

Public attitudes towards invasive animals and their impacts

**A summary and review of Australasian
and selected international research**

**Prepared for the
Invasive Animals Cooperative Research Centre**

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Invasive Animals Cooperative Research Centre

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Front cover images (left to right): Dingo, wild horses (Michelle Dawson), stoat (John Dowding), rabbit (Brian Cooke).

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Executive summary

This project in the Detection and Prevention Program of the Invasive Animals Cooperative Research Centre (IACRC) identifies and reviews the research literature on public attitudes towards, and understanding of, invasive animals and their impacts. The need for a review was identified by participants in the IACRC's socio-economic 'Costing the Impacts' workshop, held in November 2005 (Norris et al 2006). The review aims to maximise the use of existing knowledge, to identify knowledge gaps, to identify suitable social research approaches, and to help focus research efforts across the work of the IACRC.

Animals covered in the Australasian literature include: foxes, wild dogs, rodents, cane toads, rabbits, horses, pigs, deer, goats, kangaroos, possums, stoats, bandicoots and flying foxes. The review observed that little primary research has been done on attitudes and perceptions of invasive animals in Australia. Studies to date have generally been reactive and not well informed by previous work. The geographical coverage is patchy, and no national Australian picture for pest animals is available. The species coverage is variable, as is the quality of the work, with almost no coverage of perceived or experienced social impacts.

Perceptions and attitudes to invasive animals were found to vary with:

- gender — males are generally more likely to consider invasive animals a 'serious' problem, and more likely to support intervention and the use of lethal controls
- age — older people are generally more likely to regard an animal as a pest (and a more serious problem) than younger people are
- residence — rural residents generally perceive invasive animals as being more of a problem than urban residents do
- species of invasive animal — animals that are capable of being companion animals or are large, attractive mammals, are generally considered more favourably than rodents and non-mammalian species
- personal situation — attitudes towards species that are seen as a pressing national or local problem tend to be more negative than towards species that are seen as being less pressing, or farther from home

- interest — attitudes vary between people with ethical or conservation interests, animal industry practitioners, conservation groups, scientists and health professionals
- culture — certain species of animals are seen as companion animals in one culture but as pests and/or food in other cultures.

The review recommends that a national-level survey of the Australian public's attitudes towards and understandings of the main invasive animals be undertaken. It also recommends that a review of the literature on social attitudes to pest control methods be done to complement the current review.

1 About this review

1.1 Purpose

The aim of this paper is to provide an overview and summary of the primary identifiable social research to date on attitudes to invasive animals. In particular, it identifies the Australasian and relevant international research literature on public attitudes towards, and understanding of, invasive animals¹ and their social impacts.

The review is designed to serve as an information resource for those involved in researching and managing the impacts of animal pests in Australia and New Zealand. It was funded by the IACRC, and it is accompanied by an Endnote database that provides the reference details (and a brief synopsis) of the papers cited in this review.

1.2 Scope

In reviewing the research literature, we have focused on the invasive animals of most relevance to Australia and New Zealand, and especially those relevant to the work of the IACRC. As such, we have not attempted to cover the increasing international social research literature on wildlife in general, except to provide a general overview of the field, nor have we attempted to cover studies of invasive animal species that are of little relevance to the IACRC.

The search for literature aimed to identify primary research published mainly in books, journals, and agency reports — as recorded in library catalogues, journal databases, internet portals, and publication lists from government and non-government agencies and professional associations. This was complemented by

¹ In this review the term ‘invasive animals’ includes ‘pest animals’.

requests for references from IACRC participants and their associates. The following were *not* systematically reviewed:

- university theses (except for recommended significant studies)
- studies focused mainly on attitudes to pest animal controls or management policies and strategies
- literature that is essentially commentary on previous or others' studies, and/or draws on secondary data.

It is possible, then, that some works considered important by some readers do not appear in this review.

In general, there is a growing body of social research on public attitudes to invasive animals in Australia and New Zealand, and their impacts. However, the number of studies remains quite small, and there have been relatively few in-depth studies of attitudes to particular species.

While there are some excellent quantitative studies of people's attitudes towards invasive animals, in methodological terms, many of the studies covered by this review have not used representative samples. Instead, they have used samples that are too small to be representative, drawn from limited sections of society, or used purposive or self-selecting samples (instead of randomly selected samples). This means caution needs to be exercised when generalising from some of the research in this review.

1.3 Structure

This review commences by setting a theoretical context around the research tradition known as 'human dimensions of wildlife management' and a range of new social movements that have emerged since the 1960s (Section 2). It then describes research on public and stakeholder perceptions of invasive species generally, rather than on specific species; first in Australia and New Zealand and then in other countries (Section 3). Section 4 reviews research on perceptions and attitudes to individual invasive species, focusing first on species of particular

importance in Australia and New Zealand and then considering relevant international research. The review then provides an overview of what is known about attitudes to invasive animals (Section 5). Strands of research on individual species are combined to produce a set of general observations about attitudes to invasive animals (Section 6).

2 Theoretical context

A quick survey of the literature indicates two emerging fields of study of relevance to this review, namely ‘the human dimensions of wildlife’, and ‘animals and society’ (referred to as ‘human–animal studies’). The former is typified by articles in journals such as *Human Dimensions of Wildlife*, *Wildlife Society Bulletin*, and *Society and Natural Resources*, and the second in *Society and Animals*.

2.1 Human dimensions of wildlife management

The attitudes that people have towards invasive animals (and how they value wildlife in general) are part of a broader and growing field of study that is often referred to as the ‘human dimensions of wildlife management’ (or HDWM).

