along' interviews as a "mechanism to engage with practices on-the-go" (Dowling *et al.* 2016, p683). These efforts were partially successful: I accompanied four grey squirrel control officers on trap-checking rounds, and landowners and survey volunteers on walks around their properties. In total, I interviewed 50 participants across the four study regions. I also attended events where I observed how project officers interacted with current and prospective volunteers. However, some of my plans were disrupted by the 'messy' (Law 2007) realities of squirrel management. For example, many trap-loan volunteers had no trap set at the time of my visit. On several trap-checking rounds, we caught red squirrels and woodpeckers, but no grey squirrels. I also learned that though I was interested in management practices, these are not always the planned, physical interventions I had envisioned them to be: some squirrels are controlled with kill-traps strategically placed at certain times of year, and others are simply shot on an ad-hoc, opportunistic basis. Despite these complexities, adopting these complementary methods significantly enhanced my understanding of how grey squirrel management is conceptualised, presented and performed (see Chapter 7).

Analytic approach

My analytical approach has been inductive and interpretive. I have also, as noted above, taken a 'relational' approach to interpreting the 'whys' and 'hows' of the events, negotiations and practices involved in each case. This means that I have focused on analysing relations between entities and on process and performances, or how things are 'done', rather than static comparisons between

[5] These were mostly conservation project officers, but also included researchers, civil servants and a well-connected landowner in the south-west, whom I first encountered during the previous case study.

individuals, groups (of humans or nonhumans), attributes or structures (Dempsey 2010; Tsing 2011; see also Chapter 1). For example, in order to understand the dispute surrounding monk parakeet management, I examine different ways in which government agencies and urban residents encountered parakeets and interpreted their presence; and how these different interpretations come into (combative) relation with one another.

The specific theoretical and analytic approaches I employed for each study are detailed in Chapters 4, 6 and 7. There are commonalities across the studies, however, and I took the same broad approach to analysing each case. Although I loosely followed a process of 'read-do[fieldwork]-write' (Crang and Cook 2007), whereby I began each study with a great deal of reading, set out 'into the field' to interview and observe, and then returned to my desk to 'analyse' and write, in practice the process was recursive and involved continuous refinement and re-ordering of my questions and ideas. Most of my sources were text-based, but varied, including writing that told a story (e.g. media reports), that was not intended for publication (e.g. internal correspondence), that aimed to present knowledge (e.g. scientific and other academic literature) and transcriptions of my interviews and field-notes. All sources were organised and coded using computer assisted qualitative data analysis software NVivo for Mac (V11); some of this collation and my initial analyses took place alongside field research.

I analysed 'pre-written' documents through close reading and loose thematic coding of key words, ideas, and accounts. I conducted preliminary analyses of interviews and field notes during transcription, when I was additionally able to recall and consider actions, gestures, and physical expressions that do not translate well into text. In all cases, I conducted a 'complete' (re)analysis of all materials together, where I reordered, refined and augmented my codes and notes, cross-referenced between sources, and revisited academic publications that informed, resonated with, and/or diverged from, my interpretations. Although I analysed sources collectively and with reference to one another, I organised them in ways that helped me remain cognisant of variability in their contexts and agendas (e.g. media articles, government reports, campaign materials). I treated all accounts and knowledge claims as situated and partial, rather than better-or-worse representations of an objective truth (Haraway 1988). The final stage of all

analyses took place through the writing process, as I made decisions about which stories to tell, how to tell them, and what to exclude. I further adjusted my manuscripts and revisited materials in response to comments and questions from my academic supervisors.

My analytic approach is informed by a range of methodologies (see above), but in practice is perhaps most comparable to the orientations of actor-network 'theory', whereby my initial uncertainties about what mattered (Latour 2005) led me to follow and 'track' (Dempsey 2010) ideas and actors through texts and transcriptions. This process manifested slightly differently in each study. In the monk parakeet and beaver cases my primary aim was to understand why and how events and associations developed as they did, and how different actors interpreted different incidents, relationships, and outcomes. I found that drawing together detailed chronologies helped me to identify when, why and how relations formed (and dissipated), and to trace the 'histories and geographies' (Hinchliffe 2007) of ideas and narratives. For example, in Chapter 4 I identified links between the published arguments of English 'parakeet protectors' and comparable claims previously made by their American counterparts: I confirmed and furthered my understanding of this association through an interview with a campaigner, who informed me that he had also followed a trail of (online) references to monk parakeets and found like-minded American protectors at the other end, whose arguments he and his associates adopted and adapted to their cause. In my analysis for Chapter 6, I 'tracked' beavers through the discourses of participants and consultees, and subsequently identified important patterns and differences in how these animals were encountered, described and conceptualised.

As discussed above, throughout all cases (but especially in Chapter 7) I attempted to identify and attend to practices, both discursive (e.g. acts of linguistic classification which have material effects) and material (e.g. the physical act of killing). I also made efforts to attend to that which was, or became, *absent* from speech or action. For example, in Chapter 4 I consider why parakeet protectors dropped emotional arguments in order to re-present their case as 'serious' in formal discussions. In Chapter 6, I demonstrate how the Government's deferred decision-making and inaction on beaver reintroduction constituted, in practice, a decision. Finally, in Chapter 7, I consider the significance of some participants

not appearing to comprehend, or take seriously, one of my questions about the appropriateness of killing.

Finally, although I had few physical encounters with the nonhumans at the centre of this research, I nevertheless treated them in my analyses as lively – and, sometimes, becoming lifeless – beings with the potential to both shape and be affected by activities, events and disputes (Kirksey and Helmreich 2010). By 'opening-up' my analysis to consider this potential, I was able to identify several instances in which nonhuman animals (often, but not only, through their associations and alliances with humans) influenced the course of events.

Research ethics and 'mindful ambivalence'

In this final section, I summarise four key ethical challenges arising from this research and how I worked to address these.

First, given my understanding that all research on social relations is also made through social relations (see above), I consider participants of this work 'co-producers' of knowledge. As such, although many aspects of my research process were not visible to participants, I also made concerted efforts to be open with them, and treat their contributions fairly. Those who took part in formal interviews were provided information about the project and its aims, often in advance of the interview (a sample information for participants sheet and consent form is included as Appendix 3). Others, whom I encountered informally or 'in the field', were verbally briefed, and all recorded interviewees signed written consent forms. I provided my contact details and assured participants that they were welcome to ask questions, or withdraw their consent, at any time. During interviews and participant observation, I maintained this open approach by engaging in dialogic communication with participants. That is, although interviews were focused on participants' accounts and experiences, I did not evade answering questions about myself or my research. I did, however, avoid expressing a position on the specific management problems under consideration (see below). I offered participants the opportunity to access recordings or

transcripts of their own interviews, and where possible I am making the 'final products' of my research available to participants.[6]

Second, I have maintained awareness of my responsibility, as a researcher, to protect the confidentiality and (as far as possible) anonymity of participants. Accordingly, identifiers were removed from transcripts and participant details were held in a single password-protected file. In this thesis and associated publications, participants are anonymised either (a) by their (usually self-described) role in relation to the cases presented in Chapters 4 and 6, or (b) with pseudonyms in Chapter 7. Given that the cases described in Chapters 4 and 6 are both particular and public, this anonymity has limits; it would not be difficult for a keen observer to trace some participants back (through media articles, for example) to individuals. I worked to avoid negative ramifications from this in two ways: by informing participants of this possibility as part of our discussion about consent, and how their contributions would be used; and by excluding, from published work, direct quotes that could foreseeably cause harm to potentially-identifiable participants if made public.

Third, although I spent little time directly engaging with the nonhuman animals involved in this research (an issue I return to in Chapter 8), it is worth noting the ethical implications of my involvement in lethal control of grey squirrels (Chapter 7). I did not kill any squirrels as part of my research process, and consequently there were no formal ethical responsibilities placed on me as a researcher. I did observe squirrel killing, however, and arguably my presence and observation of lethal control makes me ethically complicit in the process. My defence against accusations of complicity would be that (as discussed above) listening to people talk about their practices is incomparable to physical researcher presence and observation. Indeed, by not engaging in killing myself my understanding of the act of killing remains somewhat limited and reliant on others' accounts. I was (and remain) conflicted as to whether I could have learned more or differently by 'doing killing' myself, but decided against this for several reasons. Symmetrical

[6] At the time of writing, I have produced summaries of my findings from Chapters 6 and 7 to the Devon Wildlife Trust and the Scottish Wildlife Trust, and intend to produce a lay summary of my findings from Chapter 7 that can be shared with participants from across the UK.

attentiveness to a variety of killing practices could have been undermined by my involvement in only one method (cranial dispatch), and it would have been ethically problematic (in both personal and institutional terms) for me to have additionally killed via poison, drowning, or other methods. Furthermore, although observing killing is not innocent, to directly participate could reasonably be interpreted as my condoning the acceptability of killing, and thereby making an overt ethical statement (that, at least for the duration of my research, I worked to avoid). Moreover, it quickly became clear that killing 'well' by cranial dispatch involves a degree of skill, competence and confidence that I do not have, and I was unwilling to justify the risk, or tolerate the consequences, of an inhumane or otherwise distressing kill for the sake of a more embodied research experience.

Finally, the position of social researchers in relation to their project and/or participants is often configured as a spectrum: open activist or advocate on the one end, and 'neutral' observer on the other (Kellett 2009). In anthropology, however, the idea that research and analysis (which generally involves active participation among communities and cultures) could be sharply distinguished from involvement in social life has been largely superseded, as it became recognised that participation in social activities contributes to the formation of knowledge and understanding (Milton 1996). In other words, engaging in anthropological research contributes to socio-cultural knowledge and change whether the researcher intends it to or not. Milton (1996) therefore contends that, while participatory research does not necessitate advocacy, researcher engagement in public discourses is consistent with the central concerns of anthropology. This being said, researching social conflict involves working across divergent understandings and communities, to investigate relationships between them with regard to a particular problem (see Satterfield 2002). Consequently, and especially in positional or polarised disputes, advocacy is inherently limiting: by 'speaking for' one position, the researcher inevitably 'speaks against' another.

The position I have adopted whilst conducting this research, then, might best be described as mindful ambivalence. Recognizing that my presence and actions have the potential to shape responses and events, I have nevertheless endeavored to (a) approach disputes symmetrically, and (b) engage with management practices in a curious and open-minded manner. Maintaining this

ambivalence has required work, including seeking out a diversity of participants, treating all knowledge claims to the same degree of critical scrutiny, and recognizing and checking my own potential biases. Although I have purposefully avoided ‘taking a side’ in the two disputes I have studied, and judging the morality and legitimacy of specific management practices, in this thesis I do make several normative propositions about management planning and implementation. However, these recommendations are not equivalent to taking a position on specific management scenarios or disputes. Rather, my intention is to suggest how some of the issues I have identified through this research might be more effectively recognised and articulated in the process of planning and delivering management. They are therefore primarily recommendations that relate to management process, rather than solutions to specific management problems.

Chapter 4

THE PARAKEET PROTECTORS:

UNDERSTANDING OPPOSITION TO INTRODUCED SPECIES MANAGEMENT

Chapter 4: The Parakeet Protectors: understanding opposition to introduced species management

Structured for, and submitted to, the Journal of Environmental Management.

Abstract

The surveillance and control of introduced and invasive species has become an increasingly important component of environmental management. However, initiatives targeting 'charismatic' wildlife can be controversial. Opposition to management, and the subsequent emergence of social conflict, present significant challenges for would-be managers. Understanding the substance and development of these disputes is therefore vital for improving the legitimacy and effectiveness of wildlife management. It also provides important insights into human-wildlife relations and the 'social dimensions' of wildlife management. Here, we examine how the attempted eradication of small populations of introduced monk parakeets (*Myiopsitta monachus*) from England has been challenged and delayed by opposition from interested and affected communities. We consider how and why the UK Government's eradication initiative was opposed, focusing on three key themes: disagreements about justifying management, the development of affective attachments between people and parakeets, and the influence of distrustful and antagonistic relationships between proponents and opponents of management. We draw connections between our UK case and previous management disputes, primarily in the USA, and suggest that the resistance encountered in the UK might readily have been foreseen. We conclude by considering how management of this and other introduced species could be made less conflict-prone, and potentially more effective, by reconfiguring management approaches to be more anticipatory, flexible, sensitive, and inclusive.

Introduction

> "You probably sense an element of frustration in my voice, 'cause this stuff's not new! [Laughs]…Wildlife and space in the city is highly contested, and you need to understand those kind of politics before you start wading in and doing stuff, no matter how well meant it is."
>
> (interview with conservation professional, London, 15/1/15).

As global biotic exchange continues apace, management of introduced and invasive species has become an increasingly important component of conservation and environmental management (Simberloff *et al.* 2013). Simultaneously, however, management interventions targeting these species have emerged as new arenas of social contestation, disputes and conflicts (Dickie *et al.* 2013; Estévez *et al.* 2015; Crowley *et al.* 2017b). This contestation and its outcomes develop at the interface of science and politics, and are therefore of interest to both natural and social scientists. While natural scientists working in applied disciplines are perhaps most interested in overcoming or circumventing opposition to deliver management goals (e.g. Blackburn *et al.* 2010; van Wilgen 2012), social researchers often focus on exploring the competing aims, knowledges and values underpinning these disputes (e.g. Bhattacharyya *et al.* 2011; Jeffery 2014; Porth *et al.* 2015). We conducted a detailed case study of localised conflict surrounding the attempted eradication of monk parakeets *(Myiopsitta monachus)* from the UK, a project initiated in 2011 but, as of the end of 2016, yet to be successfully completed. We also refer to monk parakeet populations and disputes surrounding their management in the USA. Although we focus on a single species, the findings of this research have not only specific relevance to management of other introduced parrots but also to 'charismatic' introduced species more broadly.

We begin with a brief introduction to monk parakeets and their management, followed by our methodological approach. We then provide a chronological summary of the UK case, before turning to the three key drivers of conflict identified in our analysis. We also briefly explore our identification of patterns and connections between management disputes in the UK and USA, including the repeated failure of management initiatives. We conclude by suggesting how adjustments to management approaches could improve the acceptability and effectiveness of parakeet management and, more broadly, how the planning of

management projects could be improved by routine, inclusive and explicit assessment of their social implications.

Background: monk parakeet distribution and management

Monk parakeets, the sole member of the genus *Myiopsitta,* are small, green parrots native to central South America. In the latter half of the 20th century, monk parakeets were exported in large numbers as part of a booming international trade in exotic pets (Spreyer and Bucher 1998). Intentional releases and accidental escapes have subsequently resulted in a wide but patchy distribution (Figure 4.1). Monk parakeets are intelligent birds and exhibit high behavioural plasticity, enhancing their ability to adapt to a range of habitats and climactic conditions (Davis *et al.* 2013; Hobson *et al.* 2014). Their success as colonists has also been partly attributed to their ability, unique amongst parrots, to build large communal nests. These structures reduce their reliance on specific landscape features (e.g. cliffs or tree-holes) and potentially increase their tolerance of cold climates (Spreyer and Bucher 1998). A generalist, flexible diet enables monk parakeets to exploit a wide range of food sources, including introduced crops (Strubbe and Matthysen 2009). These adaptive capacities make monk parakeets good candidates for survival and establishment in a range of novel environments. Their overall success has, nonetheless, been variable: whilst there have been notable population expansions in the USA, Mexico and Spain, other populations have been transient or remained restricted to discrete locales. In the colder regions of their introduced range, establishment success has been linked to human population density and other anthropic factors (Strubbe and Matthysen 2009; Davis *et al.* 2013), including winter provisioning via bird feeders (South and Pruett-Jones 2000).

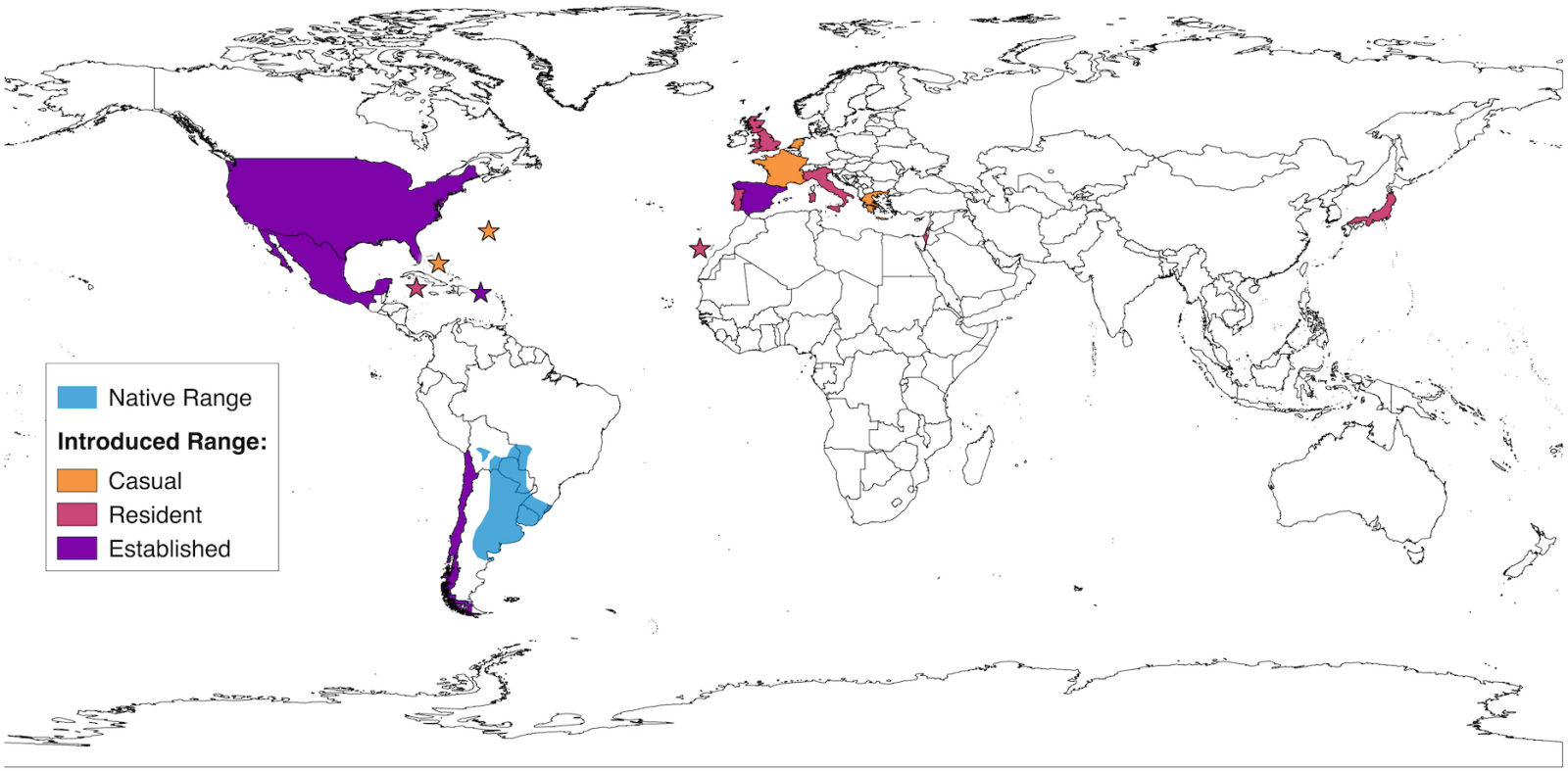

Figure 4.1: Reported populations of monk parakeets worldwide, as at January 2016.
Countries with reported populations of monk parakeets (as at 2016). Casual: wild populations or individuals occasionally recorded within 10 years, but intermittently or in different locations; Resident: wild populations repeatedly recorded within 10 years, including evidence of breeding, but little/no evidence of spread from area of introduction; Established: wild, breeding populations persisting in multiple locations with evidence of spread from area(s) of introduction. Island populations are marked with stars (Casual: Bahamas, Bermuda; Resident: Canary Islands, Cayman Islands; Established: Puerto Rico). For a comprehensive list of distributions within countries, known historical populations and sources, see Appendix 4.

The success of introduced populations is also affected by management activities. Monk parakeet management has two main drivers: precaution and mitigation. Precautionary control of introduced wildlife populations is supported by international agreements such as the Convention on Biological Diversity (CBD: 1992), and conservation guidance arising from them. Precautionary management tends to involve definitive solutions, such as measures to prevent introductions and 'rapid response' eradications, to avoid populations establishing, future introductions and/or problematic environmental, economic or social impacts (Simberloff *et al.* 2013). In contrast, management as mitigation addresses current, known impacts, particularly crop damage and nesting on built structures (Avery *et al.* 2006; Canavelli *et al.* 2013; Linz *et al.* 2015). This has been the focus of monk parakeet management in regions with established populations (including in their native range). Mitigation measures include removing problem nests, deterrents and exclusionary devices, structural and habitat modifications to prevent nesting, and population control. Whilst various national and regional government authorities have initiated precautionary eradications of parakeets, mitigation activities are primarily undertaken by private property owners or utility companies to protect their services and assets, sometimes with the assistance of government agencies.