In their 2004 review of the field, Decker et al describe HDWM as the application of social science to the task of understanding:

- how people value wildlife
- the benefits that people seek from wildlife management
- the acceptability of management practices
- how stakeholders affect or are affected by wildlife and wildlife management decisions (2004, p187).

Decker et al identify three ‘domains’ of interest in the HDWM literature:

- descriptions of people’s wildlife-related activity
- social psychological factors in people’s relationships with wildlife and wildlife management (such as attitudes, norms and motivations)

- the management application of HDWM knowledge (in, for example, policies, practises, and education/communication).

As noted above, this literature review focuses on a particular type of relationship between humans and wildlife; that is, one where the behaviour of an animal species hampers or is at odds with the aspirations, values and wellbeing of particular human communities.

HDWM that focuses on people's attitudes therefore fits into the 'social psychological' dimension. Early social psychological studies focused on typologies for describing how different segments of society value and relate to wildlife. For instance, Kellert (1980) created a typology with ten different categories to describe the views that Americans had towards animals². Similarly, Purdy and Decker's (1989) *Wildlife Attitudes and Values Scale* was designed to understand Americans' attitudes towards wildlife in human–wildlife conflict situations. These early studies are useful for demonstrating the range of views that people have towards wildlife, as well as describing the diversity across that range of views. More recent social psychological work has emphasised the role of broader social, cultural, and political contexts in shaping the views that people have towards wildlife.

One stream of work in the HDWM field has looked at public attitudes towards potentially dangerous wildlife and its management, and the role of risk perception (see for example, Loker and Decker 1995, Manfredo et al 1998, Riley and Decker 2000).

What the HDWM research clearly shows, regardless of methodology, is that attitudes towards wildlife vary among different stakeholder groups, for different situations, and for different species of wildlife. This finding, although seemingly obvious, has significant consequences for how wildlife (including invasive animals) is managed, especially in the zone where humans and wildlife interact.

²

Naturalistic, ecologicistic, humanistic, moralistic, scientific, aesthetic, utilitarian, dominionistic, negativistic and neutralistic.

Studies of attitudes towards the destruction of problem wildlife show that acceptability varies, depending on the species of animal (McIvor and Conover 1994), and basic attitudes to that animal. Variations in the animal's image, perceived abundance, and impact potential all play an important role here. For instance, in North America, coyotes are often portrayed as scavengers or pests, and as a result destroying a coyote is more acceptable than destroying other animals (*ibid*).

2.2 Animals and society

Lloyd and Mulcock (2007) have recently provided an overview of the emerging field of animals and society, and its current directions. In Australia, as elsewhere, studies in human and animal relationships and interactions are multidisciplinary, drawing from anthropology, psychology, history, sociology, philosophy, environmental science and cultural studies. They also tend to focus on human values, beliefs, and practices with respect to animals. Our literature search in this area identified work on wildlife as well as domesticated and companion-animal (pet) species. Publications in the field cover a wide range of theoretical perspectives, though tend be critical, reflexive, and social issues-focused, such as animals in human production systems, animal rights and welfare, companion animals, and the status of dangerous and pest species. As such, work in this field sits closely with the emergence new social movements as discussed below.

2.3 New social movements

Public attitudes need to be interpreted in a broader social context. There is a common belief among many of those involved in wildlife management that attitudes toward wildlife have become more 'protectionist' and less 'utilitarian' (Butler et al 2001, 2003). This shift in attitudes is often explained by reference to the influence of 'new social movements' such as environmentalism and animal rights.

The term ‘new social movement’ describes a collection of social movements that have emerged in advanced western democracies (described by sociologists as ‘post industrial economies’) since the mid 1960s. These movements differ from traditional social movements (such as those based on social class) that focused on economic concerns and, as the name suggests, focus instead on social issues such as sexism, peace, and society’s relationship to the natural environment, and creatures within it. The link with HDWM is made through the notion of ‘post materialism’³. Many New Social Movements emphasise social changes in lifestyle and culture, rather than pushing for specific changes in public policy or for economic change. These movements differ from simple protest groups, as the latter tend to be single-issue based and are often local in terms of the scope of change they wish to affect. In contrast, New Social Movements last longer and campaign for achieving wider-ranging change.

Opinions vary on the extent to which these movements have influenced attitudes to wildlife. For example, Fraser (2001) argues that their influence can be seen in New Zealanders’ attitudes towards introduced animals. He notes that there is some evidence in his research that New Zealanders have been sensitised to global trends in endangered species and biodiversity conservation, environmental contamination through pesticide use, and animal welfare issues⁴. Franklin (2007), looking at animal–human relationships over the last decade or so, also argues that western people have become more sensitive to animal rights and welfare.

However, Butler et al (2001, 2003), based on research involving an examination of surveys archived by the Human Dimensions Research Unit of Cornell University (which contain standard scales for measuring wildlife attitudes and values) since 1984, and encompassing 7589 respondents in New York State,

³ ‘Post-materialism’ is an economic philosophy that emphasizes quality of life and environmental sustainability issues instead of earning income and material possessions. Post-materialists give high priority to values such as more citizen input in government decisions, the ideal of a society based on ideas instead of money, and maintaining a clean and healthy environment, rather than to values associated with the philosophy of materialism such as economic growth, a strong national defense, and “law and order”.

⁴ Fraser notes that a major dilemma for politicians when dealing with wildlife is weighing up the preferences (attitudes etc) of those who are directly affected by wildlife compared to the larger, indirectly affected, public. This situation is heightened by the actions of small but highly vocal lobby groups demanding immediate solutions to particular problems, in contrast to the wider public who are typically less extreme in their views and less vocal in expressing them.

argues that no simple trend (such as an increase in pro-environment/conservation attitudes) is apparent.