Methods

We generated and qualitatively analysed data from multiple sources to build a detailed understanding of the UK case. This included a range of relevant documentation about the dispute, including: publications by campaigners, civil society organisations and the UK Government; minutes of meetings; internal Government correspondence; and national and local media reports. We interviewed seven 'key informants' (Gilchrist and Williams 1999) in relation to the eradication project: a lead campaigner, a borough ecologist, representatives from two conservation charities, and three civil servants.[1] Interviews were held, with informed consent, at participants' homes and offices, then recorded, transcribed and analysed. Key informant interviews provide extensive, detailed data for

[1] Civil servants were unable to discuss the details of the specific case in interviews, and are therefore not quoted here. However, they provided extensive general information about the UK Government's strategy and procedures relating to introduced species.

exploring a particular issue or series of events, but these findings should also be triangulated and cross-referenced against other sources (Yin 2014).

We conducted additional analyses on a range of sources relating to monk parakeet populations and management outside the UK, which fell into four main categories: (a) academic, peer-reviewed publications; (b) 'grey' literature publications by local and national governments, civil society organisations and campaigner groups; (c) media articles and reports relating to specific management disputes; and (d) informal electronic sources, including email correspondence with managers and campaigners, and public blog and Facebook posts.

Our inductive analysis involved three stages: first, as our case study was largely retrospective, we wanted to establish what had happened. We therefore constructed a detailed chronology (briefly summarised below) to understand how the dispute emerged and developed. Second, we were interested in understanding why and how campaigners, residents and town councils challenged or opposed the eradication project. We therefore coded the reasons campaigners gave for their opposition and sorted these into loose thematic categories. Finally, on recognising connections between this case and others in the USA, we extended our analysis to include the additional sources, looking for similarities and differences between drivers, events and outcomes of management disputes.

Chronological case outline

Transient populations of monk parakeets may have occurred in the UK since 1936 (Parrott 2013), but statutory interest in managing these populations only arose in 2007/8. Since 2006, all non-native species (introduced through human activity) in the country, and those considered likely to arrive, have been subject to a standardised risk assessment procedure involving expert evaluation of (a) the likelihood of the species' wild establishment and spread, and (b) its potential negative economic, environmental or social impacts. Completed documents are peer reviewed and appraised by a Risk Analysis Panel, then presented to the Non-native Species Programme Board (NNSPB) comprising senior

representatives from Government bodies and agencies. The NNSPB considers the risk assessment and other information (e.g. management feasibility, cost) before making recommendations to Government ministers. Two points about the risk assessment process are worth noting here: first, it does not consider any positive impacts an introduced species' presence might have. Second, it does not consider the potential impacts or feasibility of management activities, nor include management recommendations.

The risk assessment for monk parakeets designated the species a 'medium' risk with 'moderate' potential impacts, based primarily on evidence of damage to crops and artificial structures from the native and the introduced range (GBNNSS 2010a). This assessment, combined with the technical and financial feasibility of removing the small, spatially restricted populations (see below), were key drivers of the UK eradication initiative. There are also other, more general influences on management decisions, which are taken with reference to supranational agreements (such as the CBD) that recommend precautionary and rapid responses to introduced species, and the national GB Non-Native Species Strategy (Defra 2008b).

The two main monk parakeet populations in England are in Borehamwood (Hertfordshire) and the Isle of Dogs (London), which are about 24km apart and are assumed to be distinct. Both groups have lived outside captivity since the early 1990s (Parrott 2013), and by the early 2000s were reported to be expanding (Tayleur 2010). Management feasibility trials were discretely conducted by the Government's Animal Health and Veterinary Laboratories Agency (AHVLA)[2] between 2008 and 2010. Trapping efforts were largely unsuccessful, but shooting (using a specialised ammunition) was found to be reasonably effective (GBNNSS 2008). These findings were reported to the NNSPB, who recommended that the parakeets should be eradicated as a 'rapid response' precautionary measure. The programme received ministerial approval and began in early 2011. Civil servants consulted with 'stakeholder groups' (GBNNSS 2010b), and prepared statements for the press should enquiries be made. The project was not publicly announced, but homeowners in the target areas were approached and requested

[2] Since restructured as the Animal and Plant Health Agency (APHA)

to allow agency staff to conduct management activities (i.e. nest removal, trapping, shooting) in private gardens.

In April 2011, a national newspaper revealed the Government's "secret plans…to exterminate" monk parakeets (Osborne 2011). The story was picked up by several other news outlets, most of which included Defra's (the UK Government's Department for Environment, Food and Rural Affairs) press statement:

> "This invasive species has caused significant damage in other countries and we are taking action now to prevent this happening in the UK…We want to get rid of the wild population. There will be trapping, rehoming in aviaries and we will probably have to shoot some as well."
>
> ('Defra spokesperson' quoted in Bowcott 2011)

The story drew attention in both boroughs with resident monk parakeet populations. Led by a handful of committed individuals, concerned parties employed a range of techniques to oppose the scheme. In Borehamwood, campaigners corresponded with a local reporter (who regularly published partisan updates on the story) and animal protection organisation Animal Aid, who helped them organise and promote their campaign. Physical and online petitions against the eradication were set up: ~2,000 signatures were collected from borough residents and presented at the Prime Minister's residence. Relations between campaigners and Government deteriorated and became increasingly antagonistic. Campaigners photographed Government agency staff removing nests in camouflage uniforms; allied journalists subsequently published reports labelling them as "overweight soldiers" (Darlington 2011d) and civil servants as "petty pen-pushers" (Jones 2011). Shortly thereafter, the campaigner who took the photographs was visited by police officers and threatened with legal action. Borehamwood's campaigners also lent their support to the parallel campaign on the Isle of Dogs, where campaigners additionally took direct action against management attempts. A network of 'parakeet protectors' was set up to 'leaflet' residents, asking them not to co-operate with government agency staff (*The Wharf* 2011), and "when the man in charge of trapping…come[s] along there is usually a phone call, and we make a bunch of noise, and the birds fly away" (campaigner, Isle of Dogs, quoted by *Bird Toy Factory* 2011).

Campaigners also lobbied their local governments. In October 2011, two lead campaigners in Borehamwood collaborated on producing a report, written in a semi-academic style, arguing against the eradication. This was submitted to Hertsmere Borough Council, which, in response to residents' concerns, had temporarily withdrawn permission for birds to be shot on public land. The Council requested both campaigners and Defra to submit their arguments to its executive group. Following these representations, the Council resolved to make decisions about parakeet management on public land on a case-by-case basis, but banned shooting. A similar story unfolded in the Isle of Dogs, where the Tower Hamlets Council, following representations from campaigners, restricted management methods permitted for parakeets on public land (Hayes 2012). This, in combination with private individuals denying access to gardens (where many of the birds were nesting) created significant delays for the project. At the time of writing in early 2017, the stalemate continues, but the Government continues to aim for eradication and has since changed the law in a way that improves its chances: The Infrastructure Act (2015) specifically provides Government agencies powers of access to private land for the purposes of removing 'invasive, non-native species'. Exercising these new powers of access is almost certainly the Government's next step; whether and how the project's opponents continue to resist remains to be seen.

Drivers of conflict

Our analysis identified three important sources of tension between proponents and opponents of management. First, we found disagreement around the justification and necessity of the project, and particularly around whether monk parakeets posed a (significant) threat to their new environment. We demonstrate how opponents and proponents of management used the same evidence base to draw different conclusions about the necessity of management. Second, human relationships with introduced parrot populations are more emotional and complex than cost-benefit analyses and risk assessments suggest. We discuss and provide evidence for important affective factors that drive opposition, and which may be overlooked in formal deliberations. Finally, opponents of eradication in the UK were partly driven by their distrust of, and resentment towards, the Government and their dissatisfaction with the process by which

management was planned and delivered. We therefore consider the importance of management process, and the relationships that develop between proponents/agents and opponents of management.

Evidence, justification and (in)justice

In their respective written submissions to Hertsmere Borough Council in 2011, both the Government and campaigners drew on international experiences of monk parakeet introductions and management to argue their case. Table 4.1 provides a detailed summary of how both parties employed existing evidence to support their respective positions. The same pool of information was selectively applied to support different arguments, made possible by extensive variation in the degree and severity of monk parakeets' impact elsewhere, and significant uncertainty around the likelihood of their impact and spread in new regions. Thus, whilst the NNSPB was convinced the threat posed by monk parakeets was sufficient to warrant action, campaigners concluded that: "there is no evidence to justify the cull of parakeets. There is also no evidence to show they are a threat to agriculture or to local wildlife" (campaigner, Borehamwood, quoted in Thain 2011).

One point of agreement was that the existing small, spatially limited populations of monk parakeets had not yet created demonstrable problems in the UK. Campaigners used this observation to contest Government claims that monk parakeets constitute a significant threat: "these little birds have been in the town for a very long time and they haven't to my knowledge caused any damage to crops or pylons. I believe the reason they haven't is because they won't" (campaigner, Borehamwood, quoted in Darlington 2011a). However, lack of observed impact was less germane to the Government's case, which approached eradication as a precautionary (rather than mitigation) measure. The Government argued that "a lack of full scientific certainty about the precise nature of the threat…should not be a reason to delay effective action" (submission to Hertesmere Borough Council). This is an iteration of the 'precautionary principle', the power of which lies in its rational proposition that, in the face of uncertainty, acting now to prevent future problems is the least risky, most effective way to proceed (Cooney 2004). Adherence to the principle promotes a 'guilty until proven innocent' approach to introduced species, a term regularly employed in

invasion science to advocate stronger biosecurity measures (Ruesink *et al.* 1995; Davidson *et al.* 2013). However, the appropriateness of applying the precautionary principle has been challenged when management interventions involve the death or captivity of sentient animals on the grounds of possible future impacts. In such situations, the principle's application has been interpreted as unjust, not least because it sits uncomfortably in relation to existing societal rules norms: 'guilty until proven innocent' is, of course, the antithesis of the presumption of innocence at the heart of Anglo-American law (Simberloff 2005). Similarly, the 'punishment' (i.e. capture or killing) of individuals to prevent potential future offences parallels the troubling practices of predictive policing and punishment: an emerging, contentious area of modern criminal justice systems (Zedner 2010).

We do not mean to suggest that these socio-legal principles can or should be directly transferable to wildlife management. Rather, they are widely established concepts that can make precautionary management appear counter-intuitive or unjust in the public realm. This supposition is supported by studies of public attitudes to introduced species management, in which (British) participants were more likely to support interventions, at least in principle, when there was clear evidence of a species' negative impacts elsewhere and, particularly, on human health or native species and ecosystems (Bremner and Park 2007; Selge *et al.* 2011; Van Der Wal *et al.* 2015). Although monk parakeets have demonstrably created economic losses in their native and introduced range (see Table 4.1), no research has directly assessed health or ecological impacts, and there is no substantiated evidence of either having emerged, thus far, in any part of the species' range. Some felt, therefore, that not only was eradication unjustified by current evidence, but that it was also an injustice. The UK's parakeets were being targeted for impacts they had not yet produced, and which Defra could not confidently claim would emerge: "I could understand if they were killing other birds but they live their life and leave others alone" (resident, Borehamwood, quoted in Darlington 2011b).

The disagreements over management justification identified here can also be understood as divergent assessments of the relative costs and benefits of eradication. For Defra, eradication provides long-term national 'security' against

the possible spread and negative impacts of a non-native species. Resourcing a discrete project with a definitive outcome was preferred over the potentially high costs of ongoing management, should the population expand. It was also argued that eradication was preferable to long-term population control because fewer birds would be killed overall. Campaigners, armed with the same information, argued that the costs of animal suffering and loss of life were disproportionate to the risk: “tragically it seems to be the case that saving costs and time clearly take priority over the lives of these birds” (campaigners, quoted in *The Docklands and East London Advertiser* 2011). They contended that eradication was a poor use of public money, and disputed the Government’s claim that it provided a definitive solution: "Defra is spending approximately £1,000 per bird for this eradication programme when anyone can still go to a pet shop, buy one and then release it" (as above).

Finally, and more difficult to tease out from formal discourse (for reasons discussed in more detail below), some residents felt that the parakeets’ presence brought certain benefits to their boroughs. Indeed, that campaigners went to considerable lengths to defend the parakeets indicates not only that they opposed what they felt was an unjust, unjustified intervention, but also that they wanted the birds to stay, and were dismayed at the prospect of losing them.

Affective attachments

We found that the development of affective attachments to introduced populations can be important drivers of opposition. As in other environmental conflicts (see Satterfield 2002; Buijs and Lawrence 2013) we found emotional drivers to be intertwined with ‘rational’ argumentation throughout our analysis. For example, there are indications of deep apprehension, and even guilt, felt by eradication proponents concerned about the effects of human-mediated species introductions: “we brought them here…it’s our fault and we are taking the blame for that and we’re trying to fix it” (interview with conservation professional, 16/1/15). There is also an emotional element to the ‘sense of injustice’ experienced by those who feel management is unwarranted (above). Here, however, we focus specifically on affective responses to parakeet presence, to attend to this comparatively neglected aspect of opposition to wildlife management.

We use the term ‘affective attachments’ to describe emotional and material connections humans can develop with ‘charismatic’ nonhuman animals through repeated positive interactions, and the integration of particular populations and species into individual, community and cultural identities. Monk parakeets are regularly described as a ‘charismatic’ species (e.g. Simberloff 2003; Avery *et al.* 2006; Parrott 2013), a term often used in bioscience and conservation to describe wildlife with “popular appeal” (Lorimer 2015, p39). However, few discuss exactly what charisma means or the properties that constitute it. Lorimer (2007, 2015) has taken a relational approach, and suggests this nonhuman charisma is neither an inherent characteristic of a species, nor simply a property attributed by humans. Rather, charisma is produced through various forms of encounter between humans and nonhumans. Lorimer outlines a loose, three-part typology of *ecological, aesthetic*, and *corporeal* charisma. *Ecological* charisma identifies how human senses and biorhythms intersect with those of other species in ways that make certain wildlife more detectable, recognisable and distinguishable. Monk parakeets are brightly coloured, build obvious nests, and vocalise well within the range of human hearing. *Aesthetic* charisma refers to general species characteristics, including appearance and behaviour that elicit affective responses in humans. Parakeets’ attractive plumage and entertaining social and foraging behaviour can produce positive emotional responses: “if you watch one eating crab apples in the tree, picking them up with its feet and lifting them…they are absolutely endearing, there’s no doubt about it” (interview with conservation professional, London, 12/1/15). The volume, pitch and insistency of the birds’ social calls is less well-received, described by some as “screeching” and “bedlam” (UK residents quoted in Whalen 2013), though others are less troubled: “it might wake you up, but it sounds very nice.” (Chicago resident quoted in Brotman 1988). Aesthetic charisma, then, can vary in relation to parakeet numbers, proximity, time of year, and the disposition or mood of affected humans. *Corporeal* charisma describes the “affections and emotions engendered by different organisms in their practical interactions with humans” (Lorimer 2007, p921). ‘Epiphanies’, for example, are a manifestation of corporeal charisma: memorable, formative “moments of connection” (p922) with other living organisms. A common affective response to material encounters with parakeets in their introduced range is perhaps best described as ‘dissonance’: the surprise of encountering an organism out of (expected) place. This dissonance might

manifest negatively, as illustrated by those human residents concerned that parakeets don't fit in*:* "they are a nuisance…an alien species has been introduced and it is not right" (resident, Borehamwood, quoted in Darlington 2011b). Equally apparent, however, are more positive experiences of dissonance, such as curiosity or wonder arising from encounters with incongruous parakeets:

> "It surprises and delights many observers to find that parakeets aren't entirely confined to warm climates. One cold winter day I went for a walk in Chicago's Hyde Park…Flurries were dusting the deep snow already on the ground…To then see a half-dozen emerald-green birds with lazuli primaries flying around the park was like witnessing apparitions escaped from some travel agency's promotional posters."
>
> (Friederici 2005)

Monk parakeets also have the capacity to respond to, and probably even recognise, individual humans:

> "The monk parakeets have this thing…if there's not seeds out there, they give me the `YAA YAA YAA' - I mean, they're yelling. It's, like, they know when there's no seeds. They'll tell you,"
>
> (Chicago resident, quoted in Janega 2007)

> "They squeak and squawk in the elm tree in my front yard…Sometimes I'll go out on my porch and squawk back, just to let them know I'm listening. They'll stop, and look at me out of one eye, then the other, and then continue their conversation."
>
> (Robin M. 2014: comment posted to Yelp.com)

Correspondingly, people also recognise, distinguish and attend to particular birds.[3] For some, their association with parakeets develops into an important part of their identity: they become a self-styled "parakeet protector" (Whalen 2013) or "parrot trooper" (Brotman 1988), working to represent their 'friends'[4] (Bingham

[3] A striking example of this is the relationship 'the parrot guy', Mark Bittner, developed with introduced parakeets (in this case red masked parakeets *Psittacara erythrogenys*) in San Francisco, documented in *The Wild Parrots of Telegraph Hill* (Irving 2003). Bittner spent many hours feeding and observing the parrots, and acknowledged that he became very attached to them. On the death of one individual, he said: "I had to admit [after that] that I really did love them".

[4] Where cross-species friendship is "characterised not (as has traditionally been the case) by the sorts of entities it links but, rather, by a certain quality of being open to and with others" (Bingham 2006, p489).

2006) in campaigns, legal proceedings and the media. Dedicated 'parakeet people' can be found both in the UK and the USA, leading campaigns, conducting research or simply sharing their enthusiasm: in Brooklyn (NY), for example, the local expert leads tourists on regular 'Wild Parrot Safaris' (brooklynparrots.com).

Parakeets also become integrated into the identities of particular communities. Seymour (2013) highlights conceptual links that campaigners make between parrots and certain peoples (e.g. immigrants, cosmopolites) and locales. We also found these links in our analysis, for example: "[Parakeets] are successful Brooklynites, in that they are adaptable, eat a wide variety of foods and like to talk" (resident quoted in Powell 2006). Identity integration, then, includes parakeets coming to symbolise or encapsulate existing ideas about the defining characteristics of places and people. However, over time parakeet presence can equally *produce*, or at least enhance, identities: "it turned into a Borehamwood thing…in the sense that…they were Borehamwood parakeets, and so the thing about them being *here* was…important" (interview with campaigner, Borehamwood, 17/1/15). In both our UK and wider analyses we found numerous discursive indications of the interweaving of parakeet presence and activity with the self-identification of certain communities. Quotes illustrating this, and other indicators of affective attachments from multiple regions, are presented in Table 4.2. There may also be subtler, less linguistically explicit markers of developing attachments: for example, a colony in San Leon, Texas, inspired the logo of the Railean rum distillery (railean.com); one can buy a t-shirt 'honouring' parakeet colonies in Chicago and Brooklyn (zazzle.com); and introduced colonies in Texas have dedicated Facebook pages where residents report sightings and share stories.[5]

These associations between people and parakeets can develop latently, without explicit attention or declaration. However, management proposals have forced people to reveal hitherto unspoken attachments, as they realise – and are compelled to articulate – that something they have come to care about is under threat. Actively engaging in protection campaigns has also contributed to the

[5] Austin (https://www.facebook.com/MonkParakeetsAustinTexas/) and Dallas/Fort Worth (https://www.facebook.com/The-Monk-Parakeets-of-the-DallasFort-Worth-Metroplex-157513654299450/)

development of attachments. The campaigner we interviewed in Borehamwood, for instance, had paid little thought to the birds frequenting the garden until informed of their impending removal:

> "Half a dozen parakeets used to sort of swoop into the garden and go onto the trees and then sweep out again, and [I] didn't think anything more of it. [Some years later] there was a knock at the door…they gave me a letter…to say that [parakeets] were an introduced species and they were a threat, and they wanted to try and eradicate them. And she said 'would you have traps in your garden?' I said 'oh…I'm not sure about that, [I'll] have to think about it'. And that's kind of how it all started."
>
> (interview with campaigner, Borehamwood, 17/1/2015)

Attachment and protectionism are therefore closely interrelated, although one doesn't automatically signify the presence of the other. For instance, one might appreciate parakeets yet be unconcerned by the prospect of management (e.g. "much as I like the birds, I don't want them here if they're going to be a plague", Chicago resident quoted in Brotman 1988). Conversely, some people defend monk parakeets against management without having any specific association with them: regional or national animal rights and/or welfare organisations, for instance, have opposed management in the UK, Connecticut and Yacolt (Washington) on the grounds of more general ethical oppositions to lethal wildlife control and/or the exotic pet trade.

Whatever the initial drivers, however, defending parrots against management and proactively promoting their safeguarding have drawn protectionists into politico-legal or techno-scientific arenas. In these domains, positions must be rationalised and decisions justified in relation to expert advice and/or quantifiable cost-benefit analyses (Adams 1997). Consequently, the various components of attachment – affective logics, relationships and identities – become comparatively ineffective, and may be considered illegitimate (Buijs and Lawrence 2013; Whitney 2013). Politico-legal protectionism therefore involves translating attachments into resolutely unemotional reasoning. Consequently, over time, "I can't make a logical argument for keeping them, but I can make an emotional one" becomes, "we will continue to campaign…not for emotional reasons but because their eradication is senseless and unjustified" (same campaigner, Borehamwood, quoted in Darlington 2011b and writing in a 2013 statement, respectively).

Campaigners in Borehamwood, particularly, felt a rationalised approach was the most likely to achieve results:

> "There wasn't really much point in jumping up down with placards and shouting and screaming…so the whole approach [was] to try and make a reasoned, sensible argument as to why they were wrong and why it was a waste of money…we wanted to…show that we were serious, and that it was a serious piece of work, and it wasn't just like…we like them and why get rid of them"
>
> (interview with campaigner, Borehamwood, 17/1/15).