3 Attitudes to invasive animals

3.1 The Australian research

The Australian social research typically focuses on public and stakeholder perceptions, attitudes and values towards wildlife and pest management options (including different forms of control). Survey respondents include landholders, urban or suburban residents, wildlife managers, and the general public. Baseline attitudes towards particular species have sometimes been canvassed as part of these studies, including towards indigenous animals being impacted by pest species. Some studies have only looked at wildlife in general.

The largest body of Australian research on public perceptions of invasive species and wildlife in general is that by Miller and various co-authors (1999, 2000a, 2000b, 2001, 2003, 2005, 2006). Miller's earlier work (up to and including 2003) focused on public and stakeholder perceptions of wildlife regardless of pest status; her more recent research was on the perceptions of wildlife managers. Others have studied attitudes to pest animals, wildlife and animal–human relationships in Australia. The results of this research are summarised below.

Miller's PhD study looked at how people in Victoria value wildlife in general — using a survey of 1431 public and stakeholder respondents. Her work on values about wildlife was based on Kellert's (1996) typology of six basic values. She found that Victorians have a relatively strong emotional attachment to individual animals (the 'humanistic' value) and are interested in learning about wildlife and the natural environment (the 'curiosity/learning/interacting' value). In addition, the respondents described native Australian wildlife as 'unique', 'interesting', and 'important'. Those in the study scored highly on a 'curiosity/learning/interacting' scale but, at the same time, had low rates of participation in conservation activities.

Miller's later research with Jones focused on the values held by wildlife managers (2005, 2006), particularly of 118 members of the Australasian Wildlife Management Society that they surveyed. This work develops a slightly different set of value scales, and included a 'management/consumptive use of wildlife' scale. Those who score highly on this scale believe that it is ethical and appropriate to manage wildlife by controlling introduced and pest species. They also believe hunting to be a valid pastime, and that wild animals may be used for food and other purposes where appropriate. Miller also described a 'protection of wildlife/compassion for individual animals' perspective, which refers to the belief that people who use or consume wild animals should be concerned about the pain and suffering of those animals, and that human activities should be restricted to those that minimise impacts on wildlife. Miller's 2005 and 2006 research shows that there are gender differences among wildlife managers in their attitudes towards wildlife and wildlife management but that these differences are small. The 2006 study by Miller also found that age is a factor in attitudes towards wildlife (with older female respondents scoring higher on the 'management/consumptive' scale).

The 2005 Miller study shows that while Australasian wildlife managers believe that it is necessary and/or appropriate to manage, control, and use wildlife for a variety of reasons, they also placed a strong emphasis on minimising pain and suffering among individual animals. This 'humane' effect was considerably stronger than a comparable United States study (Brown et al 1994). Another stakeholder group studied by Miller and McGee (2000) was naturalists. This group of supposedly 'lay' stakeholders had greater scientific knowledge than had been expected by professional wildlife managers. These studies have particular relevance for those developing and implementing pest control programs.

With regard to attitudes to wildlife in suburban environments, in 2003, FitzGibbon and Jones (2006) conducted a survey of householders in suburban Brisbane whose properties were located adjacent to one of 38 identified bushland fragments. The survey, to which 172 responses were received, mainly focused on experiences with and attitudes to bandicoot, although information on other species was also gathered. The surveyed householders identified 83 faunal

species that they encountered in these areas, including mammals (most commonly possums, fruit bats, bandicoot, and foxes), birds (especially bush turkey, laughing kookaburra, and rainbow lorikeet), and reptiles (most commonly, carpet python, blue-tongued lizards, eastern water dragon, and lace monitor). The vast majority (96%) of respondents agreed they were 'pleased to be living among amongst native wildlife'. A proportion of the respondents (not specified by the authors) identified 18 of these species they particularly disliked, mostly crows, cats, bush turkey, foxes, and flying foxes. The study concluded that 'residents of Brisbane clearly appreciate and value local bushland areas and the wildlife contained within these habitats', and such areas 'are perceived as important in terms of wildlife conservation' (FitzGibbon and Jones 2006, pp239–240).

With respect to perceptions of pest animals, Johnston and Marks (1997) conducted a postal survey of the Victorian public's attitudes to the management of vertebrate pests, to assist in the design of pest control strategies. The survey, which had 822 respondents, included a number of questions on perceptions of pest animals. In terms of the status of 'introduced animals', relatively few respondents (19%) believed that introduced animals should be considered to be 'native' if their populations were established for 100 years or more. Most Victorians are therefore prepared to make a distinction between 'native' fauna and 'exotic' fauna, and therefore attribute different status to each. In the survey, respondents were asked to classify 14 animals as 'pests or 'non-pests''. The list of animals included emu, kangaroo, wombat, platypus, brushtail possum, corella (cockatoo), fox, wild rabbit, domestic rabbit, wild dog, feral cat, domestic cat, starling, and Indian mynah. The overwhelming majority of respondents identified the feral cat, wild rabbit, fox and wild dog as pests (respectively by 96%, 95%, 87%, and 79% of the respondents), and felt they should be 'eradicated'. The starling was also seen as a pest by the majority (59%) of respondents. The respondents had less clear-cut views of the domestic rabbit, domestic cat, and Indian mynah — although more respondents felt each of these species were non-pests than pests. Each native species, except for corella, was considered a non-pest by at least half the respondents. There appeared to be localised issues around wombats, corellas and kangaroos, and in some locations the authors felt attitudes to these animals were likely to vary considerably from those of the rest

of the Victorian public. When asked to indicate any other species they considered to be a pest, 43% of the respondents listed other introduced species (24 species in all) — most commonly mice, rats, pigs, and carp — and 15 native animal species (mostly birds).

Doak (2002) surveyed 580 people who attended a Pet and Animal Expo in Brisbane in 2002. Although this survey has a selection bias problem, and was not likely to be representative of the public, it found that 85% of participants thought that wild pigs, wild dogs, and foxes were pest animals. 93% of the people in this study did not think that red kangaroos were pests. Those in this study thought the most common impact of invasive animals was on environmental fauna. Unlike the Oliver and Walton (2004) study, the majority of respondents in the Doak study thought the impact of feral animals was ‘everyone’s problem’, and not just a rural problem.

Following on from this study, a telephone survey of 800 primary producers and 476 residents of regional centres and large country towns across Queensland was done by Oliver and Walton (2004). They assessed perceptions, attitudes, impact experiences, and control activities with respect to pest animals and plants. The survey allowed the respondents to nominate the animals they were concerned about. In all, 87% of primary producers were concerned about some kind of animal: 33% nominated dingoes and wild dogs as their main pest animal, 16% nominated feral pigs, and 16% kangaroos and wallabies. These concerns were followed by concerns about rabbits, foxes, and several bird species. The main impact concerns among the primary producers were closely related to their type of farming and included killing of stock (45%), destruction of crops (30%), competition for livestock feed (16%), and damage to the environment (16%), followed by loss of vegetation, spread of disease, property damage, and general nuisance. Just under half the primary producers believed that pest animals were increasing on their property.

The residents of regional centres and large country towns in Oliver and Walton’s survey were less concerned about pest animals than their rural counterparts, with only 51% nominating a particular animal as a pest. The main animals of concern

to the town residents were: domestic cats (12%), domestic dogs (10%), crows and cockatoos (6%), and to a lesser extent, feral cats, and cane toads. Not surprisingly, these respondents indicated nuisance and wellbeing problems (such as animal wastes, noise, garden damage, and threats to people and pets) as the main impacts, followed by environmental impacts. The town residents were found to be less aware of prohibited pet species than the primary producers, although the two groups of respondents had similar views about animal pest management.

Queensland landholders were also surveyed by Finch and Baxter (2005). As part of a study of attitudes to wild deer the landholders were surveyed on their perceptions of various pest animals. Some 2624 landholders in three areas of Queensland where deer were known to occur were sent questionnaires by post, and 583 useable responses were received. The respondents were asked to rate the agricultural or environmental pest significance of 14 species, using a scale ranging from 'very significant pest' to 'not a pest species'. The species listed were: feral cats, feral pigs, rabbits, wild dogs/dingoes, foxes, mice, rats, feral goats, hares, wild donkeys, brumbies (wild horses), wild deer, kangaroos, and wallabies. Eight of these species were rated 'significant' or 'very significant' pests by more than half the respondents, including feral pigs (90% of respondents), rabbits (87%), feral cats (85%), wild dogs/dingoes (82%), mice (78%), foxes (78%), rats (63%), and feral goats (63%). All of the other species were considered significant or very significant pests by between a third and a fifth of the respondents. The survey indicated that the perceived pest status of some species varied according to locality.

The problem of vertebrate pests in built-up (ie urban) areas was reviewed by O'Keefe and Walton (2001). They provided a summary of the current knowledge on their impacts (including social impacts) and public attitudes. However, no new social research was conducted for the study. The review covered introduced animals such as feral cats, feral pigs, wild dogs, foxes, rabbits, hares, cane toads, deer, and various 'minor' species, including indigenous bird and animal species.

In the area of animal–human relationships, Franklin (2007) telephone surveyed 2000 representative Australians about their attitudes to animals, animal ethics,

rights, and perceived risks, as well as animal-keeping practices. One section of the survey covered attitudes to native and other animals on the respondent's property — including frogs, kangaroos, lizards, possums, snakes, toads, wallaby, bats, cats, dogs and birds. For the most part, Australians at least 'tolerate' animals on their local property, except for cats, dogs, snakes and cane toads. Asked about their animal-related activities and attitudes, 5% of the respondents indicated they had hunted feral animals 'at least once' or 'frequently', 60% disagreed that it was wrong to hunt Australian native animals such as kangaroo and wallaby, and 68% agreed that it was acceptable 'to hunt feral animals such as pigs and wild horses that degrade the environment'. When asked about the risks of various animals, the highest rates of anxiety were recorded against 'stings or bites from spiders' (64%), 'stings or bites from snakes' (61%), and 'attack by dog' (46%).

Studies of attitudes to particular species and their impacts are covered in Section 4 below.

3.2 The New Zealand research

There has been limited social research on New Zealanders' attitudes towards wildlife and invasive animals/pests in general. As with some of the Australian studies, some of the available New Zealand work on attitudes to particular species and their control include comparisons between different species and types of pests. There have been a number of studies of public and stakeholder attitudes to particular invasive animal species (especially possums, rabbits, and stoats) and these are outlined in Section 4.

Sheppard and Urquhart (1991) conducted a national telephone survey of 1000 adults to understand the views of New Zealanders about a range of pests and methods for their control. The survey focused mainly on attitudes to possums and rabbits and their control, and to a lesser extent, on wasps. An opening question on the perceived seriousness of various animal and insect pest species also mentioned rats, flies, fruit flies, termites and grass grubs. In terms of the perceived seriousness of the various pests at the time of the study, about 90%

thought that possums and rabbits were ‘very serious’ or ‘serious’ pests, and about 42% also considered rats to be a ‘serious’ or ‘very serious’ pest. In an open-ended question, 5–10% of the survey participants also volunteered that dogs, deer, and ‘people’ were serious pests. When analysed for variation by age, the perception of the seriousness of the animal pest problem was found to increase with the age of the respondent, but there was no clear pattern for residence or sex of the respondent. Additional findings specifically in relation to rabbits and possums are outlined in Section 4.