Although employing emotive appeals in publicity statements and materials, campaigners recognised that even though there are multiple reasons for concern about monk parakeet eradication, only some would be considered "serious". Accordingly, the document campaigners wrote for Hertsmere Borough Council focused on refuting Defra's case with evidence and economics, and included little about either affective factors or positive associations between people and parakeets.

Campaigners in the Isle of Dogs took a more direct approach to opposing management, including the placards and direct action rejected by the Borehamwood contingent, but also made political progress through formal representations to Tower Hamlets Council. Again, the key line of argument was that the threat was overstated, but local councillors also seemed to appreciate the significance of community attachments: "Councillor Khan said we should be proud of them rather than try to destroy them. That was all we were asking for because the people on the Island really love these birds" (campaigner, Isle of Dogs, quoted in Hayes 2012).

Relationships and management process

Despite institutional recognition that an eradication project could generate controversy, the potential strength and power of opposition to management was either severely underestimated or intentionally disregarded by central Government. Internal correspondence indicates that efforts were made, at least with the feasibility trials, to maintain a low profile and avoid public attention. Presumably, this strategy was an effort to avoid conflict, but may have exacerbated it. Campaigners were unhappy that the trials had proceeded in what they felt was an underhand manner, and became distrustful of Government

agencies: “I started doing some digging around, and found in 2008 they’d been secretly shooting them…and I thought, I don’t really like this” (interview with campaigner, 17/1/15). Similarly, *The Independent on Sunday* bolstered the drama of their story by “revealing” the Government’s (accessible, but not publicised) “secret” eradication plans (Osborne 2011). Civil servants had approached specific householders to request permission to access private gardens. However, there does not appear to have been an effective mechanism for engaging broader resident communities and addressing concerns. Campaigner and press enquiries were met with standard lines from a (faceless) ‘Defra spokesperson’:

> “We made all these arguments as to why, perhaps, they shouldn’t be doing what they’re doing, and they just didn’t want to know…They were obviously just trotting out the same letters every time…we’d make an argument and they would just write exactly the same thing. Didn’t really feel as though they were engaging in the debate.”
>
> (interview with campaigner, 17/1/15)

Campaigners also suggested rehoming the birds in a local aviary, but this was not an option considered favourable by the Government (Defra 2008a). Consequently, campaigners added feelings of exclusion and disempowerment to their grievances, and challenging the perceived anonymous authoritarianism of the Government became part of their mission:

> *Interviewer:* Why is this so important to you?
> *Campaigner:* Ultimately it is the birds…because it is nice having them around…[pause] And maybe there’s a little bit of…it’s sort of David and Goliath isn’t it?
>
> (Borehamwood, 17/1/15)

> “My argument is, the sky doesn’t belong to Defra”
>
> (campaigner, Isle of Dogs, quoted in Whalen 2013).

In their submission to Hertsmere Borough Council, Borehamwood’s campaigners drew on their experiences to cast the Government and its agencies as incompetent and untrustworthy. They highlighted conflicting statements about the project’s aims and whether the birds would be captured or killed. Highly partisan, but nevertheless supported by (selective) references, quotes, appendices and a petition signed by ~4,000 people, this document and presentation was sufficient

to convince the Council to prohibit lethal management of monk parakeets on its land. In contrast, Defra's confident but equally selective submission included no supporting references (relying instead on the assumed legitimacy of the peer-reviewed non-native species risk assessment) and argued that national and supra-national strategies for invasive species management gave it authority to act. In terms of public support, it referred to a national independent survey, which found "broad support for lethal control of non-native species". However, it made no reference to the specific concerns of the community represented by the councillors receiving the report. Furthermore, "there was no representative from Defra present at the meeting, which [the] chairman…said "was a shame and frustrating" (Thain 2011). Similarly, in the Isle of Dogs, only campaigners met with councillors to make their case. Arguably, the national Government's failure to engage in meaningful dialogue about the issue damaged its relationships with concerned citizens and local authorities and, ultimately, the success of its project.

Networks and patterns in management disputes

Finally, an interesting feature of this case was that, in building a counter-narrative against eradication, campaigners sought out and learned from the experiences and arguments of previous management disputes. Indeed, a loose network of parakeet protectors formed within and between regions, states and nations: Borehamwood campaigners were advised by veteran parakeet advocates from the New York metropolitan area, and went on to support activists in the Isle of Dogs. By comparison, whilst the UK Government has established a strong system for conducting risk assessments for non-native species, drawing on evidence from around the world, there is currently no formal or explicit mechanism for learning about (or from) past management initiatives. This is unfortunate, because monk parakeet management has a documented history of social conflict and unsuccessful interventions (see Appendix 5). There are commonalities between past disputes that could enable would-be managers to anticipate, and potentially address, social concerns. For example, disputes have repeatedly arisen in northerly, urban-suburban areas where charismatic parakeets have established relatively small populations over several years (and sometimes decades) before being threatened with eradication and/or lethal control.

Concluding discussion

Although focused on a single species and a handful of cases, the findings of this study are useful in informing future management approaches, both specifically, in relation to introduced monk parakeets, and more broadly, in relation to other introduced species. First, as noted in a summary report of the UK case, "there appear[ed] to be a lack of understanding, or resistance, to the concept of the precautionary principle – certainly in the case of colourful and charismatic species such as parakeets" (Parrott 2013, p85). We have identified some challenges to application of the precautionary principle in cases such as this, where 'precautionary' action involves lethal control or eradication of sentient animals. Indeed, the problem may be compounded in monk parakeet management because the small, locally restricted colonies considered technically eradicable may be the same populations with which humans develop affective attachments. Moreover, where attachments exist, opposition to eradication may be a response to the impending *loss* of parakeet presence, rather than solely (as is often assumed) animal welfare concerns. Finally, in the UK, eradication was framed as a 'rapid response' intervention. However, although 20 years – the interval between first records of monk parakeets in southeast England and the eradication project – is considered short in ecological time, this represents almost a generation for humans and provides ample opportunities for individuals and communities to associate with, and form attachments to, 'charismatic' introduced populations.

This is not to suggest that precautionary action is not warranted for monk parakeets. Rather, there is room for greater focus on precautionary management at earlier stages in the introduction process. Measures to prevent introductions of parakeets and other exotic pets involve reducing source populations and preventing releases/escapes. The import of wild-caught parrots has been banned in the USA since the introduction of the Wild Bird Conservation Act (1992) and in Europe since 2007 (European Commission Regulation No 318/2007). However, many countries – including those that have banned live imports – still permit monk parakeets to be bred and kept in captivity (NB in the USA and Australia restrictions on ownership, breeding and trade vary between states: Tillman *et al.*

2000; Moscatello 2003). Robust regulations on domestic parrot trading and ownership may be one means of reducing source populations and propagule pressure, as well as potentially improving captive animal welfare. Other preventative measures could include establishing clear channels through which people with unwanted exotic pets might surrender them, and enforcement of existing laws relating to the release of non-native species. Whilst not providing ultimate solutions, a greater, more explicit focus on preventative measures would also serve to eliminate some of the inconsistencies (highlighted by campaigners, but agreed on by both conservation professionals and civil servants) in current strategies that focus disproportionately on reactive management. In other words, a joined-up approach could be both more effective and more convincing.

Similarly, rapid response eradications still have important application to the management of introduced parakeets. Such measures may be more acceptable, however, if carried out rapidly in human as well as ecological terms (e.g. shortly after detection) and, importantly, with sensitivity. Where ownership remains legal, quickly retrieving and rehoming exotic birds in the same way that authorities might recover escaped pets may be preferable – both socially and in welfare terms – to responding to parakeet presence as the incursion of an invasive species.

Established populations present a slightly different set of challenges. Where populations are small and localised, eradication may be technically feasible. However, the *social* feasibility of such interventions, particularly when they involve lethal control, may be more limited. In the UK case, the Government does not appear to have accounted for the potential depth and strength of opposition. This reveals an important missing step in the management planning process: explicit assessment of the social impacts and implications of management, and mechanisms for addressing or responding to the concerns of affected communities. We have discussed the potential value of social impact assessments in invasive species management elsewhere (Crowley *et al.* 2017a)[6] but in brief, we propose that the management of introduced species (like any other form of environmental intervention) can produce both positive and negative social impacts that need to be explored and effectively taken into account in

[6] See Chapter 5.

decision-making. Social impact assessment could also help improve relationships between would-be managers and affected communities, provided they incorporate early, good-faith public engagement. The distrustful and combative relationship that developed between Government and campaigners in the UK clearly contributed to the resulting uneasy stalemate, and plants potential for the conflict to reignite should the Government reattempt eradication in future. Management disputes in the USA have also become antagonistic at times: for example, campaigners in Connecticut filed a lawsuit when a utility company killed parakeets following nest removal (Harper and West 2010) and state efforts to remove the Chicago population resulted in public protests (Brotman 1988). Elsewhere, however, more collaborative approaches have emerged. In Edgewater, New Jersey, the state utility company – learning from the experience of their Connecticut counterparts – works with campaigners and researchers to develop and refine impact mitigation measures that minimise the welfare costs of nest "teardowns" (Burger and Gochfeld 2009). Campaigners maintain a constructive relationship with the company, whose representatives, they claim, have been "very forthright, open, and cooperative" (*Edgewater Parrots* n.d.) The issues surrounding impact mitigation and eradication are somewhat different, but protectionists may nevertheless be more open to population removal if they can participate in decision-making processes, and feel assured that every effort will be made to safely rehome the birds. Thus, there is a need not only for would-be managers to anticipate and understand the concerns of affected communities and interested publics, but also a willingness to take these concerns seriously, and adjust management approaches accordingly.[7] The past missteps of others – including ill-considered wildlife introductions and insensitive management interventions – cannot easily be corrected. They do, however, provide opportunities to learn, anticipate, adjust, and prevent history repeating itself.

[7] I outline a framework for adjusting management practices in ways that could make them more context-aware, inclusive, and responsive to concerns, in Chapter 2 (Table 2.1).

Table 4.1. Comparison of Government and campaigner use of evidence in documents submitted to Hertsmere Borough Council for consideration.
The Government submission was presented by the Department for Environment, Food and Rural Affairs (Defra)

Issue	*Government submission*	*Campaigner submission*	*Notes: use of evidence*
Population size and growth	"The population… is not in decline. It has shown sustained overall growth over the years."	"The tiny population in the UK has been carefully monitored and is known to be in decline."	*Defra's records show slow but steady population increase in England. The population was recorded to decline following, and likely affected by, management trials.*
	"In … Spain and the USA, their population has grown exponentially once they have become established"	"The climate [in Spain] is different from that of the UK. In New York State, where temperatures are similar to in the UK, observations over the past few years indicate that the populations are either self-limiting or are remaining stable with little increase."	*Populations in southern Spain, particularly Barcelona, have shown rapid expansion, as have populations in Texas and Florida, USA. In northern regions of the USA, population success and growth rates have been more variable.*
	"A population of monk parakeets were kept at liberty in Whipsnade Park, Bedfordshire for some time… but had to be recaptured due to them causing "so much damage in orchards for some miles around."	"Previous populations existing elsewhere in the UK have died out naturally."	*Both statements are supported by historical records from the UK* (Yealland 1958; Tayleur 2010)
Risk / evidence of economic impact	"**Agriculture:** • Implicated in causing over one billion dollars per annum in damage in native range.	"Dr Gochfeld… wrote "*I have found no evidence that my earlier concerns about its pest status were warranted.*	*Dr. Gochfeld is an American environmental scientist whose statement of support for removing monk parakeets from the 'potentially dangerous species' list in New*

- Capable of causing severe local damage in their introduced range: Dade County Florida, more than 30-fold increase in damage where monk parakeets present and estimated revenue loss of $477 per agricultural acre attributed to monk parakeet."

This means little or no evidence of major agricultural damage from its native haunts in Argentina and Brazil, nor its adopted lands in Florida and New Jersey."

Jersey, USA, is appended to the campaigner's submission.
The Government submission from Defra contained no references, but the figures provided from Florida and Spain are from Tillman et al. (2000) and Conroy and Senar (2009) respectively.

"Utilities:

- Frequently nest on electrical structures which can cause frequent power outages. This behaviour is observed in every state in the USA where the birds are breeding. Costs for repair estimated to be $566,000 annually in South Florida or $551 per incident. Total costs associated with power failures attributed to the Monk Parakeet in 2001 were $585,000, or $570 per incident. **NB This impact was not anticipated when the birds first started to breed.**
- The cost to remove both a nest and the birds inhabiting it is estimated at $1,500 per nest.
- In the USA the cost of nest removal alone to reduce the risk of

"This issue is not so applicable here in the UK because of our electricity supply infrastructure; we don't have many pylons in towns and the distribution network in towns is, in the main, below ground. In the US they have a 110v system which necessitates thicker cables and higher currents (more waste heat) with transformers and cables strewn across the local street scene.
"…In Borehamwood we do have telegraph poles for phone lines and the Eruv poles.* There have been no nests on any of these structures in the 18 years

Defra's figures can be found in Avery et al. *(2002, 2008) based on studies in Florida, USA. The figure provided for per-nest removal is actually "$415 to $1,500 per nest" (Avery et al. 2008, p1449). The final estimated cost over five years is also only for Florida.*

There is only one record of monk parakeets nesting on infrastructure in the UK, on a mobile phone mast. Both documents acknowledge this.

	power outages was estimated to be $1.3 million to $4.7 million over a five year period."	feral monk parakeets have lived here."	
	"Monk parakeets have shown their propensity for crop damage in the UK in the past." "The Risk Assessment made clear that this species is capable of causing severe local damage to crops"	"According to Tayleur (2010) there are no reports of agricultural damage by monk parakeets in the UK" "Few studies provide convincing evidence of widespread agricultural damage. No massive agricultural damage as had been predicted thirty years ago in the US (Spreyer and Bucher 1998)."	*Tayleur (2010) supports both statements: "In Argentina, the amount of damage caused by Monk Parakeets is* ***locally severe****, but regionally negligible (Bucher 1992).* ***Very little empirical evidence exists*** *that Monk Parakeets are highly destructive agricultural pests and predictions of severe damage to crops in the USA (Davis 1974) appear not to have been borne out (Spreyer & Bucher 1998)… There* ***are no reports of agricultural damage*** *by Monk Parakeets in the UK." (emphases added)*
Risk / evidence of environmental impact	"Although there is unlikely to be competition with native birds for nesting sites, competition for food may be an issue since monk parakeets are known to dominate feeding areas and act aggressively to competitors"	*"[Monk parakeets] do not compete with other species for nesting sites. On the contrary they will happily share their large communal nests with a variety of creatures and have been known to share with bats, opossums and geese (Athan 2007) as well as house sparrows here in the UK. According to the New York Protection of Monk Parakeets*	*The risk assessment states: "Monk parakeets frequently dominate feeding areas (South and Pruett-Jones, 2000) and have been reported to kill native birds (Davis, 1974)" (GBNNSS 2010a, p1). The Davis (1974) reference, though widely used, is based on anecdotal reports. No research has investigated monk parakeet resource competition with native species, including the South and Pruett-Jones (2000) paper, which makes no comment as to dominance in feeding areas or interaction with native species.*

		Bill (New York State Senate 2011b): Quaker parakeets are neither harmful to the environment, nor displaced or been a threat to any native species."	*There are records of monk parakeets sharing nest structures with other species (see Spreyer and Bucher 1998). Anecdotal reports suggest their interactions with sparrows can be agonistic, however (Freeland 1973; Wagner 2012)*
Risk of health and social impact	"Potential for disease transfer both to livestock (e.g. poultry flocks) and humans. In Barcelona, a number of pathogens have been detected in the faeces of feral monk parakeets - *Chlamydophila, Psittacosis, Salmonella, Campylobacter, E.coli* and a number of viruses."	"…there is no evidence that the droppings of Quakers are more substantial or more infective than those of any native bird species."	*Neither statement refers to external evidence.*

** 'Eruv poles' and linking wires are structures associated with the creation of an Eruv (an area within which Orthodox Jews are permitted to carry or push objects on the Sabbath).*

Table 4.2. Quotes indicating development of personal and community attachments to monk parakeets

Location:	Quote:	Parakeets associated with:	Source:
Brooklyn, NY, USA	*"They've been here so long…it's like we grew up with the parrots."*	Place (over time) Personal history	Resident quoted in Cohen (1996)
	"A West Indian-born parks worker…and his fellow laborers hear what sounds like a flock of sea gulls dive-bombing at their heads. The workers instinctively duck and whip-round and look up and see - those crazy green parrots, expertly mimicking the seagull's caw. "Man, they do that a couple times a week just to play with our minds," Joseph said, grinning wide and shaking his head. "They are a crazy bunch of immigrants, those birds."	(Positive) interactions Cultural symbolism (immigrant community)	Powell (2006)
	"They've been here for 30 years…They're part of the neighborhood."	Place (over time) Community identity	Campaigner quoted in Durkin (2008)
Chicago, IL, USA	*"I think of them as my parrots, as does everyone in Hyde Park...Whenever a professor comes in from Europe and I give him a tour of Chicago, I drive by and point out the parrots."*	Place (uniqueness) Personal identity	Campaigner quoted by Brotman (1988)
	"The Hyde Park parakeets, miraculously surviving brutal winters, [are] a colorful example of life that adamantly refuses to perish, of the kind of instinct that has made Chicago harsh and great. I actually have never seen one: the possibility that they are made up makes the whole thing even better."	Place (character) Cultural symbolism (resilience)	Hemon (2013, p131)
New Haven, CT, USA	*"Denysenko said his dad, Alex, planted the locust in 1966, taking a 4-foot sapling from a family member's home…Alex Denysenko loved the exotic green parrots that squawked around the neighborhood. He would pour sunflower seeds into a bird-feeder and reel it to the middle of the clothesline, attracting the birds. When the trees got big enough, the birds would settle there in large communal nests. Alex Denysenko died three years ago at the age of 98."*	Personal history Positive interactions	Bailey (2013)
Yacolt, WA, USA	*"I don't know why they chose Yacolt, but they've wakened up this town…this town has become famous…I mean, most people have never even heard of Yacolt. It's not even on the map sometimes."*	Place (uniqueness) Community identity	Resident speaking in Driggins (2010)

	"They're more than just birds to us, they're part of our community"	Community identity	Resident quoted in Gilbert (2007)
Isle of Dogs, London, UK	*“These birds have been here for years and the locals love seeing them here. They are part of the Island's wildlife and very friendly...”*	Place (over time) Positive interactions Community identity	Campaigner quoted in Hayes (2011)
	“People…are quite proud of having the[m]…they feel there’s something rather special…birdwatchers come down to see them…I think…there was a feeling of pride that the Isle of Dogs had got this special bird.”	Place (uniqueness / character)	Interview with borough ecologist, 12/1/15
Borehamwood, Hertfordshire, UK	*"They add a little bit of colour to the environment, it’s something a bit out of the ordinary, which brings character to Borehamwood...”*	Place (character)	Campaigner quoted in Darlington (2011b)
	“[Many residents] view the birds as an attractive and charming addition to the town and feel they are as much a part of Borehamwood’s heritage as the film industry.”	Place (character)	Campaigner submission to Hertsmere Borough Council, 2011
	"They are part of the community, people want them to stay, people enjoy looking at them.”	Positive interactions Community identity	Campaigner quoted in Darlington (2011c)

Chapter 5

INVASIVE SPECIES MANAGEMENT WILL BENEFIT FROM SOCIAL IMPACT ASSESSMENT

Chapter 5: Invasive Species Management will benefit from Social Impact Assessment

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Abstract

1. Invasive species management aims to prevent or mitigate the impacts of introduced species but management interventions can themselves generate social impacts that must be understood and addressed.

2. Established approaches for addressing the social implications of invasive species management can be limited in effectiveness and democratic legitimacy. More deliberative, participatory approaches are emerging that allow integration of a broader range of socio-political considerations. Nevertheless, there is a need to ensure that these are rigorous applications of social science.

3. Social impact assessment offers a structured process of identifying, evaluating and addressing social costs and benefits. We highlight its potential value for enabling meaningful public participation in planning and as a key component of integrated assessments of management options.

4. Policy implications. As invasive species management grows in scope and scale, social impact assessment provides a rigorous process for recognising and responding to social concerns. It could therefore produce more democratic, less conflict-prone and more effective interventions.

Chapter 6

NONHUMAN CITIZENS ON TRIAL

THE ECOLOGICAL POLITICS OF A BEAVER REINTRODUCTION

Chapter 6: Nonhuman citizens on trial: the ecological politics of a beaver reintroduction

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Abstract

Wildlife reintroductions can unsettle social and ecological norms, and are often controversial. In this paper, we examine the recent (re)introduction of Eurasian beavers to England, to analyse responses to an unauthorised release of a formerly resident species. Although the Government response to the introduction was to attempt to reassert ecological and political order by recapturing the beavers, this action was strongly opposed by a diverse collective, united and made powerful by a common goal: to protect England's 'new' nonhuman residents. We show how this clash of state resolve and public dissent produced an uneasy compromise in the form of a formal, licensed 'beaver reintroduction trial', in which the new beaver residents have been allowed to remain, but under surveillance. We propose that although the trial is unorthodox and risky, there is an opportunity for it to be treated as a 'wild experiment' through which a more open-ended, experimental approach to co-inhabiting with wildlife might be attempted.

Chapter 7:

KILLING SQUIRRELS

MOTIVATIONS AND PRACTICES OF LETHAL WILDLIFE MANAGEMENT

Chapter 7: Killing Squirrels: motivations and practices of lethal wildlife management

Accepted, subject to revisions in Environment & Planning E: Nature and Space.