Fraser (2001) reported on a study of public attitudes to introduced wildlife in New Zealand. This work was the result of a 1994 national postal survey that yielded 859 useable responses. The survey asked respondents about their knowledge and experience of wildlife, their perceptions of 14 introduced species (13 of which were animals), attitudes to these animals and their management, and the acceptability of various forms of control for particular species. The introduced wild animals covered by the survey included: deer, chamois, feral goats, feral pigs, brushtail possums, Himalayan thar, wallabies, hares, rabbits, feral cats, mustelids (stoats, ferrets and weasels), rodents (rats and mice), feral horses, and wasps. Most respondents were clear that, despite being present in New Zealand for over 100 years, these introduced species did not constitute part of New Zealand’s ‘natural’ fauna. Over half the respondents considered rodents, wasps, feral cats, possums, rabbits, mustelids, hares, wallabies, feral goats, feral pigs, and deer to be pests in that ‘the New Zealand environment would be better off without the impact or modification caused by this species’ (2001, p18). At the same time, more than half the respondents saw deer, feral pigs, feral horses, feral goats, chamois, and thar (ie the larger animals) as a resource, in that they ‘value their presence and the aesthetic recreational, or commercial opportunities they represent’ (*ibid*). So, while the majority of the public recognised deer, feral pigs, and feral goats as pests, the majority also saw them as a resource. In terms of the place of these various introduced species in the landscape, over half the respondents felt that they would enjoy seeing the larger animals (except for pigs) in the wild (ie bush or high country); however, they felt that the damage they caused outweighed their value in terms of recreational opportunity. The majority of respondents did not enjoy seeing the smaller animals in the wild. Fraser

concluded that 'overall, this survey shows that New Zealanders have more of a utilitarian than a protective attitude to introduced wildlife' (2001, p7). Fraser also noted there are few differences in attitudes towards control between urban and rural residents, unlike in the United States, where residence is a key consideration.

Bell (2001) provided a synthesis of surveys of the New Zealand public's understanding of environmental issues. This comprehensive review of research up to 2001 includes references to surveys of perceptions, attitudes and values, of which a subset covers perceptions of invasive animals in New Zealand. Of interest is Bell's finding that although the most important environmental issues were water quality, general pollution, and air pollution, the impact of possums was also an issue of concern.

3.3 Overseas research

There is a significant body of research that shows considerable difference in attitudes to pest animals by species (Driscoll, 1995). This difference is seen most clearly in the ratings of the acceptability of certain kinds of animal control techniques. Where these techniques involve companion animals or large, attractive mammals, they have consistently been found to be less acceptable than the same activities when they involve rodents or non-mammalian species (Kellert and Berry 1981, Driscoll 1992, Furnham and Heyes 1993and). Driscoll's (1995) own research involved a survey of 133 respondents, who were asked to rate their attitudes towards 33 species of animals on six dimensions (useful–useless, smart–stupid, responsive–unresponsive, lovable–unlovable, safe–dangerous, and important–unimportant). From this research, Driscoll concluded that there are clearly popular and unpopular animals. Consistent with Kellert and Berry (1981), the most popular animals were large mammals, especially primates and companion animals, and the most unpopular animals were biting invertebrates (mosquitoes).

Fox (1990) argued that the (American) public's evaluation of different species of animals is based on:

1. The historical regard for the species

2. The species' utility to humans, and
3. Peoples' emotional reaction to the species.

Driscoll's research supports Fox's view and especially illustrates the importance of a species' emotional appeal. What the research is less clear on is how people form their attitudes toward animals. This is a gap in the literature that warrants further research.

Differences in situational contexts of people's interactions with wildlife have been shown to influence norms of acceptable management actions (Vaske and Whittaker, 2004). One concept used here is the 'wildlife acceptance capacity' (WAC) idea, which argues that a person's acceptance threshold (the maximum acceptable level of wildlife population in an area) is situation-specific and dependent on the severity of the human–wildlife interaction problem. These problems can be arranged along continua from 'nuisance' to 'economic' or 'aesthetic' impacts to 'health and safety' threats — the more severe the threats, the more likely urban residents will accept lethal methods for managing wildlife. For instance, Connelly et al (1987) found that suburban New York residents were more willing to accept aesthetic impacts of wildlife than health risks. The WAC concept was refined in 2000 (Carpenter, Decker, and Lipscomb) with a more complex view of tolerance, recognising that people perceive both positive and negative impacts associated with human–wildlife interaction, and that different stakeholders weigh the positives and negatives differently.

There is considerable evidence that urban residents have different attitudes to animals from those held by rural residents. For instance, Schofield (2005) researched attitudes to the reintroduction of mammals (wolves and beavers) around an area of the Scottish Highlands. Combining a survey of residents and interviews with key stakeholders, Schofield showed that membership of environmental organisations, urban residence, young age and a short period of time living in the area were associated with positive attitudes, whereas farming was associated with negative attitudes.

However, the picture is more complex than a simple urban/rural dichotomy suggests. For instance, Hauser (1962) argued that classifying all urbanites without regard to their rural origins ignored the cultural effects of rural life on recreation. A population of urbanites who grew up in rural areas should be more likely to participate in hunting, for example, than multigenerational urbanites, because of the rural cultural influences on hunting. Heberlein and Ericsson (2005) extended Hauser's logic to include attitudes toward hunting, wildlife, and wolves. This research examined whether the place where city residents grew up made any difference to their attitudes. Based on a national survey of Swedes, the research argues that multigenerational urbanites — those who were city-born of parents who lived in cities — have more negative attitudes toward hunting, and feel that wildlife is less important, in comparison to those with rural experience. Urban residents who had more contact with the countryside had more positive attitudes toward hunting, wildlife, and wolves. This finding is significant because as urban residents become further divorced from rural settings, support for wildlife, hunting and wolves may be expected to decline.

From our initial literature searching it is clear that there is a growing body of international research on attitudes to animals, wildlife, pests, and to particular pest species. However, within the resources available for this review, and the need therefore to prioritise Australasian work, we have only been able to canvass a limited range of the published international research.

4 Attitudes to particular species

While the number of original Australasian research publications on attitudes to pest animals remains small, some of the work is of high quality and provides a high degree of confidence that we understand particular kinds of attitudes, or attitudes towards particular kinds of animals, in depth. This includes work done on attitudes towards rabbits, possums and stoats, and their impacts. The sections covering these animals are comparatively large, reflecting the body of detailed research on public attitudes towards them. Other sections, some of which concern animals of greater interest to the IACRC, are necessarily smaller than those on rabbits, possums and stoats, but some of the principles learned in the

detailed research can be extended to (or at least used to form hypotheses about) attitudes to other invasive animals.

In this section, we focus mainly on studies of introduced animal species that are regarded as pests in Australia and/or New Zealand. Again, the reader should note that this review does not cover attitudes to the management of the particular pest or to possible control methods.

4.1 Foxes

In Johnston and Marks' (1997) survey of Victorians, 87% of the respondents classified the fox as a pest animal, with 53% believing that it should be eradicated, 26% believing that it should be controlled at low numbers, and 13% believing that it should be managed as a resource. Almost no respondents felt that no management action should be taken at all.

In Oliver and Walton's (2004) survey in Queensland, 5% of primary producers and 1% of town residents listed the fox as the pest animal causing them the 'most concern'. Concern was greatest in the south-west region of the state, and highest among sheep producers. In Finch and Baxter's survey of Queensland landholders (2005), 76% of the respondents felt that the fox was a significant or very significant pest, ranking it sixth out of the 14 listed animals in terms of seriousness. In FitzGibbon and Jones' (2006) survey of Brisbane suburbanites, 4% of the respondents indicated they particularly disliked having foxes in their local bushland, mainly because they threatened native wildlife.

Fisher et al (2006) conducted an internet-based survey of 506 members of the Tasmanian public and 40 farmers, on foxes. The purpose of the survey, commissioned by the IACRC, was to ascertain 'the views of the Tasmanian community about foxes, their presence in Tasmania and what, if anything, should be done about them' (Fisher et al 2006, p4). The limited results made available indicate that about three quarters of the respondents believe that foxes are present in Tasmania or have been at some stage. Over half the respondents believe that the introduction of foxes was accidental. Foxes are mainly seen as causing negative environmental and economic impacts, with over half the

respondents seeing them as a threat to wildlife, to farming, domestic animals, and as a potential tax burden. The greatest perceived benefit of foxes is as a biocontrol for other introduced animals (though only about 40% of the respondents noted this). Just over half the respondents indicated a clear concern about foxes becoming established in Tasmania; this concern is high compared with that for 12 other environmental issues listed. Note that because of the method in which the survey was administered (by the internet), the sample and the views obtained about foxes are not necessarily representative of the Tasmanian population.

4.2 Wild dogs and dingoes

The various surveys on pest animals indicate that wild dogs and dingoes are considered a serious pest by rural landholders/primary producers. For example, in Johnston and Marks' (1997) Victorian survey, 79% of the respondents classified wild dogs as pest animals. Consequently, 63% felt that wild dogs should be eradicated, 20% that they should be controlled at low numbers, and 6% that they should be managed as a resource. Few respondents (4%) felt that no management action should be taken at all.

In Oliver and Walton's (2004) Queensland survey, 33% of the primary producers selected wild dogs/dingoes as the pest animals of most concern. However, the town residents were more concerned about domestic dogs than wild dogs (10% concerned compared with 3% for wild dogs). Wild dogs/dingoes were seen as the worst pests by those in the south-east and central-west regions of the state, and were rated the worst pest by stock farmers.

In Finch and Baxter's (2005) survey of Queensland landholders, 82% of the respondents felt that wild dogs/dingoes were a significant or very significant pest, ranking them forth out of the 14 listed animals, in terms of seriousness. In FitzGibbon and Jones' (2006) Brisbane survey dogs were among the species that people particularly disliked in their local bushland.

Russell (2006) conducted a small phenomenological study of the problem of wild dogs attacking sheep. Because dog attacks seem to be concentrated in specific

locations (perhaps because of factors such as topography and proximity to bush), some farmers experience repeated attacks while their neighbours do not. This results in different perceptions of the scale of the problem, depending on whether one is an affected grazier, a less-affected or unaffected neighbour, or a local officer of a government agency. Pastoralists who spoke to Russell about dog attacks on their sheep talked of not being believed, not only by officers of government agencies, but also by their neighbours. This suggests that calls for more control for wild dogs are unlikely to be widespread. This lack of agreement on the scale of the wild dog problem (and how to manage it) is compounded by the desires of various agencies to protect dingoes. Public perceptions of dingoes are further complicated by the national and sometimes international interest in the small number of cases where a dingo is believed to have attacked humans.