Abstract

Wildlife management, pest control and conservation projects often involve killing nonhuman animals. In the United Kingdom, introduced grey squirrels *Sciurus carolinensis* are killed in large numbers to protect remnant populations of European red squirrels *Sciurus vulgaris*. Grey squirrels are also killed outside of red squirrel areas to protect broadleaved trees from squirrel damage, as part of routine pest control, opportunistically, and sometimes recreationally. We used semi-structured interviews and participant observation to investigate motivations for, and practices of, lethal squirrel control in the UK. We identified important variations in practitioners' approaches to killing squirrels, and here we outline three 'modes of killing' – reparative/sacrificial, stewardship, and categorical – which comprise different primary motivations, moral principles, ultimate aims, and practical methods. We identify both productive alliances and possible tensions between these modes, and propose that clear, explicit consideration of how animals are both killed and 'made killable' should be a key component of any wildlife management initiative that involves lethal control.

Introduction

There's more than one way to kill a squirrel. In the United Kingdom (UK), people bring about the deaths of thousands of grey squirrels *Sciurus carolinensis* every year: in houses, gardens, barns and woodlands; on public and private land; and with guns, traps, weighted priests, and water. Killing is an occasional pot-shot from the window, or a full-time occupation; it is distressingly difficult and/or a matter of routine.

The killing of nonhuman animals (hereafter 'animals') is ubiquitous in human societies (The Animal Studies Group 2006), and "fundamental to the creation of the social order between sets of creatures" (Marvin 2006, p20). Nevertheless, despite an abundance of theoretical and philosophical discussions of the ethics of killing, comparatively little empirical social scientific research has examined how nonhuman killing is practised and performed. Exceptions include work in the 'domestic killing' spaces of slaughterhouses, research laboratories and animal shelters, where people who routinely kill animals face a range of psychological and emotional challenges (Dillard 2008; King 2016), and anthropological research investigating hunting practices amongst 'Western' and indigenous peoples, which indicates that 'wild killing' can be experienced as positive and/or rewarding (Cartmill 1993; Ingold 2000; Watson and Huntington 2008; Marvin 2010; Knight 2012). More recently, there has been increasing academic interest in how killing and death "circulate alongside care and life" (Ginn *et al.* 2014, p113), addressing the 'violent-care' of killing in conservation (Clark 2015; van Dooren 2015), rescue shelters (Reeve and Rogelberg 2005) and veterinary practices (Law 2010). Practitioners working in these domains can find killing 'genuinely difficult' (van Dooren 2011; Atchison *et al.* 2016), and experience moral stress, or "a sense of discord and tension" (Rollin 1987 p119) between their reasons for acting (care) and their actions (taking life). Scholars have also, therefore, begun to examine the potential significance of detachments and 'non-relation' between killer and killed (Ginn 2014).

Haraway (2008) argues that living 'outside killing' is effectively impossible, and proposes that it is not killing *per se* that is fundamentally problematic, but making others – animals or humans – 'killable'. She cautiously suggests that, to avoid the

‘exterminism’ associated with ‘making killable’, people might aim to stay “in the presence of” (Haraway 2008, p83) those they kill, and take responsibility for killing. Here, then, we aim to contribute to this emergent body of literature that does not seek either to condemn nor to defend nonhuman killing. Rather, we aim to problematize killing, and take it seriously as an inescapable and consequential form of human-animal interaction, but have avoided making general judgements about its appropriateness or morality. We are also interested in the distinction between killing and ‘making killable’ in both the specific context of squirrel management and wildlife management more broadly.

Killing wildlife is often, and perhaps increasingly, controversial (McLeod 2007; Meurk 2015), and the evaluation of ‘public’ and ‘stakeholder’ attitudes towards lethal control has become an increasingly important component of research investigating the ‘human dimensions’ of wildlife management (e.g. Sharp *et al.* 2011; Dandy *et al.* 2012; Farnworth *et al.* 2014; Enticott 2015; Lute and Attari 2017). In comparison to these broader ‘communities of interest’ (Patterson *et al.* 2003), relatively few people, in the UK at least, comprise the ‘communities of practice’ (Lave and Wenger 1991; Everts 2015) that kill or bring about the death of wild vertebrates, and less academic research has directly engaged with these diffuse, diverse communities (Boonman-Berson *et al.* 2014).

Our research aimed to engage with a range of people involved in managing introduced grey squirrels in the UK (including professionals, volunteers and private individuals), to better understand their aims and motivations, and to explore how these are translated into practices. Here, we explore some of the complexities and considerations of wildlife management ‘in practice’, focusing on killing as a central component of contemporary squirrel management. We identify patterns and variations in how practitioners rationalise, perform, and respond to killing.

We begin with a brief introduction to squirrels and their management in the UK. Following a summary of our methods and analytic approach, we draw on our empirical work to outline three different ‘modes of killing’, or ways in which our participants approached, performed (or brought about), and responded to killing. These modes are linked, though not restricted, to different ‘arenas’ of squirrel

management: conservation of red squirrels *Sciurus vulgaris*; tree protection; and routine or ad-hoc control of 'vermin' and 'invasives'. We conclude by highlighting the complex relations between 'killing' and 'making killable', and discuss how a detailed understanding of different modes of killing, and how they interact, might contribute to the development of effective, socially legitimate and sustainable wildlife management policies and projects.

Background: squirrels in the United Kingdom

There are two species of squirrel in the UK: the Eurasian red squirrel and the Eastern grey squirrel. The 'natural' history of red squirrels in the UK, prior to the 1930s, is "somewhat perplexing and difficult to unravel" (Lloyd 1983, p69). Although populations declined significantly nationwide in the 18th century, reforestation and reintroductions enabled something of a resurgence, and by the late 19th century red squirrels had become so abundant that intensive efforts were made to reduce their numbers (Holmes 2015). By the early 20th century they were in decline once again, affected by disease, deforestation and competition with grey squirrels (Coates 2015).

Introduced from North America over a hundred years ago, the socio-ecological place of grey squirrels in the UK remains contested (Coates 2015). Despite efforts to control their spread and numbers, grey squirrels are now established across most of Great Britain and Northern Ireland (Mayle and Broome 2013). They have become a visible and popular visitor to many urban-suburban parks and gardens (Bonnington *et al.* 2014), but also pose significant challenges for both red squirrel conservation and arboriculture. As grey squirrels spread during the 20th century, red squirrel populations continued to decline (Mayle and Broome 2013). Current scientific understanding is that this supplanting of one species by another is primarily the result of disease-mediated competition (White *et al.* 2014). Direct resource competition with grey squirrels adversely affects red squirrel fitness and recruitment (Wauters *et al.* 2002; Gurnell *et al.* 2004) but grey squirrels can also carry squirrelpox virus (SQPV), which causes high mortality in red squirrel populations while hardly affecting grey squirrels (Tompkins *et al.* 2002; Chantrey *et al.* 2014). Strategic controls have helped red squirrels persist in designated 'strongholds' (White *et al.* 2014; Shuttleworth *et al.* 2015), however, most of the red squirrel population in mainland Great Britain is now restricted to

Scotland, and a ‘front-line’ against grey squirrel expansion has been established along the Scottish borders (Tonkin *et al.* 2016).

Grey squirrels damage growing trees by bark stripping, primarily in late spring and summer (Mayle and Broome 2013). Multiple hypotheses have been advanced to explain this behaviour (see Nichols *et al.* 2016), but it remains poorly understood and continues to frustrate woodland owners and managers (Forestry Commission (England) 2014; Royal Forestry Society 2014). Indeed, the issue has become more pronounced as native broadleaved woodlands, extensively planted with the assistance of generous grant aid in the 1990s, reach the most vulnerable age for squirrel damage (10-40 years: Mayle and Broome 2013). Publicly-owned woodlands are still largely comprised of less vulnerable non-native conifers (85% of the area of the public forest estate cf. 38% in private woodland: Forestry Commission 2016), and the Forestry Commission (England) concentrates its grey squirrel control in red squirrel areas and highly vulnerable forestry plantations. In private woodlands, grey squirrels are subject to variable degrees and methods of control. Poisoning with the anticoagulant rodenticide warfarin was a popular control method from its introduction in 1973 to its effective banning (for outdoor use) in mid-2015 (Commission Regulation (EU) No 186/2014). Remaining legal control methods include shooting and trapping, using both kill- and live-capture traps. In some areas, however, rather than invest in costly management, woodland managers have simply stopped planting vulnerable broadleaves. Grey squirrels are also regularly killed during routine and/or reactive pest control on farms, around pens for rearing and releasing pheasants *Phasianus colchicus* for shooting, and in houses and gardens, where they create (what some see as) nuisance by digging bulbs, denning in attics, and disturbing birds (Bonnington *et al.* 2014). Finally, drey-poking (where shooting parties use poles to coax young and adult squirrels from their arboreal dens, known as dreys) and free-shooting are both used to supplement other methods (Royal Forestry Society 2014).

Grey squirrel management has become something of a cyclical issue in British political discourse: Sheail (1999) concluded that ever since grey squirrels started to spread, consistent pressure from concerned lobbyists has prompted intermittent government efforts to address the problem, or at least to “be seen [to

be] responding" (p145). This trend has continued since Sheail's analysis: squirrels appear in parliamentary questions and debates almost annually, and national and regional governments are involved, to varying degrees, in grey squirrel control initiatives (primarily focused on red squirrel conservation, although grants for squirrel control in vulnerable woodlands are available as part of 'Countryside Stewardship' schemes). As of 2017, Government policy for grey squirrel management in England focuses on providing funding and support for research and coordinated control programmes (Forestry Commission (England) and Defra 2014). The devolved Welsh, Scottish and Northern Irish governments also support targeted grey squirrel control projects in red squirrel areas (Wales Squirrel Forum 2009; Scottish Squirrel Group 2015; Northern Ireland Squirrel Forum 2016). The issue also features regularly in the news media, often coinciding with the launch of new grey squirrel control and/or red squirrel conservation initiatives. Nevertheless, at present grey squirrel management maintains a relatively low public profile, unlike other wildlife management problems in the UK, which can be dominated by fraught, high-profile, chronic public debates (e.g. surrounding culling badgers *Meles meles*, hunting foxes *Vulpes vulpes*, and persecuting raptors).

Methods

Case regions and participants

This multi-sited case study focused on four regions: three with established red squirrel conservation projects including grey squirrel control (Scotland, Wales, and northwest England), and one where red squirrels are currently absent, and control is primarily conducted for woodland protection (southwest England). We sought a diversity of management strategies and contexts in our selection of regions[1] and, where possible, a range of backgrounds, motivations, aims and experiences amongst participants within each region. There were 50 participants in total (30 male, 20 female; see Table 1 for spread of locations and primary role in relation to grey squirrel control). Conservation project officers were contacted directly and assisted with recruitment of project volunteers and wildlife

[1] There was also an element of self-selection, as we sent research invitations to multiple conservation projects and organisations with an interest in grey squirrel management, and only worked with those that expressed an interest in participating.

management professionals. Forestry professionals and woodland owners were recruited with the assistance of Confor UK (Confederation of Forest Industries). All participants provided written consent and were supplied with information about the research. Here, participants' identities are protected with pseudonyms.

Interviews and participant observation

The primary method of data generation was semi-structured interviews, following a schedule of topics that was adapted to different participants and management contexts.[2] We also used, where appropriate, 'go-along' interviews, in which "fieldworkers accompany individual informants on their 'natural' outings, and…actively explore their subjects' stream of experiences and practices as they move through, and interact with, their physical and social environment" (Kusenbach 2003, p463). This method complements the discursive focus of 'static' interviews with observations and interpretation of material practices (Rapley 2007; Wanderer 2014). The lead author also participated in relevant events: a volunteer recruitment evening in Wales, a volunteer update meeting in Scotland, a volunteer working group in northwest England, and an excursion with members of a forestry organization in southwest England.[3] All fieldwork took place between April and July 2016.

Analysis

Our analysis began with a detailed reading of field notes and interview transcripts, and loose coding of emergent ideas and themes (using NVivo for Mac v11.4). We then focused on identifying patterns in how practitioners spoke about (both species of) squirrels, the 'place' of squirrels in Britain, and the role of squirrel management; how they explained their decisions and ethical positions; and how squirrel control was 'done' in practice. We organised these patterns into several 'interpretive repertoires' (consistent variations in discursive patterns of explanation, justification and terminology: Wetherell and Potter 1988) associated

[2] See Appendix 2.

[3] In Wales, Scotland and southwest England these events included informal discussions with attendees (who were informed about the researcher's presence and purpose). Informal discussions were not recorded, but field notes were taken. At the volunteer working group in northwest England, the semi-structured interview schedule was adjusted to a group interview format. The group interview was recorded and transcribed.

with relatively consistent variations in management strategies and methods. We combined these repertoires of discursive and material practices into 'modes of killing'. We understand these modes as different ways of ordering (see Law 1994) and practising killing: collectives of motivation, morality, aims and actions that do not necessarily correspond to a categorisation of participants, but of different orientations towards the meaning and purpose of killing, and how it is performed (Marvin 2010). Our use of this orderly typology is primarily for analytic clarity, as these modes are connected in complex ways, and not mutually exclusive: practitioners might shift between modes, depending on context.

Results: arenas and modes of killing

Red squirrel conservation and reparative/sacrificial killing

For participants participating in grey squirrel control for red squirrel conservation, killing was often considered a 'nasty necessity' (Temple 1990): an unpleasant but fundamental component of conservation work. Killing for conservation is a complex issue. People working to protect species and ecosystems are often motivated by an interest in preserving – rather than curtailing – wild lives. Consequently, participants were often quick to emphasize that they would rather not kill animals. However, there was broad consensus that killing grey squirrels was acceptable in the context of the "greater good" (Matthew, squirrel control officer) of biodiversity conservation, and was currently the only realistic means protecting red squirrels.

Several connected but subtly different concerns underpin the 'killing for conservation' rationale. Participants regularly referred to the importance of preserving native nature, and introduced species that disrupt the 'natural balance' of native ecologies therefore required control. This argument was closely intertwined with the belief that, because people were responsible for introducing grey squirrels, they also have a moral duty to manage the consequences: "We mucked it up basically [by] upsetting the balance originally, and I think we need to try and undo that" (Matthew). "We", it was argued, should correct the mistakes of ancestors and conspecifics: "We as mankind, if you like, have contributed to the demise of some of these species; it's our responsibility to redress that imbalance" (Paul, volunteer trap-loan coordinator). Thus, killing grey squirrels is

considered not just an unfortunate aspect of managing and correcting imbalances in nature, but – when these imbalances are anthropogenic – a moral duty.

More specifically, killing grey squirrels is understood as a necessary component of red squirrel conservation. One volunteer, after emotively recounting the collapse of the local red squirrel population following a disease outbreak, explained: “I’d rather not [kill grey squirrels]. But…in the interests of saving the [red] squirrels, it’s a necessary evil. It’s the injustice that gets me, it is the injustice of this – it is all our fault, and we need to do something about it” (Deborah). Similarly, Gwen, another volunteer, said: “I don’t like doing it, I’ve never killed anything in my life…but then, the reds have to be saved, don’t they? …I really don’t have much choice.”

These and other conservation volunteers expressed a sense of personal responsibility not only to correct anthropogenic ecological disruption, but also to defend animals with whom they felt connected, and which might otherwise be lost (see also Lurz 2014). Jan explained that, “I’d never given red squirrels a second glance, because the[y] were always there. And suddenly…they weren’t…and that was really what [motivated me] …I thought, that’s just dreadful, because red squirrels belong here…” Humans can develop emotional and material attachments to ‘charismatic’ (Lorimer 2007) species through positive interactions, and specific populations and organisms can become integrated into personal, community and cultural identities. Should these valued individuals or collectives be threatened, their human supporters rally to their defence, committing extensive time, resources and emotional energy to their protection. Such attachments were evident amongst conservation volunteers, and commented on by conservation professionals: “[People in this area] kind of feel like [the red squirrel is] theirs, and so they need to protect it – it’s like they’ve got ownership of those red squirrels, really” (Jessica, conservation project officer). Red squirrels, then, are not simply protected as an ecologically ‘native’ species, but also carry important cultural values. These include nostalgic affection (“We want to see some about! As I did as a kid, you know”: Eric, volunteer); associations between isolated red squirrel populations and the identities of communities and locales (“people are quite proud [of the squirrels] …that sounds silly, but it’s something special, isn’t it?”: Lin, volunteer); and even links with national identity,

as “one of those iconic [Scottish] species” (Sandra, local government official).[4] The red squirrel’s popularity (particularly in the regions they persist) may be intensified by the grey squirrel’s presence and expansion: that is, part of the red squirrel’s contemporary appeal appears to lie in its status as the victim and underdog of an unfolding struggle between ecologically similar species: “the greys [have] got a couple of weapons haven’t they, they’ve got the pox virus, they eat them out of house and home, they can eat the food earlier…everything’s against the reds!” (Barry, volunteer).

Nevertheless, individual grey squirrels were still often regarded as ‘innocent’, and their killing caused some participants discomfort and regret. Gillian, a volunteer in Scotland, was strongly protective of red squirrels but felt unable to fully support lethal control of grey squirrels, because “it’s not the squirrel’s fault, [yet] it’s the squirrel that gets murdered!” This encapsulates an important dilemma that many participants faced: they felt people had a moral responsibility to ‘undo’ ill-considered introductions, and protect red squirrels, but disliked the idea that it was grey squirrels that would ‘pay’ for this. However, even though some participants sympathised with, and even expressed respect for grey squirrels, there was a widespread belief that their choice was straightforward: “You can’t have both squirrels. You can have one, or you can have the other, but you can’t have both” (Diana, volunteer). Grey squirrels, then, are sacrificed so that red squirrels might persist. We have termed this approach to killing ‘reparative/sacrificial’, because it is motivated by a sense of moral duty and responsibility towards anthropogenically-disrupted ecologies, and protectiveness of red squirrels. It is accompanied, however, by unease about killing ‘innocent’ wildlife, which is overcome by framing squirrel killing as a necessary sacrifice.

Official red squirrel conservation projects advocate systematic live-trapping of grey squirrels. Systematic trapping is considered the most effective means of ‘clearing’ an area of grey squirrels, and live-trapping is necessary where red

[4] Our participants only occasionally specified this as a motivational factor, however, it is clearly a component of broader public interest in red squirrels: 88% of Aberdeenshire respondents to a Scottish Natural Heritage (the statutory nature conservation organization) survey associated the red squirrel specifically with Scotland (Ashbrook Research and Consultancy Ltd. 2010), and in 2013 it was voted runner-up of ‘Scotland’s Big 5’ wildlife species (Tonkin *et al.* 2016).

squirrels are present because kill-traps cannot discriminate between the two species. Trapped squirrels are killed by a shot to the head with an air pistol/rifle, or by cranial concussion. The latter involves transferring the squirrel to a hessian sack before delivering a forceful blow to the head with a heavy, blunt object (often a weighted wooden 'priest'). The procedure is visceral and physical, and can be challenging and anxiety-inducing to perform (and indeed, to witness). Trapped squirrels are vocal and agitated, and may twitch, convulse and/or gasp following the strike. Ironically, these affecting final reflexes are good indications that the blow was sufficient to immediately stun, and rapidly kill, the squirrel (Central Science Laboratory 2009). To be this effective, however, the strike requires confidence and commitment: "You've got to put brutality behind it. So, do it as if you really mean it, doing it half-hearted is not going to do the job, it's going to stress the animal" (Craig, squirrel control officer).

Practitioners of all kinds reported feeling responsible for killing 'properly' (skilfully and confidently enough to ensure a rapid, 'humane' death), but this was made particularly explicit by those performing reparative/sacrificial killing, where there was evidence of a heightened sense of moral responsibility towards grey squirrels:

Lloyd: I've killed probably thousands of grey squirrels but…I even get anxious doing it, I still just get ever so slightly nervous, every time…because I'm anxious to do it properly.

Tim: Every time I do one, I want it to be the one hit, and it's gone. And that's always the thing…am I gonna hit this right so it's finished straight away?

(Wildlife management professionals assisting conservation project)

The persistent discomfort surrounding reparative/sacrificial killing produces a range of strategies by which participants detach and/or distance themselves from the troubling act of killing. Detachment, here, describes processes by which practitioners cognitively or physically remove themselves from killing, even as they perform it. Barry, a volunteer, explained why he preferred shooting over cranial dispatch: "You feel more detached…it sounds corny, but you go into the zone…it's a target…you don't even think that it's an animal." Tim (see above) further explained that "I don't look at the animals before I do it…if there's an

animal in [the trap] it goes straight in the sack."[5] However, as Craig noted, cranial concussion warrants a certain 'brutality' that an emotionally detached person may find difficult to muster. One method of overcoming this involves channelling anger and frustration at the broader situation towards the individual to be killed: "I recognise that you have to sort of demonise the squirrel in a way, in order to do it. You think, that's the baddy, and we're doing it for the red squirrel" (Lloyd). Thus, the moral imperatives of reparative/sacrificial killing provide the emotional impetus to kill whilst simultaneously enabling practitioners to detach from, and justify, individual deaths. Here, grey squirrels are killed, but are nevertheless *not* considered 'killable': their killing is a moral and physical challenge that must be overcome every time, and is justified in relation to a specific context and/or 'bigger' ethical rationale.