In Franklin's (2007) nationwide survey of Australian's attitudes to animals, 46% of respondents said they were 'very anxious' or 'quite anxious' about being attacked by dogs (not necessarily wild dogs or dingoes), while 61% said they actively tried to keep dogs out of their properties.

4.3 Mice and rats

Of the Australian multi-species studies outlined above, only Finch and Baxter's (2005) survey of Queensland landholders included a question on attitudes specific to mice and rats. In this study, 78% of the respondents considered mice to be a 'significant' or 'very significant pest', while 74% considered rats to be a 'significant' or 'very significant' pest.

Sheppard and Urquhart's (1991) survey of New Zealanders' attitudes to pests asked the respondents to rate the seriousness of rats as a pest species. Of the eight listed species, rats were thought by the public to be the least serious pest (42% rating them a 'serious' or 'very serious' pest), with the rating of seriousness generally being higher among older age groups. Mice were barely mentioned in an open-ended question about other pest species.

Fraser's 1994 survey of New Zealanders' attitudes to introduced animals asked about 'rodents'. When asked to indicate if they were a pest, resource or both, 97% of the respondents regarded 'rodents' as a pest, and less than 5% regarded them as a resource (Fraser, 2001). Furthermore, about 96% said they would not enjoy seeing rodents in a bush (forest) or high country setting.

4.4 Cane toads

Van Dam et al (2002) note that local Aboriginal people's perceptions of cane toads were investigated as part of an assessment of the risks of the animal to Kakadu National Park. In this case, the local Aboriginal people had accepted the toads' presence, and while noting some effects on their lives, saw no need to introduce control measures.

In Oliver and Walton's (2004) survey, 3% of the town respondents said that cane toads were the main pest of concern to them, and a further 4% mentioned cane toads in an open-ended question about other animals of concern. None of the primary producer respondents in the survey rated cane toads as a pest that concerned them. In FitzGibbon and Jones's (2006) Brisbane survey, 2% of respondents noted seeing cane toads in their local suburban bushland, while 3% reported that they did not like seeing cane toads in their local bushland.

Our literature search identified several reports that mention public antipathy for cane toads, concern about their impacts, and community involvement in control efforts (eg Taylor and Edwards 2005, Molloy and Henderson 2006), but did not draw on any systematic studies of public attitudes. In the area of animal–human relationships, Franklin (2007) noted that 37% of the respondents in his national survey encountered toads (mainly cane toads) on their properties, of whom 69% actively tried to keep them away.

4.5 Feral cats

Several studies have canvassed the public's opinion of the status of feral cats. For example, in Johnston and Marks' (1997) survey, the Victorian public appeared very united in their opinion that feral cats are a pest animal (96% of the respondents rating them as such), and the vast majority (84%) felt that they should be eradicated. Furthermore, 34% thought that domestic cats are also a pest, although 50% disagreed. Of the 14 animals listed in the survey questionnaire, feral cats were the most likely to be considered a pest.

In Fraser's (2001) survey of the New Zealand public, about 85% of the respondents regarded feral cats as a 'pest', about 2% as a 'resource' and about 5% as both pest and resource. In all, about 90% of the public considered feral cats to be a pest animal, the third highest pest rating of the 14 animals listed. About 93% of the respondents said they would not enjoy seeing feral cats when visiting the New Zealand bush or high country. In FitzGibbon and Jones's (2006) survey of Brisbane suburban residents, cats were among the animals that people most disliked seeing in their local bushland areas (as noted by 15% of the survey respondents in an open-ended question).

In Queensland, Oliver and Walton's (2004) survey showed that primary producers considered feral cats to be a minor pest, with less than 1% saying that cats were their greatest concern. Concern, while comparatively low, was more evident among horticulturalists and dairy farmers. Among the town residents, feral cats were seen as more of a problem, with 5% rating them as the pest animal of greatest concern. Of all the animals covered by the survey, domestic cats caused the most concern to town residents — 12% of the town residents rating them as their pest animal of 'most concern'. Finch and Baxter's (2005) survey of Queensland landholders revealed a different picture, with 85% of respondents rating feral cats a 'significant' or 'very significant' pest — ranking second in terms of perceived seriousness (after feral pigs).

4.6 Rabbits

Williams et al (1995) provide a series of best practice national guidelines for managing the agricultural and environmental damage caused by rabbits in Australia. Their work shows that various segments of the community see rabbits either as appealing characters from cartoons and literature, a commercial resource, a subsistence food source, an animal welfare concern, or a major pest. Some Aboriginal groups include rabbits as a major part of their diet and perceive them as an integral part of the land. The authors note that it is unlikely that these deeply held attitudes can be changed quickly.

Johnston and Marks (1997) found in their survey of the Victorian public that 95% regarded the wild rabbit as a pest animal, with 56% believing that it should be eradicated, 22% that it should be managed as a resource, and 19% that it should be controlled at low numbers.

In a telephone survey of 566 land managers in south-west Victoria, Australian Total Quality Research (2001) assessed attitudes of farmers toward the presence of rabbits on their properties. Respondents generally did not regard rabbits as wildlife that they liked to have on their properties, and few stated that it was good to have a few rabbits for shooting. However, they generally expressed a tolerance of the presence of small numbers of rabbits. The attitudes of landholders to rabbits can clearly be changed by the combination of extension, facilitation and the threat of regulation. Russell (1964), in a survey of 120 farmers in the Victorian Mallee, found that their fairly positive attitudes to controlling rabbit numbers could be transformed to strongly positive following an intensive rabbit eradication campaign.