Practitioners might cognitively and emotionally detach themselves from killing (with the assistance of tools like the sights of a gun or a hessian sack), but they are nevertheless the immediate cause of death. Other participants found these acts too challenging, however, and although they bring about squirrel deaths, they also perform 'choreographies of separation' (Law 2010, p10) through which they physically and perceptually distance themselves from killing. For example, despite it being illegal in Britain under the Animal Welfare Act (2006), significant concerns about its humaneness (Central Science Laboratory 2009), and a high-profile prosecution (Ellicott 2010), drowning trapped squirrels is still, seemingly, a common practice (see also Ginn 2016). This method of killing, while deliberate, is less immediately violent than shooting or cranial concussion. By submerging the trap in water (and closing a lid), it is possible to 'walk away' from the squirrel's death.

Those unable or unwilling to kill squirrels themselves can also create distance by having someone else kill for them. In some regions, professional grey squirrel control officers enable householders to participate in management without needing to kill. Householders monitor a trap, cover trapped squirrels (which serves to calm both squirrels and discomforted humans), and phone a control

[5] The hessian sack serves multiple roles: the darkness calms the squirrels; it can be rolled to help immobilise and position them; and the practitioner can't see "its snooky [cute] little face…its little fluffy tail" (Annette, volunteer)

officer. There is an interesting split, however, between those householders who then avoid further involvement and those who "want to see it through, from reporting…to seeing the squirrel killed. It's like a process for them. They'd rather see it right the way through to the very end" (Craig). Some participants of these schemes therefore purposefully face killing, whilst simultaneously maintaining some distance from it.

A final note on distancing is the role played by terminology. The most common term employed for killing squirrels is 'dispatching'. Although dispatch has long been a synonym for 'kill', this is a secondary meaning. Primarily, 'to dispatch' means 'to send off'; indeed, one volunteer (and former pest controller) recounted how the term had caused confusion in the past, when he had included it in a technical note and subsequently been asked: "Where are you dispatching them to?" (Frank). Several participants mused that they would happily ship all grey squirrels 'back' to America. 'Dispatching' hints that the relation of killer to killed, in reparative/sacrificial mode, is not necessarily one of vitriol, retribution, or even justice. Rather, it can be interpreted as simply a desire to make grey squirrels *absent* (Ginn 2014), by whatever means necessary.

Management approaches that might achieve the same goals – restoration, conservation, atonement – with less strain are therefore appealing to those performing reparative/sacrificial killing. One such alternative is 'biocontrol' of squirrels through the reintroduction of native pine martens *Martes martes*, a tantalisingly plausible 'solution' to the seemingly Sisyphean task of killing grey squirrels in perpetuity. The idea that healthy pine marten populations could control grey squirrel populations through predation has been around for some years (see Barr *et al.* 2002). It has recently been reinvigorated, however, following an influential Irish study that identified a negative correlation between pine marten and grey squirrel abundance (Sheehy and Lawton 2014). Now, several organisations are engaged in projects that aim to restore pine martens to British woodlands. The restoration of a native species (formerly subject to human persecution) is itself reparative; that this might serve to control a problematic species is considered a bonus (Macpherson *et al.* 2014). Furthermore, successful biocontrol would limit the amount of killing (by humans) involved. It is therefore particularly appealing to those permanently troubled by the act of killing, who

might prefer the more ‘natural’, nourishing, and hidden deaths afforded by pine marten predation.

Woodland protection and stewardship killing

Where red squirrels are no longer present, grey squirrels are often killed with the aim of protecting trees, particularly timber trees. Private economic interest is therefore an important motivation, although the economics are more nuanced than ‘kill squirrels, save trees’: “you’ve got to look at the difference in value of undamaged broadleaf timber…compared with what you’d be able to sell it for as firewood. And the difference in value is in theory what you could afford to spend on squirrel control. If you could be sure that squirrel control [would prevent damage]” (Ian, forestry professional). However, squirrel control is not, contrary to hope or expectation, guaranteed to prevent damage, and might even exacerbate it (Rushton *et al.* 2002). Bark-stripping therefore has consequences beyond simple economic loss: it can also affect woodland composition, because (a) cumulative damage stunts tree growth and reduces canopy height and (b) growing hardwoods is a significant investment, and uncertain economic returns mean that some ageing plantations are not being replaced.

Squirrel control is also motivated, therefore, by the expectation that without it, native broadleaved woodlands will not flourish long-term. There is an emotional component, too, to the (often sudden) ‘devastation’ of trees by squirrels: “You look up, and you think, heavens, that’s been growing there for ten, fifteen, twenty years, and it’s been ruined during the last week, and…now it’s had it.” (Richard, woodland owner). This problem is compounded by a similar, contemporaneous struggle with the management of (native and introduced) deer populations; indeed, squirrels and deer were raised as issues in tandem in most of our conversations with foresters. Furthermore, trees are multivalent, and the commercial, amenity and conservation value of woodlands are intertwined: “I have heard the argument that a squirrel-damaged tree is still a habitat. [But] trees and woodlands can produce a resource and be sustainable. If you’ve got a pest in them that’s completely undermining the economics, then you’re just having a bush [with] dead wood and insects in it” (Robert, forestry professional).

A broader ethos here, then, is that "[the countryside] has to work, and it has to pay for itself" (Paul, wildlife management professional). The countryside (and wildlife therein) is considered productive property to be carefully maintained, or stewarded, by humans, and wildlife management – including killing – is part of this caretaking and harvesting. 'Stewardship' killing, is therefore motivated by (not necessarily economic or instrumental) evaluations of the benefits of various environmental components – including trees, squirrels, and deer – against the costs of intervention. It is underpinned by an anthropocentric, utilitarian ethic (Minteer 2013), in which economics and the maintenance of productive landscapes for future generations are important motivators. Conservation (especially of native or 'traditional' trees), still plays a role, but this tends to be secondary, for example: "[our woodland is] managed for commercial production…but very much with an eye to the landscape and wildlife…we encourage retention of British, indigenous hardwoods" (Arthur, woodland owner).

Squirrels are evaluated negatively where (and because) they create problems for property and profit, and/or threaten valued landscapes. Correspondingly, killing is practised when it is considered warranted and worthwhile: "We felt the need to exercise some degree of control, just to reduce the population to the point where the damage [squirrels] do is acceptable rather than unacceptable" (Ian, forestry professional). The grey squirrel's status as an introduced species is less pertinent to stewardship killing than the amount of damage they cause, though it is still relevant, due to their apparently greater economic impacts in British woodlands than in their native range (perhaps related to differences in population density). Nevertheless, red squirrels, a former "prime pest of the forester" (Ritchie 1920, p297) were also historically subject to extensive 'stewardship killing' in coniferous forests. In this mode, being a 'pest' renders grey (and, previously, red) squirrels killable, as it renders deer and other nuisance wildlife killable. That is, it is always acceptable to kill pests. What constitutes a 'pest', however, may be spatially and/or temporally dependent, and shifts according to the aims of stewardship and extent of the problem. Here, then, squirrels are generally classified as killable, in the sense that they are configured as one of a range of species that might 'require' control. However, the appropriateness and probability of killing is nevertheless context-dependent.

In practice, stewardship killing is decidedly matter-of-fact. The lead author accompanied Greg, a professional wildlife manager, on a trap-checking round. On encountering a trapped squirrel, Greg coaxed it into a well-used hessian sack, before quickly twisting the end and securing it with his foot. He delivered a swift, hard blow to the squirrel's head, before turning out the sack to confirm the kill. He checked the gender and condition of the squirrels' bodies, but left them in the woodland "for the buzzards". This was all done quickly, calmly, and without ceremony. Greg only expressed minor discomfort when recounting that he sometimes killed lactating females (as their young would then starve). Nevertheless, he kills every trapped squirrel, because "[shrugs] it's the job, isn't it?"[6] Greg's actions were not carried out in an aggressive or zealous manner. Neither, however, did he express unease about the squirrels' deaths. Several professional wildlife managers working in red squirrel conservation also approached killing in this pragmatic mode, and attributed their relative comfort to their socio-cultural backgrounds (in farming and/or 'countryside management'), for example: "I was a gamekeeper, so trapping was second nature…I've been involved ever since I was young in shooting and fishing" (Craig).

The proposition that people can become inured to killing was supported by participants who had 'never killed anything before' (a repeated refrain) and initially felt nervous, squeamish and upset, but found killing squirrels easier with repetition and experience. Possibly, then, early and/or regular involvement with, or exposure to, killing wildlife produces a better ability to cope with (or never develop) emotional discomfort (something McLeod 2007 also proposed in relation to duck hunters). Still, even amongst the most pragmatic, certain situations could provoke emotional discord; notably, one professional found killing squirrel kits upsetting because they "scream".

Inhumane methods, including drowning, were considered "unnecessary" (Paul). However, there are indications that this utilitarian approach to killing allows trade-offs between humaneness and economics: warfarin, for example, causes prolonged suffering, but tended to be rejected or promoted based on its assumed

[6] It is also illegal to release grey squirrels once trapped.

effectiveness, rather than the humaneness of its action.[7] Similarly, although humane kill-traps were ostensibly preferred, there were indications that this could also be contingent on cost: "[Humaneness is] all to do with how long it takes to kill something efficiently, and you're talking about seconds or something…Well, a Fenn trap's ten quid and the recommended alternative's fifty" (Richard). The popular, inexpensive Fenn Mk IV was believed 'on the way out' due to the trap failing to satisfy international standards for humaneness for a different target species, the stoat *Mustela ermine* (Warburton *et al.* 2008). Wildlife management professionals repeatedly mentioned GoodNature™ traps (http://www.goodnature.co.nz) as a potential alternative, as it was hoped that a version of this might become licensed for squirrel control, thereby bringing the possibility of more *efficient* killing. There were high expectations for this gas-powered device, which rapidly kills curious individuals with a bolt to the head, drops the body to the ground, and resets itself. This new killing technology makes deaths quicker and cleaner, and significantly reduces the labour required to check, clear and reset kill-traps.[8]

Woodland managers also considered systematic trapping the most effective means of reducing squirrel numbers. However, it is resource-intensive and, if practised in isolation, creates sinks into which surrounding populations may rapidly disperse. Foresters and woodland owners expressed frustration that their neighbours didn't undertake consistent (or any) control; this was considered poor stewardship. Accordingly, some were seeking political and financial support for more effective, coordinated and collaborative 'landscape-scale' management.

Controlling vermin, controlling invasives, and categorical killing

The term 'vermin' has a long history, and designates a shifting category of troublesome animals as, fundamentally, "the enemy" whose killing is not just accepted, but expected (Fissell 1999). Some practitioners place squirrels in this category, along with a variable collection of other species including rats, mice,

[7] Forestry professionals were divided on the importance of both warfarin and the recent withdrawal of its licenced use in the UK. Two reported using warfarin for years with little reduction in damage, and therefore considered it no great loss, but one reported recent damage to a stand of oaks that he attributed to the removal of warfarin.

[8] At the time of writing, however, GoodNature™ traps have not yet been approved for squirrel control in the UK.

rabbits, foxes, corvids, mustelids and/or raptors. Routine vermin control takes place both within and outside of conservation projects and strategic pest control. For example, one farmer at a volunteer event explained that he shot squirrels anyway, but took advantage of the free trap provided by the local trap-loan scheme. Indeed, participants working in conservation rarely encountered difficulties obtaining permissions to trap on farmland, which they attributed to "an understanding…amongst farmers" (Lloyd, wildlife management professional) about the need for vermin/pest[9] control.

We call this mode of killing 'categorical', because it targets squirrels (and other animals) not because of what they *do*, but because of what they *are*. The act of classification renders anything within that category 'killable': subject to being killed always and everywhere. Indeed, whereas the key ethical questions for other modes of killing are about justifying actions (why/when/where/how would you kill grey squirrels?), the equivalent for categorical killing is about justifying restraint (why would you *not* kill squirrels?). Accordingly, some participants were confused when asked if there were places or times when grey squirrels should *not* be killed. They responded that squirrels should always be subject to control because they are 'vermin', 'a pest' or 'an invasive' (more on the latter below).

The term 'tree-rat' (applied to grey squirrels in Britain since at least 1936: Coates 2015) is a discursive indication that this deadly classification has occurred. Like 'rats with wings' for pigeons, 'tree-rat' loads squirrels with "the moral and aesthetic baggage of the rat" (Jerolmack 2008, p87), indicating they should be received and treated as rats are: "if you think of them in those terms, then that's the way they need to be dealt with – right through from killing, controlling – to not eating" (Ian, forestry professional). The term not only renders squirrels killable, but also, because of the association between vermin and disease, makes them inedible (which can present an obstacle for those who argue that grey squirrels should be harvested for food). Although 'tree-rat' is regularly applied to grey squirrels, red squirrels are exempted. Participants put this discrepancy down to

[9] The terms 'pest' and 'vermin' are sometimes used interchangeably. However, 'pest' can be used both as a categorical indictment (like vermin) and to describe animals that are demonstrably creating problems. Reactive pest control is normally more closely aligned with 'stewardship killing' than 'categorical killing': to avoid confusion, we use the term 'vermin' throughout.

fundamental differences in the species' appearance and behaviour (e.g. "there is something more rodent-like about grey squirrels, they're not as charming": Jan, conservation volunteer). However, it is worth reiterating that until relatively recently, red squirrels were considered equally verminous (Holmes 2015). They have since undergone 'reputation rehab' (Jerolmack 2008), however. As one controller in Scotland pointed out, "red squirrels are just tree-rats with good PR" (Jenny, squirrel control officer).

Throughout the 20th century, as different ways of valuing wildlife have emerged and interest in wildlife conservation grown, the concept of 'vermin' has consistently been challenged and the list of species to which the classification applies (legally, at least) has reduced (Smout 2003). Arguably, however, the categorisation of species as 'invasive' is replacing 'vermin' as a label that designates certain animals as 'out of place' (Milton 2000; Crowley 2014), troublesome and, ultimately, killable. Numerous participants advocated killing grey squirrels nationwide on the basis that they were 'invasives', even when/where this was unlikely to have any substantive benefit for either red squirrels or trees: "I don't see any excuse for treating an animal cruelly, but I don't see any other reason not to control grey squirrels" (Jenny, squirrel control officer) and *"*the more [control] the better, it's just getting people to do it really, isn't it?*"* (Matthew, squirrel control officer). The 'ethical taxonomy' of invasive species (van Dooren 2011), then, does similar work to 'vermin', with material effects: for example, grey squirrels can be killed year-round and without limit in Britain, whereas red squirrels cannot be legally killed without a specific licence.

Categorical killing is associated with (largely discursive) political endeavours to influence cultural and politico-legal valuations of squirrels, and encourage more extensive and/or more intensive control, rather than a specific management strategy. Several participants referred to an ongoing "psychological war" (Frank, volunteer) against what is believed to be (a) loss of societal attachment to/concern for the red squirrel and (b) an insidious 'invasion' of grey squirrels into the UK's cultural discourse and its citizens' affections. The 'defence' against these perceived socio-cultural changes is being mounted on three fronts. First, there is the promotion of the red squirrel, including work to "establish a network of red squirrel enclaves in Grey Squirrel Britain" (Vass 2016 [UK Squirrel

Accord]). Making red squirrels physically present and visible is intended to instil and/or reinvigorate attachments amongst British publics who no longer encounter them, and help "alleviat[e] some of the anxiety that a strong grey squirrel control will bring" (Vass 2016). These developments are not just for red squirrel conservation, but also to improve the 'public face' and acceptability of grey squirrel control, and to promote engagement: "if we're going to change public opinion on the greys we need a flagship to pin it on and the reds is the obvious one" (Arthur, woodland owner).

A second component of this 'psychological war' is resistance to socio-cultural (including legal) assimilation of grey squirrels. The 2014 removal of a clause in the Grey Squirrels (Prohibition of Importation and Keeping) Order 1937 means it is no longer a legal requirement to report grey squirrel sightings. The Red Squirrel Survival Trust, however, "didn't feel comfortable supporting this move because it's one step closer to accepting an invasive non-native species and giving it the right to live here" (spokesperson quoted in Cohen 2014).[10] Some of our participants also criticised organisations that depict grey squirrels in promotional materials, and 'the media' was accused of "paint[ing squirrels] as harmless, fluffy little fun things" (Arthur), or "good, cuddly, something to be encouraged" (Richard, woodland owner). Their implication is that these depictions are inappropriate, misleading, and even subversive, rather than reflections of broader shifts in public attitudes. The third strategy, then, is to ensure that if grey squirrels are to be culturally salient, this is as "public enemy number one…There are people who think that grey squirrels are sweet…if they were referred to as tree-rats, which they are, that might elicit a different response" (Arthur). The message is that grey squirrels are not appropriate subjects of care or concern (indeed, some implied that encounters with them shouldn't be encouraged or enjoyed), that their appropriate classification is as vermin or invasives, and that they should be treated (killed) accordingly.

[10] Popular naturalist and television presenter Chris Packham was 'named and shamed' by several participants for having intimated that grey squirrels were here to stay. Packham has said that he is not opposed to all grey squirrel control, but that "killing greys where they do not threaten crops or infect reds is a complete waste of money, time and energy" (quoted in Flanagan 2014).

Tensions and alliances

The divergent management rationales and strategies produced by the co-existence of these multiple modes can produce tensions between projects and practitioners. The importance that reparative/sacrificial killing places on regretful, necessary sacrifice, and the attendant configuration of grey squirrels as blameless 'collateral damage', sits uneasily alongside comprehensive, categorical killability, and associated disregard for – and even vilification of – grey squirrels: "there are people who want to malign grey squirrels and just get rid of them as vermin…[but] I would like them always to be treated with respect" (Emma, conservation project officer). Similarly, the potential introduction of GoodNature™ traps, and the associated ability to automate killing, troubled those who placed a lot of significance on the personal moral responsibilities of killing. Some were concerned that squirrel control might subsequently become *laissez-faire*: "if you can't be bothered to come out and check a trap every day…you shouldn't be trapping. You should care enough to want to do that*"* (Jenny, wildlife management professional).

There are also, however, areas of convergence between modes. Recreational squirrel hunting is a traditional, if declining, pursuit in parts of North America (Beardon *et al.* 2002). In Britain, although red squirrels were historically hunted for their pelts and 'squirrel clubs' targeting first red, then grey squirrels, enjoyed some popularity in the 1900s and 1940s respectively (Sheail 1999; Holmes 2015), there is no strong tradition of recreational squirrel hunting (compared with, for example, fox and deer hunting, or game-bird shooting). Recreational hunting therefore currently comprises a small proportion of squirrel control, and we did not directly investigate the motivations and practices of people who kill squirrels recreationally. Nevertheless, we would postulate that the aims and methods of recreational hunting likely constitute a fourth mode of killing that diverges again from those described here (Dickson 2009; Marvin 2010), and there are suggestions that 'recreational killing' could increasingly contribute to squirrel management. The British Association for Shooting and Conservation (BASC) is helping to develop a new strategy in which woodland owners allow recreational

air-gunners to shoot grey squirrels at baited hoppers on their land.[11] Recreational shooters were therefore considered "a resource" (Richard) by some woodland owners and managers, as they provide a cost-effective supplementary control measure.

Several conservation projects are also working with the BASC and/or volunteer squirrel-shooting clubs to "harness" (Harriet, conservation project officer) existing enthusiasms, and incorporate recreational shooting into conservation control measures. However, some participants expressed reservations about the contribution of recreational hunting to conservation projects, and particularly local eradications, which emphasise "getting those last few…but that [recreational] volunteer might want to go somewhere different where there's lots of grey squirrels to shoot" (Jessica, conservation project officer). Furthermore, several expressed reservations about the morality of recreational killing, and its practitioners: "it's the ones who enjoy killing that you've got to watch…I think the shootists are the ones that come closest" (Paul, volunteer).

Concluding Discussion

We have identified three prominent modes of killing squirrels (reparative/sacrificial, stewardship, and categorical), and have suggested that a fourth mode (recreational) may increase in prevalence. There are important differences as to how squirrels are killed and made killable within each mode. In reparative/sacrificial mode, grey squirrels – as 'innocent individuals' – are not in principle considered killable, but are nevertheless regularly, if remorsefully, killed. In stewardship mode, squirrels are generally killable as 'culpable pests', but are nevertheless not always killed; decisions about their control are often pragmatic and contextual. In categorical mode, 'vermin/invasive' squirrels are killable always and everywhere. These multiple modes have effects, and in this final discussion we propose (continuing to draw on squirrel control as an exemplary case) that their different drivers and aims need to be well understood, and well

[11] Accessibility is an important issue for hunting in Britain, and gaining permission to shoot in private or public woodland is not always straightforward. Shooting on publicly-accessible land raises health and safety issues, whereas hunting on private land without permission constitutes trespass. Furthermore, once killed wildlife becomes the property of the landowner, not the shooter.

articulated, in the development and implementation of wildlife management (or 'co-existence') projects, strategies and policies.

Reparative/sacrificial killing is in line with a concern for biodiversity conservation and 'love' of wildlife that is currently widespread amongst UK publics. Red squirrel conservation, including that which involves extensive lethal control of grey squirrels, attracts public funding and support. Indeed, in 2017, 'Red Squirrels United' (an umbrella project supporting initiatives in England/Wales/Northern Ireland) and 'Saving Scotland's Red Squirrels' both received funding boosts to continue their work by enrolling 'armies' of volunteers (BBC 2017a, 2017b). As we have seen, passionate and committed volunteers can overcome reservations about killing to make important contributions to these projects, yet it is also apparent that many find reparative/sacrificial killing challenging and emotionally draining. Even though there is relatively high support for lethal control of grey squirrels where it benefits red squirrels (Dunn and Marzano 2015), many people nevertheless feel unable or unwilling to participate. There are also, of course, many people who are disinterested in, ambivalent about, or opposed to squirrel control, who would also be unlikely to volunteer.[12] Consequently, the uptake and retention of volunteers required to carry out lethal control – and the long-term success of volunteer-reliant strategies – may be limited. An associated public preference for strategies that involve less direct lethal control promotes support for alternatives such as pine marten recovery and the development of immunocontraceptives. These alternatives might, however, be more cost-intensive, and/or have less well-understood impacts at population level.

Volunteer involvement is also a key component of the UK Squirrel Accord's (http://squirrelaccord.uk/) drive to establish coordinated, 'landscape-scale' control efforts. The Squirrel Accord, established in 2014, is a formal manifestation of contemporary efforts to unite the two primary drivers of grey squirrel control

[12] As this research was oriented towards understanding the motivations and aims of management practitioners, we have not explored the voices of those people who are not involved with, or are opposed to, killing squirrels. We are reticent, therefore, to make specific claims as to their feelings and beliefs, or the prevalence of opposition. However, our wider reading and observations during this research indicate that in addition to emotional discomfort and ethical reservations about killing, some (including Chris Packham, see note 10) do not support continued grey squirrel control because they believe it to be a futile exercise, or a lost cause.

(forestry and red squirrel conservation). One aim of the Accord, whose signatories include government bodies, conservation organisations, forestry organisations and pest controllers, is to facilitate more coordinated control through 'public education', mapping vulnerable areas of woodland, and the formation of squirrel management groups. Outside red squirrel areas, however, grey squirrel control primarily benefits private woodland owners, and is therefore challenged by the need to incentivize landowners who would be required to invest time, money, and potentially physical and emotional labour, into activities that do not benefit them. This highlights an important difference between the primary aims of stewardship killing (the benefits of which are unevenly distributed) and reparative/sacrificial killing (for the 'public good' of biodiversity conservation). There is also the potential for discord to arise between people who practice and promote squirrel control for woodland stewardship, and others who disagree that private interests are a legitimate rationale for killing wildlife. Stewardship killing is also, however, often practised by professional wildlife managers who are comfortable and confident with their work, who are not permanently troubled by killing, but who nevertheless commonly maintain an interest in killing 'well' (humanely, effectively and efficiently). Professional wildlife managers can therefore play an important role in both woodland management and red squirrel conservation projects; indeed, as in Scotland, the presence of professional control officers can enable volunteers to engage confidently with management projects without being required to kill.

For categorical killing to effectively underpin management strategies, there needs to be widespread societal agreement that a species or population 'belongs' in a given category. 'Vermin', in wider society, has lost footing, although some species (e.g. rats, cockroaches) are still commonly represented and treated in this way. More recently, the 'invasive' category has become more influential, particularly amongst settler-descendent communities in post-colonial nations, where introduced species are key contributors to the decline of distinctive native biotas (Comaroff and Comaroff 2001; Trigger *et al.* 2008; Barker 2010). Categorical killing can, however, come into conflict with other 'modes of ordering' (Law 1994) – including both those discussed here and others that render killing largely illegitimate – in which decisions about killing are made in relation to context, rather than category. In the UK, for instance, killing grey squirrels in urban areas

where they pose no immediate threat to either property or red squirrels is likely to be contested. Furthermore, categorical killing has been associated with the objectification and de-individualisation of those killed, which can result in uncompassionate and even cruel practices. For example, Trigger *et al.* (2008) note that violent methods permitted for killing invasive cane toads in Australia would "never be tolerated in relation to native or domestic animal species" (p1278: see also Parker 2007; Potts 2009; van Dooren 2011). However, categorical approaches to management are more readily translated into policy and law than the complex, context-dependent rationales of other modes, and lend themselves to simple 'educational' messages and powerful rhetorical strategies. Indeed, the current legal status of grey squirrels in the UK renders them categorically killable.[13]

We have demonstrated that there are divergences and points of tension between different moralities, strategies and communities of practice. However, the coexistence of multiple modes of killing can also be productive (Law 1994). The divergent ethical and practical priorities of different modes, and their simultaneous need to co-exist, mean that each community of practice challenges the others, and places checks and qualifiers on their activities. This can produce a rather eclectic assortment of management strategies – such as those that currently exist in relation to grey squirrels – but also means that new developments are often thoroughly debated. The competing philosophies of different modes also require governments and wider publics to continuously attend to, recognise, and articulate their values and aims, and negotiate with those of others. Though sometimes causing controversy, the existence of multiple modes can prevent debates about killing animals from becoming reduced to a binary question of 'is this species killable or not?', a problem which has caused other debates about management to polarise and escalate (e.g. the persistent British conflict surrounding lethal control of badgers: see Cassidy

[13] Grey squirrels are listed in Part I of Schedule 9 of the Wildlife and Countryside Act (1981), which makes it an offence to release them into the wild once caught, and the Grey Squirrels (Prohibition of Importation and Keeping) Order 1937, issued under the Destructive Imported Animals Act 1932, is still in force, meaning it is also illegal to keep grey squirrels in captivity. Captured grey squirrels must, therefore, be killed (unless a licence has been obtained for their captivity or release).

2012). We therefore propose that seeking out, articulating, and explicitly analysing the multiple ways in which wild life is killed and 'made killable' – as well as protected or made 'un-killable' – should form a fundamental component of wildlife management planning.

Chapter 8

DISCUSSION

Chapter 8: Discussion

I begin this final chapter by reviewing my findings in relation to the research objectives outlined in Chapter 1. I then draw together the key theoretical and applied contributions of this research through a discussion of three central themes: human attachments to (and detachments from) wildlife; the political implications of multiplicity in human responses to introduced populations; and propositions for developing complementary and/or alternative management approaches. I conclude with a consideration of the strengths and limitations of the methodology and application of this cross-disciplinary project, and highlight promising avenues for future academic enquiry.

Summary of findings

I aimed to investigate (i) why and how introduced species management (ISM) is initiated; (ii) whether, why and how it is contested; and (iii) what relations and outcomes are produced 'in practice'. Here, I collate and compare the findings of the different chapters and case studies by revisiting each of my research objectives in turn.

Why and how was management initiated?

My case studies identify three different combinations of management drivers and mechanisms. The monk parakeet eradication project was pro-actively initiated as a 'rapid' response to this species' spatially restricted establishment in south-east England. The decision to eradicate was motivated by (a) the conclusions of an expert risk assessment process (b) the UK's management commitments under the Convention on Biological Diversity and its own national strategy, and specifically (c) in the presence of uncertainty and absence of firm scientific evidence, application of the precautionary principle. The project was delivered 'top-down' using the recently developed GB non-native species mechanism; management decisions, planning, and trials took place among central government bodies and agencies with no meaningful public or community consultation.

Beaver management was also initiated in response to the species' apparent establishment in a spatially restricted area, and with the expectation that removing this small population would be both feasible and in line with a precautionary approach to a risky (re)introduction. Like the monk parakeet case, and irrespective of the beaver's status as a 'former resident', the Devon beavers' removal was motivated by an internal government assessment of the introduction as posing an unacceptable (a) public health risk and (b) institutional risk to the UK Government (whose concerns about setting precedent for unauthorised releases at least matched their concerns about zoonotic disease). Here again, management was proposed by central government and its agencies, but unlike the previous case, this response was more reactive than planned, and decisions were made under pressure from heightened public, media and lobbyist scrutiny. Furthermore, the Government's position on formerly resident species was much less clear than its stance and obligations in relation to non-native species, and there was no statutory mechanism or guidance for responding to unauthorised re-introductions. To make their case for the beavers' removal, therefore, the Government was compelled to combine the rationale of its non-native species mechanism (uncertain impacts, risk, and therefore precaution) with powers of access provided by existing zoonosis monitoring regulations.

Finally, although central government has in the past sponsored grey squirrel management, and remains nominally supportive, most management of this now-widespread introduced species is currently initiated and delivered by a diversity of civic organisations, private individuals, and volunteer groups. Motivations, strategies and goals vary depending on region and context (e.g. extent of vulnerable plantations, presence of red squirrels, funding), and management is carried out both in response to, and in anticipation of, grey squirrel presence and impacts. Management projects are often co-ordinated by either wildlife conservation organisations (e.g. The Wildlife Trusts) and/or volunteers. However, grey squirrel control also proceeds outside of these projects, undertaken by and on behalf of private individuals (e.g. homeowners, woodland owners). Although often practised as a means of mitigating observed or assumed impacts, grey squirrel management can also be motivated by broader principles (e.g. those informing 'ecological restoration') or categorical obligations (e.g. classification as vermin).

ISM in the UK is therefore motivated by (a) the scientific and normative principles of biodiversity conservation and invasion science, as interpreted by international instruments and regulations and government policies; (b) institutional or private assessments of the various socio-economic, environmental and institutional risks posed by a given species' introduction; (c) identification of, and public/private concerns about, the observed, material effects of introduced populations on their new environments; and/or (d) the species' classification (either prior to or following risk assessment) in an 'undesirable' category (i.e. non-native / invasive / pest / vermin).[1] Management might therefore be proactive (anticipating presence and/or impacts), reactive (responding to presence and/or impacts), or, as in grey squirrel management, a combination of both.

Why, how and when is introduced species management contested?

This question was the focus of my synthetic analysis (Chapter 2), through which I identified both a series of issues that recurred across multiple debates (e.g. divergent assessments of the impacts and values of introduced wildlife), and patterns in how certain approaches to management – particularly inattention to contextual factors, top-down implementation by 'outsider' groups or authorities, and unidirectional communications – had created or exacerbated destructive conflicts.

I found further evidence of these patterns of conflict substance and process in the first two case studies, in which attempts by central government to remove specific introduced populations from given localities were disrupted by alternate interpretations of what is considered risky; what it means for wildlife to 'belong'; and who has the right to intervene. These initiatives were contested, as in my review, because of differing assessments of the risks posed by parakeets and beavers, and conflicting evaluations of these species' socio-ecological place and role in the UK. Different ways of valuing wildlife are not always directly

[1] For (a) and (d), a species' identification as non-native or native is paramount, because this ostensibly dictates the response to their arrival; for (b) and (c), the significance of distinguishing between non-native and native species is diminished, as focus shifts towards the risks and impacts of new arrivals, regardless of origin. The motivations for management in (c) and (d) also converge with pest or vermin control activities which may apply to both introduced and extant species.

comparable, however, nor evenly recognised in decision-making. In the monk parakeet case, especially, the Government failed to recognise or respond to the positive associations that some human residents had formed with parakeets. The deteriorating relationship between campaigners and government agencies was therefore compounded by the absence of any mechanism for managers to meaningfully consider and address these residents' interests and concerns. In the beaver case, there were evident tensions between conservation and environmental organisations' focus on the potential ecological benefits of beaver 'engineering' (e.g. dam building, tree-felling), and agricultural landowners' concerns about how the same activities might affect their livelihoods. Farmers and landowners were given additional opportunities to contribute to consultation exercises, but nevertheless felt their interests would be outweighed by public enthusiasm for beaver reintroduction.

Management initiatives were contested by a variety of means. First, there was 'vocal opposition', where parties developed and promoted alternate narratives about the place and role of the introduced wildlife in question, and critiqued or dismissed their opponents' claims. These largely discursive contests took place in the news and social media, at public and 'stakeholder' fora, and in responses to consultations. 'Vocal opposition' also included some more demonstrative activities, such as protests and publicly threatening or performing physical sabotage of management activities. Vocal opponents of Government-initiated management in both the parakeet and beaver cases additionally worked to increase their political influence by recruiting more powerful individuals (e.g. journalists and experienced activists) and organisations, and by building wider public interest and support for their campaigns.

I also identified, however, that 'quiet resistance' can be an equally powerful means of contesting management. Although vocal campaigners in south-east England convinced their local authorities to ban the shooting of parakeets on public land, this was not the only thing that disrupted the Government's eradication project. Indeed, arguably the greatest and most enduring challenge faced by management agencies was the refusal of individual householders to allow birds to be trapped or shot on private land, which essentially created refuges for the parakeets. Refusal to engage with, or concede to, management

initiatives also frustrates grey squirrel control, which often relies on the support and, preferably, coordinated efforts of multiple landowners.

'Quiet' resistance also describes the role of nonhumans in disrupting and derailing management goals: monk parakeets were both trap-shy and awkward in their nesting locations; both they and beavers charmed their human neighbours into becoming allies and protectors; and grey squirrels proliferate, recolonise, and spread at rates that make effective population control extremely cost- and time-intensive. These forms of resistance may not carry the same political intent as human opposition, but they are nevertheless powerful, and serve as a reminder that – irrespective of clear intentions and careful planning, and even in the absence of social conflict – wildlife management rarely flows neatly from principle to practice.

What happens in practice?

Although all management scenarios have contexts from which they cannot be entirely separated, two of the cases I have examined in this thesis formed relatively distinct disputes, or at least 'episodes' in longer-term social contests. These cases also, therefore, have had identifiable outcomes, though not definitive conclusions. The monk parakeet dispute, at the time I was conducting my research, persisted in an uneasy stalemate. This is likely to be temporary, however, as the Government's response to its predicament has been to assert its institutional power and authority by changing the law in its favour; the introduction of the Infrastructure Act (2015) means that Government agencies can now access private land to remove parakeets under 'Species Control Orders'. These orders can also now be applied to other 'not ordinarily resident' species, including beavers (though the Scottish government's recent decision to recognise beavers as resident in Scotland means that attempts at enforcing control orders for their removal may be subject to legal challenge). Regardless, control orders were not an option at the time of the Devon dispute, where a Government working under pressure, and on unstable legal and constitutional ground, resorted to 'regulating' an unruly situation by assenting to the establishment of the River Otter Beaver Trial. Arguably, then – and despite the opportunities presented by the ROBT as a 'wild experiment' – this case indicates the limits of central Government control over wildlife and its (re)introduction.

The limits of centralised governance of wildlife are equally apparent in relation to grey squirrel management where, despite concerted earlier efforts, the proliferation and spread of grey squirrels has foiled attempts at both their eradication and, to varying degrees, the mitigation of their effects on broadleaved trees and red squirrels. The Government has retreated from national strategies and investments, but private management efforts (including optimistic proposals for regional and even national eradication) continue. Now, grey squirrel management is largely comprised of diverse 'bottom-up' practices and initiatives. Unlike the previous two cases, the formalised, conservation-oriented projects I encountered while researching Chapter 7 appear largely supported, or at least not vocally opposed, by the (human) residents of the target areas. This is particularly apparent where red squirrel protection is the primary aim. Elsewhere, however, private management initiatives seeking to protect trees and forestry interests are challenged by limited efficacy and inefficiency, compounded by public disinterest and/or 'quiet resistance'. Although there are not clear outcomes from my final case study, there is movement; the currently diverse and diffuse landscape of grey squirrel management is drawing together, towards greater unification. This is identifiable in emerging collaborations (a) among red squirrel projects, to share knowledge and experience and access larger 'pots' of funding (e.g. Red Squirrels United); (b) between private environmental managers (e.g. foresters, woodland owners), to enable more coordinated management efforts and, in theory, more effective damage mitigation; and (c) between conservation and tree protection initiatives, to strengthen national interest and investment in grey squirrel management (i.e. the UK Squirrel Accord).

What will transpire from this move to unification is unclear. On the one hand, the growth and coordination of 'bottom-up' management could make it more effective and sustainable, and less conflict-prone, than Government-led initiatives. On the other hand, however, my research also identified important differences in the motivations and goals of those supporting and practising grey squirrel management, which could produce challenging internal frictions, particularly in relation to the legitimacy of different management methods, and determining how grey squirrel control might be presented to wider publics.

Key contributions

The above overview demonstrates the diversity and complexity of management initiatives in the UK, and provides support for my wider supposition that case study research can play an important role in both tracing patterns and distinguishing the important details of phenomena. However, my empirical investigations and inductive analyses of the case studies within this thesis also led me to more specific insights, contributions to social scientific theory, and management recommendations. In this section, I discuss the key contributions of my research, focusing on three thematic lines of enquiry that weave throughout the chapters and cases presented in this thesis.

Wild attachments

In Chapter 4 I highlighted the significance of attachments to introduced parakeets as a key driver of protectionism. The 'wild' attachments I identify are relational, developing through interactions between human and wild nonhuman populations through an interplay of (a) nonhuman charisma (b) interpersonal relationships between humans and nonhumans, and (c) developing associations between wildlife populations and cultural, community and individual identities. Due to the vital and responsive charisma of many wild organisms, wild attachments can also develop through encounters, associations and bonds comparable to those formed between humans and individual 'companion' animals. Although these attachments were most evident in relation to monk parakeet populations (both in the UK and USA) they were also identifiable in the subsequent case studies. Several participants of the Devon study expressed feelings of affection and personal connection to 'their' newly arrived beaver population, often associated with time spent searching for and/or observing them on the river. Others, despite having never seen them, nevertheless felt that the beavers belonged in the socio-ecological communities of the Otter catchment, and considered them an important, distinctive addition to the area. In this case too, therefore, despite the recency of the beavers' residency, there were indications of nascent attachments developing between humans and wild nonhuman populations, which motivated protectionism.

I am not suggesting that positive attachments to introduced populations are either inevitable or permanent: indeed, other species introduced to the UK (e.g. American mink) do not appear to inspire particular affection or concern. Attachments might also not be wholly positive: Trigger *et al.* (2008) and Buhs (2002) both describe love-hate attachments human societies have developed towards notorious introduced species (cane toads *Rhinella marina* in Queensland, Australia and fire ants *Solenopsis invicta* in Texas, USA respectively). Species' charisma, visibility, and the outcomes of new arrivals' interactions with extant species and ecologies therefore play important roles, as do the composition and resilience of recipient communities. In Chapter 7, I demonstrated that existing personal, community and cultural attachments to *red* squirrels can serve as an important motivation for their protection against ecological supplantation by *grey* squirrels. I argued that the strength of this concern, and perceived human responsibility for the fate of red squirrels, are powerful enough to enable some conservation volunteers (who would otherwise not consider killing wild animals) to 'dispatch' grey squirrels. Ginn (2014) finds that some practices are not organised around 'being together' with nonhumans, encountering them, or even accepting their presence, but rather, excluding them, creating distance, and seeking their absence. In a similar vein, I propose that attachments to some forms of wild life can create, enable, and perhaps sometimes even necessitate, detachments from others.

In Chapter 7 I also highlighted attachments to red squirrels as key to securing continued funding, volunteer time and effort, and political support for grey squirrel management. Indeed, by establishing their proposed network of captive red squirrel populations across 'grey Britain', the UK Squirrel Accord is effectively using attachments strategically; the implicit expectation is that red squirrel presence will promote the development of concern and attachments among currently disinterested publics, which in turn will enhance investment in grey squirrel management. Wild attachments, then, are worth investigating not only as an interesting form of relation between humans and wildlife, but also because they can translate into political power.

A final thought on wild attachments is the possibility and value of their recognition and inclusion in some of the more open approaches to management I will discuss

below. Particularly, I am interested in whether and how these modes of relation between humans and wild nonhumans might enable multispecies constituencies to meaningfully participate in deliberations about environmental management. I mean this not in the sense that – for example – parakeet protectors might speak for, or on behalf of, nonhuman others (which may not always be possible or desirable: Hinchliffe *et al.* 2005; Hobson 2007; Johnston 2008), but, rather, that they might speak as part of a broader configuration of their community which, at least for now, includes parakeets. Attachments can transform into powerful, reactive protectionism when their subjects are threatened with removal. However, there are rarely explicit opportunities for non-instrumental relations between humans and wild nonhumans (including, but not limited to, introduced populations) to be considered in wildlife management planning. I am not suggesting that attachment-centred representations should take precedent over others. Rather, as Bingham (2006) also identifies, the subsequent challenge is to "find a space and/or a set of procedures in and through which…different accounts and accounts of difference might be worked through" (p495).

Multiplicities in accord

The analyses undertaken in Chapters 6 and 7 reveal 'multiplicities' (Mol 2002) in both the protection and killing of introduced populations. 'Multiplicity' describes the material-discursive generation of 'more than one and less than many' (Mol 2002, p55) things, practices, and even realities (see also Law 2004a; Hinchliffe 2007; Lorimer 2012). The identification of multiplicities is associated with relational analyses because, if the world is continually generating, assembling, and reassembling, different 'versions' of objects and practices will emerge. Multiplicity differs, however, from relativism or pluralism, as there remain "complex and intricate relations between the various versions" (Law and Mol 2008, p65).

In Chapter 6, following Lavau's (2011) exploration of the 'citizenship' and belonging of fish in Australia, I identify multiple ways in which beavers can be conceived as belonging in the UK: as companionable neighbours, (characteristic) community-members, native Britons, and European citizens with rights. In Chapter 7, I outline multiple 'modes of killing' squirrels: reparative/sacrificial; stewardship; and categorical. These analyses articulate important differences in

human-wildlife relationships and interactions, without requiring a reversion to relativism, and are therefore illuminating in themselves. However, my aim is not only to identify and describe these multiplicities, but also to consider their material and political implications.

In both the beaver and grey squirrel cases, I discuss the collective power of 'multiplicities in accord'. Put more simply, even though there are multiple ways in which beavers might 'belong', and multiple ways to kill a squirrel, if the most (or most powerful) foster similar ends – protecting and killing respectively – their political weight is increased. Consequently, although people might not all agree on why they want beavers to continue residing in Britain, and though they might not agree on the terms of that residency, if the question is simply 'residency or not?', the outcome is predictably weighted one way. Conversely, even though people may disagree about the legitimacy of killing grey squirrels in given circumstances, and about whether grey squirrels are ultimately 'killable', if the most and/or dominant 'modes of relating' to squirrels include or allow killing, then killing is likely to continue. My findings therefore indicate the value of not only thinking about how multiplicities emerge, but also how they relate to, "overlap and interfere with one another" (Law 2004a, p61), and the political effects those relationships have.

Management recommendations: towards cosmopolitics in practice

'Cosmopolitical' theory, and particularly the work of Isabelle Stengers (2005), has been supported and further developed by scholars from science studies (e.g. Latour 2004; Haraway 2008) and geography (e.g. Hinchliffe *et al.* 2005; Bingham 2006; McKiernan and Instone 2015). Cosmopolitics is theorised and proposed as an alternative – albeit a challenging one – to representational politics. That is, rather than determining in advance 'who counts' as a political subject, making sure someone represents them, and then summing up the votes, cosmopolitical theory proposes that political collectives might be assembled from within the 'midst of things' (Bingham 2006, p496), and could comprise all sorts of participants, including those that are "neither universally cultured nor linguistic" (Lorimer 2010b, p319). Moreover, the role of these political collectives is not to make final, executive decisions, but the "progressive composition of a common world" (Latour 2004, p47).

Several of the management-relevant suggestions I make in this thesis have cosmopolitical leanings, though they are perhaps not as radical as the ideal outlined above. Rather, over and above the specific reconfigurations and re-tuning of wildlife management activities that I propose (most explicitly in Chapters 2 and 5), I am advocating for management practices that enable (a) differences (between people, species, populations, and contexts) to be more effectively recognised and articulated, and subsequently (b) management responses to be determined in inclusive and productive ways.

At the earliest stages of management planning, when a potential new arrival or problem has been identified, I call for explicit consideration of 'social impacts' through social impact assessment (SIA: Chapter 5). On the surface, a process that seemingly demarcates the 'social' from the 'environmental', and the political from the scientific, might seem inconsistent with the philosophy of cosmopolitics. However, a closer examination of contemporary SIA reveals that it can do more than act as a social counterpart to environmental impact assessment. SIA provides opportunities to open discussions to wider collectives and different interests, and to explicitly consider the implications of multiple management alternatives, including non-intervention, with and for the various collectives (human and nonhuman) who will be affected by them. SIA also provides a means of bringing the more abstract management principles and procedures proposed by formal policy and guidance into contact with the specific contexts, places and communities in which projects and initiatives would be delivered.

Not everything can be this carefully planned, however, and in Chapter 6 I discuss wild experiments as another possible step towards cosmopolitical practice. More evidently emerging from the 'midst of things', these experiments open up a looser, more situated approach to environmental management, in which events and surprises are responded to in an adaptive and experimental way, without requiring all things to be known, predicted and/or finalised in advance (Lorimer and Driessen 2014). The chapter's concluding argument, that the River Otter Beaver Trial could be approached as trial of public experiments in/with 'the wild', resonates with Paulson's (2001) cosmopolitical proposition that "new types of encounter (and conviviality) with nonhumans…can give rise to new modes of relation with humans, i.e. to new political practices" (p112).

Finally, I support the continuing application of cosmopolitical ideas to long-term management, as a means of 'staying with the trouble' (Haraway 2010) of managing introduced species. More specifically, recognising and understanding multiple forms of relation between humans and wildlife – including killing – and carefully disentangling and evaluating their motivations, aims, outcomes, and legitimacy is a challenging prospect. Nevertheless, doing so may avoid reductionism to the binaries of 'belonging or not' and 'killable or not', which fail to capture the complexities of human-wildlife relationships in practice. Particularly, I have shown how designations of new wildlife populations as 'belonging' or 'killable' are not always determined in advance, and then acted upon. Rather, for some, parakeets and beavers might come to belong through their being encountered, and grey squirrels might become killable only through the act of killing. Categorical designations can also foreclose on meaningful consideration of socio-ecological novelty and change, restricting the scope and potentiality of wildlife conservation. My third contribution, then, has been to identify ways in which ISM - which is always and already political - would benefit from expressly incorporating (cosmo)political deliberations and negotiations into its design and implementation. More specifically, I have suggested how (a) relations among people involved in, or affected by, management might be improved (for example, by limiting the incidence of destructive conflicts, and increasing the social legitimacy of management projects) and (b) how policy and decision-making processes might be made more open to (though still interrogative of) the multiple ways that people respond and relate to introduced wildlife.

Directions and limitations

Challenges to implementation

There are, however, some important limitations to the application of this work. Throughout (and perhaps due to the prominent role of the UK Government in two of my three case studies) I have been considering decision-making about introduced species as an issue of public interest and responsibility, and response mechanisms as an issue for civil authorities. However, this conceals the reality that, in the UK at least, most wildlife management is initiated and directed by private interests and non-governmental organisations, which operate within different frameworks. Grey squirrel management, for example, is often carried

out by private individuals who might kill squirrels for any number of reasons, from wider principles about the place of non-native species to personal frustration with an individual 'nuisance' animal. Much of the UK landscape is officially under private ownership, although the picture is a complex one, where public/private distinctions are blurred by variable ownership access and legislative arrangements. Consequently wildlife management, including ISM, often proceeds unrecorded, and/or without a coordinated strategy or aims. Indeed, even at national level, initiatives are often prioritised by political and/or economic pressures and feasibility as much as through deliberative processes, inclusive or otherwise. Consequently, although it is possible to make a strong argument for the application of tools such as social impact assessment when ISM is ostensibly being delivered in the public interest, there is comparatively little incentive for conservation organisations, volunteer groups or private individuals to increase the democratic credentials of their projects, particularly where there is a real chance that such a move could delay their plans, and potentially even render them unfeasible.

A second challenge is that, despite their regular contestation, dominant paradigms and approaches in ISM are becoming increasingly entrenched and institutionalised. Consequently, efforts to open-up deliberations about what constitute desirable and undesirable environmental changes may face an uphill struggle. The dismissal of those who challenge the purported orthodoxy of invasion science as 'denialists' (Russell and Blackburn 2016; Ricciardi *et al.* 2017), and the intimation that researchers and commentators exploring non-equilibrium ecology, novel ecosystems, and/or 'native invasions' primarily serve themselves (Simberloff 2013b) or vested interests (Russell and Blackburn 2016) are good examples of this (see also Crowley *et al.* 2017c; Appendix 1). There is, furthermore, a consistent failure, within and beyond invasion science, to take seriously, let alone address, the troubling language and framing of practices employed by invasive species management. Although racist and xenophobic attitudes towards humans and ecological nativism are not one and the same, at best their shared terminology affects the abilities of diverse societies to have meaningful and inclusive discussions about environmental problems (Keulartz

and van der Weele 2008).[2] At worst, the language of invasive species can be (and has been) appropriated to justify racist and xenophobic discourses and behaviour (Coates 2005; O'Brien 2006).

Growing divisions and partisanship, both within and beyond academic circles, could also limit opportunities to build trust, and make propositions for 'wild experiments' untenable. The strong tradition of rationalisation in British environmental management persists: as demonstrated in the monk parakeet case, it is difficult for people to raise non-economic or non-instrumental concerns about wildlife without being accused of sentimentality or labelled as (possibly dangerous) 'animal rights people' (see Chapter 2, Panel 1). It can be equally difficult, however, to have constructive discussions about the realities and moralities of killing wildlife, as there are strong institutional aversions (both among civil society organisations concerned about membership, and public authorities reliant on political support) to explicitly and openly considering the ethics, motivations, and methods of lethal management methods. This aversion to discussing killing means that in some cases it is entirely discounted as an 'unpalatable' management option, and in others it is able to continue unqualified and unchallenged. All these issues are compounded by their over-simplification, the reporting of conflict where little (yet) exists, and the use of hyperbole and inflammatory language in news and social media. Over and above highlighting weaknesses and proposing alternatives, then, reconfiguring ISM might also require more significant shifts in academic and institutional approaches to the issue. Such shifts are conceivable, however, as it becomes increasingly difficult to separate human-mediated introductions from so-called 'natural colonisations' in response to anthropogenic climate change (Gilroy *et al.* 2016); as 'novel' ecologies proliferate (Hobbs *et al.* 2014); and as sceptics, dissenters, and interested publics continue to trouble orthodox approaches.

[2] A noteworthy tone-deaf example is the terminology applied to the physical removal of introduced plants common rhododendron (*Rhododendron ponticum*) and, more recently, Himalayan balsam (*Impatiens glandulifera*): 'rhodo-bashing' and 'balsam-bashing" uncomfortably mirror the racist discourses and violence of so-called 'Paki-bashing' in Britain (which initially emerged in the 1990s but remains relevant today) (Agyeman and Spooner 1997; Wong 2005; Pollard 2016).

Methodological limitations

The work in this thesis further indicates the potential of applying social scientific research methodologies to environmental challenges. First, by taking symbolic and material interactions between humans and nonhumans seriously, I have been able to identify where and how different modes of human-wildlife relation produce a variety of individual, community, institutional and societal responses to species introductions. Second, through detailed examination of how both management initiatives, and social conflicts arising from them, develop in practice, I have been able to draw out (a) important differences in how different people interpret and evaluate scientific and other evidence about a new species' 'place' in the UK; (b) patterns in management planning and delivery, and the development of disputes and conflicts; (c) how those in opposition gain power, disrupt and derail management; and (d) how people practicing lethal control of introduced species understand and (in some cases) reconcile themselves with their controversial work.

However, as with all case study research, generalisations must be made with care. It is therefore important to clarify that I am not suggesting that the specific findings of this research are generalisable in the statistical sense. I am not, for example, claiming that because I identified attachments between parakeets and people in London, attachment is an inevitable outcome of parakeet presence. Indeed, a key point that I have made throughout this thesis is that there are always variations, histories and geographies to be taken into account. Still, the findings I discuss here and throughout have analytic generalisability, or 'transferability'. I have, therefore, concluded that 'wild attachments', in various forms, can be an important influence on people's responses to both introduced wildlife populations and their prospective management. Similarly, some of the key features and processes of social conflict discussed in Chapter 2 are transferable across cases, even though there is situational variation.

In a related vein, this research has focused solely on the United Kingdom, and the relations and responses described are therefore nationally (in terms of institutional and legal arrangements) and culturally specific. Management mechanisms, broader societal relations among people, and relations between people and wildlife, will differ elsewhere, and produce different challenges.

Furthermore, this research focuses on the management of 'charismatic' birds and mammals. Many of the issues discussed here are transferable to the management of all kinds of introduced species; planning and public engagement strategies, for example, have demonstrably influenced responses to introduced invertebrate management (Mackenzie and Larson 2010; Zalom *et al.* 2013), and attachments might also develop in relation with species not normally considered charismatic, such as trees (Dickie *et al.* 2013; Macleay 2013). Nevertheless, the kinds of issues raised in management debates differ depending on the species in question, the management mechanism, and the site: human health issues have taken prevalence, for example, in relation to chemical control of plants and invertebrates, whereas animal welfare and rights play a greater role in debates surrounding some vertebrate management.

A further limitation of this work, and one which I have remained conscious of throughout, is that despite my efforts to avoid 'flattening' nonhumans in my analyses, attend to their variety and liveliness, and write this into my papers, humans nevertheless dominate this thesis. This is to some extent a reflection of the cases I was studying. Despite the public debate about Devon's beavers, they remained elusive and had not been materially encountered by most of those who were discussing their future (myself included). The monk parakeets took a more central role, and I learnt a great deal from two short field visits to their main nesting trees in Borehamwood, discussing eradication, quite literally, "in the presence of those who would bear [the] consequences" (Haraway 2008, p83). These experiences added an important, tangible dimension to my otherwise very discursively-focused research. These encounters were also part of the inspiration for my efforts to materially situate my final case study, working 'in the field' with practitioners, walking through woodlands in search of squirrel traps, and observing responses to both the red and grey squirrels we encountered.

Research directions

There is, therefore, a great deal of potential for more 'multi-species' work in this area, which considers both responses of human communities to introduced species *and* responses of introduced species to their new environment, including human inhabitants. For example, interesting work in the USA has investigated monk parakeet nest locations in relation to urban landscape features and human

population density (Davis *et al.* 2013; Reed *et al.* 2013), and my work has identified several areas in which parakeets have become associated with places and identities. What has not been pursued, however, is whether and how different human social responses to parakeet presence affects the behaviour, success or distribution of parakeet populations. I would therefore like to see multi-species work in this area work moving toward purposive investigations of introductions, colonisations, and indeed management, as socio-ecological phenomena (augmenting, rather than necessarily replacing, the existing division of labour between social and natural scientific research). The River Otter Beaver Trial – which has clear socio-economic as well as ecological implications – is undertaking some social research in addition to its studies of beaver behaviour and ecology, but this work remains quite distinct from that on hydrology and ecology. The management group is keen to gauge wider public perceptions of, and the degree of support for, beaver reintroduction, but has not to my knowledge pursued more detailed studies of how those directly or indirectly encountering beavers and their activity are responding to the species' continued presence. There is therefore more and better integration to be done.

A potential re-orientation towards studying introductions as socio-ecological environmental changes, rather than 'biological invasions', also has important implications for research into how and why species are arriving and establishing in the first place. The UK Government's strategy, following scientifically-informed guidance from the CBD and IUCN, increasingly emphasises biosecurity and the prevention of introductions (Defra *et al.* 2015). This involves researching and assessing potential new arrivals through risk assessment processes that focus on the incoming species. There is less attention, however, to the 'invasive [socio-ecological] networks' (Robbins 2004) that both enable introductions and mediate their success, such as the 'invasibility' of disturbed and heavily modified landscapes. My studies have focused on management processes rather than introduction processes, but, as I argue in Chapter 4, this is a key area where social science has barely been employed, and a promising avenue for future cross-disciplinary research.

Concluding remarks

This research contributes not only to advancing academic understanding of human-nonhuman relations, and contemporary ecological politics in the UK, but also as a modest step towards the practice and application of cross-disciplinary environmental science, which draws on methods, insights and innovations from a range of connected research fields. Working in relation to multiple disciplines is difficult, and involves negotiating significant philosophical and methodological divides, as well as more everyday differences in traditions, priorities and expectations. Efforts at cross-disciplinary collaboration, in my experience, are most fruitful where they are applied to complex problems that that demand multiple lines of enquiry and modes of operation to be better understood and effectively addressed. 'Introduced species management' – which also includes understanding and handling human behaviours, procedures and governance – is one such problem, which might only make constructive progress through greater, good-faith integration of natural and social scientific research. However, for such endeavours to be successful, natural scientists must be willing to take 'human dimensions' more seriously as an integral component of 'ecological' change; social researchers must be willing to take nonhumans and biotic processes seriously as affecting and affected by human behaviours, cultures and politics; and researchers of all kinds must consider the spaces, moments, and forms of encounter *between* humans and nonhumans. Finally, despite the value of guiding principles and overarching recommendations, this research demonstrates that every wildlife introduction, and therefore every management scenario, has its own unique combination of issues that, although challenging to disentangle, is worth understanding. To achieve this understanding, researchers and policy-makers alike need to 'stay with the trouble', get out in the field (with practitioners, with affected communities, and with wildlife) and get in among the mess of our collective, changing environments.

Appendix 1: Response to Russell and Blackburn (2017)

This appendix has been removed by the author in order to comply with the publisher's terms and conditions. The full citation for this work is provided below:

Crowley, S.L., Hinchliffe, S., Redpath, S.M. and McDonald, R.A., 2017. Disagreement About Invasive Species Does Not Equate to Denialism: A Response to Russell and Blackburn. *Trends in Ecology & Evolution*, 32: 228-229. DOI: 10.1016/j.tree.2017.02.004.

Appendix 2: Example of semi-structured interview schedule

This schedule was used as a guide for interviews with conservation project volunteers involved in trap-loan schemes (see Chapter 7). Interviews with these volunteers usually took place at the participant's home. Where appropriate / applicable, we also asked volunteers to show us the location and setup of their trap(s).

Introduction – tell me a bit about yourself and your background.
When and how did you become involved in the project?
What was your initial motivation?
How long have you been involved?
Tell me about the activities you are involved with as part of the project.

Tell me about the grey squirrel management methods used in your area.
Who carries out trap-checking and dispatch? (What is the process for reporting?)
OR
Do you carry dispatch out yourself? (If not, why not?)

Tell me about the trap and dispatch procedures.
How do you feel about the use lethal control involved in this project?
OR
How do you feel about carrying out lethal control?

In what situations do you think killing grey squirrels is justified/worthwhile?
(*prompts:* forestry, red squirrel conservation, urban areas)
Are you interested in, or involved with, grey squirrel management outside of red squirrel conservation?
(*prompts:* pest control, woodland protection, recreation)

Do you know other volunteers? (Are there social events or networks?)
Do you actively promote the work you're doing to friends, family, or at events?
What motivates you to continue?
(Why do you think red squirrel conservation matters?)
Do you feel like the project is working?

What do you know about / what are your thoughts on the following alternatives / developments *(as appropriate)*:

- Pine marten reintroduction
- Immunocontraception
- Squirrelpox vaccine
- Loss of warfarin poisoning
- GS groups / shooting clubs
- Changing forest mgmt. practices
- EU regulations

Appendix 3: Example of information for participants and consent form

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Information for Participants: Social and Ecological Dimensions of Managing Introduced Wildlife in the UK

We would like to ask you to participate in research investigating how wildlife management, particularly of introduced and reintroduced species, is negotiated amongst different stakeholders in the United Kingdom.

Through this research, we aim to better understand:

- How stakeholders assess the potential risks and benefits posed by introduced wildlife.
- How different stakeholders develop their perspectives as to the appropriate moral and legal status of introduced species.
- Why challenging social disputes often develop surrounding conflicting management aims and ideals.
- How introduced wildlife populations are managed in practice: i.e., how the above issues translate into case-specific decisions and actions.

Participation in this study is entirely voluntary. It will involve a meeting and conversation at a mutually agreed time and location. With your permission, the conversation will be audio recorded. Recordings will not be shared with any individuals outside the research team. If you would prefer not to be recorded, the researcher will take written notes. You can also request that the audio recording be switched off at any time during the conversation.

Only the research team will have access to the research data itself. When publishing results, we will use pseudonyms and respondents' identities will be protected as much as possible in the final project and any associated publications. Representatives of organisations can choose whether or not they also wish their organisation to be anonymised.

You may decide not to answer any of the researcher's questions if you wish. You may also decide to withdraw from this study at any time by advising the researcher at the time of your meeting, or by emailing s.crowley@exeter.ac.uk or using the contact details at the foot of this page. If you notify us of your withdrawal, all identifiable data will be destroyed.

We may ask for clarification of issues raised in the meeting at some time after it has taken place, but you will not be obliged in any way to clarify or participate further.

There are no known or anticipated risks to you as a participant in this research.

If you have any questions regarding this project or would like additional information, please ask the researcher before, during, or after your meeting. Contact details for the primary researcher and the supervisory team are provided below.

Primary Researcher:
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Consent form: Social and Ecological Dimensions of Managing Introduced Wildlife in the UK

Please tick the boxes if you agree with the corresponding statements:

I have read the information sheet, and understood the information given about the project and what my participation involves ☐

I know that I am free to withdraw my participation at any time ☐

I know that I will not be penalised in any way if I give only partial or incomplete answers to questions ☐

Please delete as appropriate

I request that the organisation I represent is reported anonymously in research outputs YES / NO

I agree to an audio recording of my interview YES / NO

Signed (participant) _____ Date _____

Signed (researcher) _____ Date _____

Appendix 4: Introduced monk parakeet populations 2016 (by country)

Key to classification:

Casual: wild populations or individuals occasionally recorded within 10 years, but intermittently or in different locations

Resident: wild populations repeatedly recorded within 10 years, including evidence of breeding, but little/no evidence of spread from area of introduction

Established: wild, breeding populations persisting in multiple locations with evidence of spread from area(s) of introduction.

Historical: no substantiated evidence of populations within last 10 years and/or reports of local elimination/disappearance

Country	Academic Literature	CABI (2011)	eBird*	Christmas Bird Count® Record	Classification (January 2016)
Austria	Recorded (Macgregor-Fors *et al.* 2011)	Present	-	NA	Unknown
Bahamas	*Eleuthera Island*, 1985-mid 1990s (Spreyer and Bucher 1998; Lever 2005) Introduced and established (Avery *et al.* 2002)	Unconfirmed record	-	1986 (4); no further records until 2008 (14), sighted each year 2010-2014 (<10)	Casual
Belgium	Occurs (Sol *et al.* 1997) Occurs (Spreyer and Bucher 1998)	Present	*Brussels*: occasional sightings of colonies since 1991, most recent January 2016	NA	Casual
Bermuda	- (Not listed on Bermuda birding lists, Audubon society or Bermuda lists)	Present (not invasive)	-	Single birds sighted 1989; 1993; 1998	Casual
Cayman Islands	*George Town* (Lever 2005)	Present (1987) (invasive)	Multiple sightings in *George Town*, most recent December 2015	NA	Resident (*George Town)*

Czech Republic	*Sázava,* ~87 in 1990 (Lever 2005) Breeding population established (Russello *et al.* 2008) "The published report on their nesting colony turned out to be a forgery" (Hudec 2015)	-	-	NA	Unknown
Chile	*Santiago* since 1970s (Iriarte *et al.* 2005)	Present (1972)	From central *Santiago* east to mountains; *Valparaiso*.	NA	Established
Canada (Quebec)	*Montreal,* occupied and disappeared 1980s (Spreyer and Bucher 1998) Self-sustaining breeding population, *southern Quebec* (Butler 2005) Recorded (Macgregor-Fors *et al.* 2011) *Quebec, near Montreal* (Johnson and Logue 2012)	Present	-	-	Historical
France	Recorded (Macgregor-Fors *et al.* 2011)	Present	-	NA	Casual
Germany	Conflicting reports about establishment (Lever 2005)	Present	-	NA	Unknown
Greece	-	-	*Athens:* colony in National Gardens sighted since 2013	NA	Casual
Israel	*Tel Aviv* (Roll *et al.* 2008) Successful reproductive population (Macgregor-Fors *et al.* 2011)	-	HaYarkon Park, *Tel Aviv,* sighted January 2016.	NA	Resident *(Tel Aviv)*
Italy (Mainland)	*Lombardy,* 1930 (Mascia and Grussu 2008) *Milan* (failed)*, Genoa, Rome & surrounds* (Marianna *et al.* 2013) *Genoa, Friuli, Pastrengo Zoo-park, Infernetto Castlefusano, Ostia-Antiga Dragona, Piemonte* (Lever 2005) List of regions where introductions made with dates (Mori *et al.* 2013)	-	Central *Rome*, most recent sighting December 2015 (Forum)		Resident *(Rome,* likely elsewhere)
Italy (Sardinia)	Sighted *Cagliari* 1885 but first nests not until 2007. Est. 150	-	-		Resident

	(Mascia and Grussu 2008; Mori *et al.* 2013)				
Italy (Sicily)	*Catania* (Marianna *et al.* 2013; Mori *et al.* 2013)	Present	-		Resident
Japan	Breeding population established *(as Kenya, refs Lever 1987, but 2005 version does not list Japan)* (South and Pruett-Jones 2000) Established (Russello *et al.* 2008) Established (Gonçalves da Silva *et al.* 2010) Successful reproductive population (Macgregor-Fors *et al.* 2011) Pops in Kanagawa and Mie prefectures, 3rd pop (Hyogo pref) disappeared in 1980s. (National Institute for Environmental Studies n.d.)	Present	-		Resident (*Kanagawa, Mie*)
Kenya	Breeding population established (South and Pruett-Jones 2000) Established (Russello *et al.* 2008)**:** Recorded (Macgregor-Fors *et al.* 2011) Most refs to Lever (1987), but country not mentioned in updated edition (Lever 2005)	Present	-		Unknown
Mexico	Direct study (Macgregor-Fors *et al.* 2011)		*Oaxaca, Heroica, Veracruz,* then scattered towards and including *Puebla* and *Mexico City,* more scattering towards *Leon,* then between *Leon* and *Guadarajara.* Also: *Guadaraja, Puerto Vallarta, Aguas Calientes, Saltilla, Hermosillo* Baja California: *Guerno Negro,*	(*Unsure how much coverage for CBC or when started recording)* First record 2006, steep increase in sightings 2013-2014.	Established

			Ensenada, La Paz		
Netherlands	Established (Fletcher and Askew 2007) Lever (2005) cites 2 refs, one claiming 2-10 pairs, the other claiming a non-viable population	Present	Sighted in Rotterdam, Ouddor and Appeldoom within two years (supplemented by Dutch birding website *waarneming.nl*)		Casual
Portugal	Occurring (Lever 2005) Established (Fletcher and Askew 2007)		Sightings and photos of nests from 2015 in *Lisbon* and *Porto*		Resident (*Lisbon, Porto)*
Puerto Rico	Naturalised (Avery *et al.* 2002) Locally common, expanding, introduced 1950s (Lever 2005) Established (Russello *et al.* 2008) Recorded (Macgregor-Fors *et al.* 2011)	Present	Commonly sighted from *San Juan* along most of northern coast, plus in *Ponce* and *Jobos Bay* on south coast.	Increased from 1980 (7) to peak in 1990 (140), dropped in 1991 (8); slow fluctuating increase to present	Established
Spain	Direct study, *Barcelona* (Sol *et al.* 1997) *Barcelona, Madrid, Valencia* (Lever 2005) *Barcelona, Madrid, Zaragoza* (Edelaar *et al.* 2015) *Madrid, Malaga* (Muñoz and Real 2006)	Present	Populations regularly sighted in *Madrid; Seville; Malaga* (and scattered along Costa del Sol); *Zaragoza; Barcelona* and immediate surrounds; and *Roses*		Established
Spain	'Occurs' (Spreyer and Bucher 1998) *Tenerife, Gran Canaria* – common and increasing; *Fuerteventura, la Gomera, la Palma* – reported (Lever 2005) *Tenerife*, purpposeful release and supplemented (Edelaar et al. 2015)	Present	2015 sightings: *Gran Canaria, Tenerife* and *Fuerteventura*		Resident (*Gran Canaria, Tenerife, Fuerteventura)* Casual (*la Gomera, la Palma)*
Switzerland	Recorded (Macgregor-Fors *et al.* 2011)	-	-		Unknown
United Kingdom	(Tayleur 2010; Parrott 2013)	Present	Sighted in London in 2015 *(and by lead author in February 2015, London and Hertfordshire).*		Resident (*Hertfordshire, London)*

USA (Alabama)	Known (Hyman and Pruett-Jones 1995) Resident (Spreyer and Bucher 1998)	Present	-	-	Historical
USA (Arizona)	Single bird, 1973 (Neidermyer and Hickey 1977)	-	Historic population in *Casa Grande* – last recorded 2011. Possible pair sighted *Phoenix,* 2015.	-	Casual
USA (Arkansas)	Single bird, 1972 (Neidermyer and Hickey 1977)	-	Last observed 2003 (record from Audubon Society)	-	Historical
USA (California)	*San Diego* zoo area, mostly retrieved (Davis 1974) 47 observations, 1970-75 (Neidermyer and Hickey 1977) Casual (Spreyer and Bucher 1998)	Restricted Distribution ('not invasive')	-	-	Historical
USA (Colorado)	Known (Hyman and Pruett-Jones 1995) Reported (Moscatello 2003) Reported (Tillman *et al.* 2004)	Unconfirmed record	-	-	Historical
USA (Connecticut)	*State-wide:* 2 in 1971/2 (Neidermyer and Hickey 1977) Reported (Hyman and Pruett-Jones 1995) Est. 400-600 (Spreyer and Bucher 1998) Established (Moscatello 2003) 19% national pop (Tillman *et al.* 2004): *Bridgeport:* >90 (Devine and Smith 1992) *Stratford:* (Burgio *et al.* 2014)	Present	(2015-2016): frequently sighted from Stamford north-east along coast, including *Fairfield, Bridgeport, Stratford, Milford* and *New Haven*, up to Connecticut River.	Limited sightings from 1973, growth appeared exponential, peaked in 2003 followed by steep decline, remained around mid-1990s levels (0.15 b/ph) 2010-present.	Established
USA (Delaware)	Recorded (Hyman and Pruett-Jones 1995) Resident (Spreyer and Bucher 1998) Reported (Moscatello 2003)	Present	*Reheboth:* former population ~1990-2003	First seen 1993, last seen 2000, <10 birds.	Historical
USA (Florida)	31 obs 1970-75 (Neidermyer and Hickey 1977) *Jacksonville, Fort Lauderdale, Boca*	Present (1972)	2015-2016: Multiple sightings of colonies, primarily in coastal regions south of	Regularly sighted since 1973, high growth from 1984	Established

	Raton, St Petersburg, Tampa, Brevard Co., Pinellas Co., Pasco Co. (Spreyer and Bucher 1998) 24/67 counties (Avery *et al.* 2002) Recorded (Hyman and Pruett-Jones 1995) Established (Moscatello 2003) Est. 100,000 (Simberloff 2003) 72% of national pop (Tillman *et al.* 2004) Est. 18,025 – 32,044 (Russello *et al.* 2008)		*Orlando*. East: fairly continuous from *Palm Bay* south and including the Keys as far as *Key West*. Concentrated in *Miami* and *Fort Lauderdale*. Central: scattered around *Orlando* and *Winter Haven*. West: from *Hudson* south along the coast, concentrated in *St Petersburg* and *Clearwater*, some in *Port Charlotte* and *Fort Myers.*	peaking in 2001-2003, then declined until 2008, since stabilised.	
USA (Indiana)	-	-	Sighted in *Gary* and surrounds since 2012 – likely expansion from *Chicago* population	-	Resident (*Gary*)
USA (Illinois)	*State-wide:* 20 obs 1970-75 (Neidermyer and Hickey 1977) *Chicago:* 64 birds increasing to 143 post-breeding (Hyman and Pruett-Jones 1995) 1973: 3 confirmed sightings (Spreyer and Bucher 1998) Established (Moscatello 2003) 2% national pop (Tillman *et al.* 2004) Apparent recent decline, but could reflect greater distribution (less density) (Pruett-Jones *et al.* 2011)	Present	(2015-2016) Most sightings within urban *Chicago*, a few key colonies including one near original Hyde Park area.	Low until mid 1990s, then fluctuating growth and decline, peaks in 2007 and 2010, currently back to mid-90s level.	Established (*Chicago)*
USA (Louisiana)	Known (Hyman and Pruett-Jones 1995) Established (Moscatello 2003) *New Orleans* (Spreyer and Bucher 1998)	Present	2015-16: Multiple colonies frequently sighted in metropolitan *New Orleans*	Few until 2001, then high fluctuation (peaks in 2002 and 2009), surrounding general growth	Established *(New Orleans)*
USA (Massachusetts)	12 observed in 1972, 2 in 1973 (Neidermyer and Hickey 1977)	-	2014-15: One pair repeatedly sighted in *Allston* – breeding	Individuals and small groups (7 or less)	Casual

	Reported (Moscatello 2003)		unknown, but photos of nest building. 2010-11: Pair/small group in *East Boston*, no sightings since. 2001-2: Pair in *Concord*, no sightings since. 1995-6: Pair in *Blackstone*, no sightings since.	occasionally recorded 1972-2010, none since.	
USA (Michigan)	Birds retrieved from *Eau Claire* & *Salem*, none by 1974 (Cooley 1974) 'Self-sustaining breeding population', (Butler 2005) (ref. American Ornithologists' Union checklist 1998).	Present	-	One record of one bird in 1983.	Casual
USA (Missouri)	-	Present	-	-	Unknown
USA (New Jersey)	Noticed (Kibbe and Cutright 1973) Resident population (Bull 1973) >35 locations (Wagg 1973) Resident (Davis 1974) >26 observed 1970-75 (Neidermyer and Hickey 1977) Resident (Spreyer and Bucher 1998) *Edgewater:* ~50 birds (Moscatello 2003) Direct research (Burger and Gochfeld 2009; Seymour 2013)	Present	2015-2016: Population regularly sighted in *Edgewater* and surrounds. Small group repeatedly sighted in *Carteret.*	Small numbers until 1999, then steady growth with fluctuation, almost 300 birds sighted in 2014.	Established (*Edgewater region)*
USA (New York)	Numerous reports (Bull 1973) *Rockaway Point, Brooklyn, Riker's Island* (Trimm 1973) Resident (Davis 1974) >143 observed 1970-75 (Neidermyer and Hickey 1977) Recorded – 1992-3 CBC (Hyman and Pruett-Jones 1995) First confirmed in the wild 1967(Pruett-Jones *et al.* 2011)	Present	2015-16: Scattered around New York metropolitan area, though rarely sighted within Manhattan. Key colonies located in *Brooklyn*, nr JFK airport, *Queens* and *Freeport*, Long Island.	Early growth in 1970s dropped by 1975 (following eradication effort), remained low until 1990, then followed steady (but fluctuating) increase, currently appears exponential growth.	Established (*New York metropolitan region)*

	Long Island, Staten Island, Central Park: Resident (Spreyer and Bucher 1998) Direct research (NY metropolitan region) (Seymour 2013)				
USA (North Carolina)	*West Ashville* 1972-3 *Barnardsville* 1972-3 (Spreyer and Bucher, 1998, citing Simpson & Ruiz, 1974)	-	2015-2016: One pair repeatedly sighted and nest building (photos) nr *Wilmington.*	-	Casual
USA (North Dakota)	*Northwood,* ~25 (Davis 1974)	-	-	-	Historical
USA (Ohio)	9 obs 1970-75 (Neidermyer and Hickey 1977) 'Known' (Hyman and Pruett-Jones 1995)	Unconfirmed record	-	Occasional sightings from 1973-1988, none since.	Historical
USA (Oregon)	Recorded (CBC 1992-3) (Hyman and Pruett-Jones 1995) Reported (Moscatello 2003) *Portland* (Spreyer and Bucher 1998)	Present	-	Small numbers observed from 1982, declining from a peak in 1988 (21) to <5 from 2000, no observations since 2012	Casual
USA (Pennsylvania)	*Allegheny Mountains*, pair 1971 (Freeland 1973) 2-6 birds obs 1971-1973 (Neidermyer and Hickey 1977)	-	Nest in *Allentown*, 2012. Facebook page (http://bit.ly/2ld6huo) states this was removed in 2012 by PA Game Commission.	1972: 4 sightings, 1974: 3 sightings, none since	Casual
USA (Rhode Island)	Recorded (CBC 1992-3) (Hyman and Pruett-Jones 1995) *Barrington, Warwick* (Spreyer and Bucher 1998) Current population (Avery *et al.* 2002): Established (Moscatello 2003) Self-sustaining breeding population (Butler 2005)	Present	Pair or small group sighted occasionally since 2006, most recent sighting 2015, around *Warwick* (nr *Providence*). *(Additional info and sightings from quahog.org)*	-	Casual
USA	Casual population (Spreyer and	Unconfirmed	-	~40 birds sighted 1993	Historical

(South Carolina)	Bucher 1998)	record		and 1994; none since	
USA (Texas)	One pair repeatedly obs 1973-1975 (Neidermyer and Hickey 1977) Recorded (CBC 1992-3) (Hyman and Pruett-Jones 1995) *Austin, Dallas, Fort Worth* (Spreyer and Bucher 1998) Current population (Avery *et al.* 2002) Established (Moscatello 2003) 4% national population (Tillman *et al.* 2004) Self-sustaining breeding population (Butler 2005) Directly studied *Dallas, Tarrant* - >50 colonies (Reed *et al.* 2013, 2014)	Present	2015-2016: Multiple city populations regularly sighted: *Dallas, Fort Worth, San Antonio, Corpus Christi, Houston*	Continuous growth since ~1984	Established
USA (Virginia)	Active eradication underway (Trimm 1973) 15 obs 1970-75 (Neidermyer and Hickey 1977) Nesting colonies reported (Moscatello 2003)	Present	Scattered sightings of individuals and pairs around James River mouth, most recent ~2011	Occasional sightings of 1-2 birds, 1972-1994.	Casual
USA (Washington)		-	Sightings of Yacolt population in 2016. *Email from local resident in January 2016 (including photos) confirms small colony still present in area.*	Single sighting (1) in 1988.	Resident *(Yacolt)*

** 2+ birds reported by >1 observer AND/OR photograph provided*

Appendix 5: Case studies of monk parakeet management in the USA

1. 'National retrieval' project, USA

In 1973, representatives of government and conservation agencies from thirteen northeastern states convened a meeting to assess concerns about possible impacts arising from the recent establishment of several feral monk parakeet colonies (Neidermyer and Hickey 1977). Their concern was inspired by (a) reports of extensive agricultural damage by monk parakeets in their native range (e.g. Bump, 1971; Mott, 1973) (b) the threat of Newcastle disease, an outbreak of which had halted the parrot import industry for a year in 1972 (Kibbe and Cutright 1973), and (c) potential competition between monk parakeets and native species (Davis 1974). The major outcome of the meeting was the initiation of a national monk parakeet 'retrieval' programme, co-ordinated by the United States Fish and Wildlife Service (USFWS). 163 parakeets were removed as part of the programme, mostly by shooting, and the retrieval project was deemed 'effective' at controlling monk parakeet numbers and spread. However, despite this apparent success – or perhaps because of it – the programme lost momentum and ended in 1975 (Neidermyer and Hickey 1977). Individual states varied in their post-programme management efforts (Spreyer and Bucher 1998). By 1975, Virginia and California had removed 67% and 75%, respectively, of recorded birds, and as of 2016 neither state has reported an established population. Elsewhere, however, populations quickly re-established following the programme's cessation, and by the mid-1990s parakeet populations in Connecticut, New York, New Jersey, Florida, Illinois and Texas had grown well beyond pre-control levels (Van Bael and Pruett-Jones 1996). Numbers in the New York metropolitan area may also have been supplemented by later releases and escapes (Edelaar *et al.* 2015).

2. Chicago, Illinois, USA

Chicago's monk parakeets were first recorded breeding in the Hyde Park neighbourhood in 1979-80 (Hyman and Pruett-Jones 1995) and have been regularly monitored since 1992 by University of Chicago researchers (Pruett-Jones *et al.* 2011). An incongruous addition to Chicago's avifauna, the parakeets first attracted media attention in the 1980s due to their association with Harold Washington, Chicago's first African-American mayor (Pruett-Jones *et al.* 2011). 'Harold's parakeets' lived in a large ash tree opposite the mayor's residence (Stevens 2004). Local legend tells that Washington was responsible for safeguarding the birds from eradication, considering them a 'good luck talisman' that symbolised his own outsider status in the city (Kendall 1997). Although Washington's attachment to the parakeets may have been exaggerated (Purrington 2005), it played a significant role following his death when, in 1988, the US Department of Agriculture (USDA) again proposed eradication. Local residents set up the 'Harold Washington Memorial Parakeet Legal Defence Fund', held protests under the colony's main nesting tree, and threatened legal action (Brotman 1988): the eradication project was subsequently halted (Hyman and Pruett-Jones 1995). The population has since grown and spread throughout the city (Pruett-Jones *et al.* 2011). However, this expansion is expected to be limited to urban-suburban areas, as in Chicago feeding at garden bird feeders can account for 100% of the winter diet (Hyman and Pruett-Jones 1995). There have been no further eradication efforts in Chicago, though problem nests are removed, and local support for the population remains: when the original nesting tree fell in 2004, Hyde Park residents and Chicago Animal Control workers actively relocated fallen nests to nearby trees (Stevens 2004).

3. The New York metropolitan area, USA

Monk parakeets have been present in the New York Metropolitan Area (NYMA: including contiguous regions of New York, New Jersey and Connecticut) since the late 1960s. Whilst colonies in Connecticut have spread northwards along the metropolitan coast, parakeets in New York and New Jersey have sustained small core populations in and around Edgewater (NJ), Brooklyn and Queens (NY). Although monk parakeets have not yet emerged as serious agricultural pests in the USA (Avery *et al.* 2006; Pruett-Jones *et al.* 2011), they have nevertheless become an economic nuisance due to their habit of nesting on electrical utility structures, including poles, transformers and substations (Avery *et al.* 2006; Burger and Gochfeld 2009; Minor *et al.* 2012; Reed *et al.* 2014). Their large stick-built nests can obstruct routine maintenance and cause transformers to short-circuit or over-heat, disrupting electricity supplies and/or creating a fire hazard (Reed *et al.* 2014). To prevent this, utility companies regularly remove nests from electrical structures. However, committed individuals and groups of activists in New York, New Jersey and Connecticut have both protested against management activities, especially lethal control, and lobbied for the birds' greater legal protection (Seymour 2013).

4. Florida and Texas, USA

Florida's monk parakeet population is the best established in the USA, and was increasing exponentially during the 1990s (Pruett-Jones *et al.* 2005), though it may have since stabilised (National Audubon Society 2016). Texas, too, has a well-established and expanding population, originating in the early 1980s (Reed *et al.* 2014). As in the NYMA, management in these southern states focuses on

mitigating the impacts of parakeet nests on electrical utilities (Avery *et al.* 2006). Over the past 15 years, researchers from the United States Department of Agriculture (USDA) and Florida Power & Light (FPL) have trialled a range of management techniques including scaring and repellent devices, trapping, nest removal and oral contraceptives (Avery *et al.* 2002, 2006; Tillman *et al.* 2004; Yoder *et al.* 2007). Scaring devices and passive trapping methods have rarely been effective (Avery *et al.* 2006), but managers have achieved reasonable success by trapping birds at night, using a specially designed net placed over nest exits. In trials, captured birds were euthanized with carbon dioxide (Tillman *et al.* 2004), however, FPL has not trapped birds during nest removal since 2007 (**J. Linsday, FPL; pers comm**). Recent research from Texas has investigated the landscape and nest substrate features preferred by monk parakeets to identify options for habitat and structural modifications, for example, to electrical substations and utility poles (Reed *et al.* 2013, 2014).

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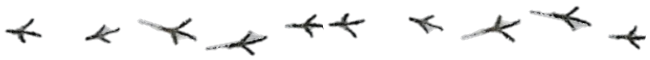
“The world isn't just the way it is.

It is how we understand it, no?

And in understanding something, we bring something to it, no?”



Yann Martel
Life of Pi