In Oliver and Walton's (2004) Queensland survey, 7% of the primary producer respondents regarded rabbits as the animal pests of most concern to them (forth after dingoes, feral pigs, and kangaroos), with rabbits especially noted as a concern to horticultural producers (21%). Relatively few town residents (2%) rated rabbits as the pest of most concern to them. The authors also noted that only 48% of primary producers and 39% of town residents recognised that

keeping of rabbits as pets is banned in Queensland. Finch and Baxter (2005) found in their Queensland survey that 87% of landholders regarded rabbits as a significant or very significant agricultural or environmental pest species — second in significance among the 14 listed pest species.

Research carried out in Australia and New Zealand by Munro and Williams (1994) showed that rabbits were considered a ‘very serious pest’, and more serious than pests such as possums and wasps. But while the respondents considered rabbits a pest, they were much less likely to consider them a pest where they lived (that is, that rabbits are a national rather than a local pest).

The Roy Morgan Research Centre (1995) also surveyed the Australian and New Zealand publics’ attitudes to rabbits (as well as acceptable management regimes). The survey had a total sample of 1897, with 1537 in Australia and 360 in New Zealand. This survey found that the majority of Australians and New Zealanders perceived rabbits as a pest, and were aware that rabbits were a problem. Young people and women were the least aware of the rabbit problem. However, while the majority of the respondents see rabbits as a pest, nuisance, or vermin (52% of Australian respondents and 53% of New Zealand respondents), a number of people in both populations saw rabbits as ‘cute’, ‘cuddly’, and/or ‘furry’ (13% of respondents in Australia, 21% in New Zealand). The most common impacts of rabbits identified by respondents were damage caused to vegetation, and damage caused to the soil. The study concluded that ‘overall, there were only minor differences in the perceptions of rabbits and their effects between the Australian and New Zealand populations’. In this study, the difference in attitudes to rabbits between urban and rural respondents was not significant.

In New Zealand, the Parliamentary Commissioner for the Environment’s (1987) investigation into the proposal to introduce myxomatosis to control rabbits received 464 public submissions. These generally argued that New Zealand had a rabbit control problem, although there was a range of views about the extent and severity of the problem. A number of submissions did not think the rabbit problem in 1987 was as bad as it had been in ‘the bad old days’.

In the Sheppard and Urquhart (1991) survey, members of New Zealand were asked to rate the seriousness of rabbits as a pest for New Zealand. Of the 1000 respondents, 93% said rabbits were a serious or very serious pest, and the main pest out of the eight listed. Perceived seriousness did not vary much with age or sex of the respondent. About 12% of the respondents said there was a problem of rabbits where they lived, 89% felt the problem had increased in the previous five years, and 79% believed that not enough was being done to control rabbits.

In a 1994 national New Zealand telephone survey of just over 1000 members of the public by Fitzgerald et al (1996a), 95% of the respondents associated rabbits with both environmental and farm damage. Rabbits were primarily seen as a regional problem concentrated in the South Island. However, although neither the Fitzgerald et al research (1996a) nor the follow up study by Wilkinson and Fitzgerald (1998) was able to find clear agreement on the extent of the rabbit problem, it was identified that the public believed that scale of the damage caused by rabbits warranted a national response. Compared with possums, rabbits were seen as less of a personal concern and were considered more aesthetically appealing (Fitzgerald et al 1996a).

Wilkinson and Fitzgerald (1998) looked at public attitudes towards the rabbit calicivirus disease (RCD) using seven focus groups with the public and stakeholders, and a telephone survey of 600 members of the New Zealand public. Both research exercises covered attitudes towards rabbits. Almost all of the focus groups recognised that rabbits had some endearing features (such as being ‘soft’, ‘cuddly’, ‘cute’ and ‘fluffy’). Many participants talked about the cultural images and references to rabbits, and that rabbits were also seen as pets. Other focus group participants talked about rabbits as a resource — as a cheap source of food, a recreational resource, or an economic asset. However, focus group participants also recognised that rabbits were a pest that caused environmental harm and threatened the livelihoods of farmers. Some thought the rabbit problem was not as severe as others, and some thought it was a regional problem (in the South Island). In the attendant national telephone survey, most respondents

thought rabbits were a problem for New Zealand but this recognition did not necessarily translate into a personal concern.

Wayne Fraser's (2001) survey of public attitudes to introduced wildlife in New Zealand showed that rabbits are mainly seen as a pest, with about 96% regarding them as such. At the same time, 24% regarded them as a resource. Approximately 60% of the respondents said they would not be happy encountering rabbits in the high country or bush.

Anthony Fraser's (2006) review of research concerning public attitudes to vertebrate pests and pest control in New Zealand notes that the public carries both positive and negative views towards rabbits. Drawing on the focus group studies conducted by Fitzgerald et al, the author notes that, on one hand, rabbits are seen as 'cute and furry' (especially by females) and sometimes associated with cultural images such as the Easter Bunny (Fitzgerald et al 1996a, Wilkinson and Fitzgerald 1998). On the other hand, rabbits are very widely recognised as a pest that causes land, soil and vegetation degradation, and as a threat to the economic viability of farmers (Fitzgerald et al 1996a, Wilkinson and Fitzgerald 1998).

4.7 Feral horses

Dobbie et al (1994) provides an overview of feral horses in Australia, which occur mostly in the extensive cattle-raising districts of the Northern Territory and Queensland. The authors note that these horses are a complex management problem because, among other reasons, they are seen by different stakeholders as a pest that damages the environment (for the agricultural sector), and a commercial resource. In addition, animal welfare concerns influence acceptability of various management techniques.

In his PhD thesis, Ballard (2005) looked at public attitudes and issues around the management of feral horses in New South Wales (NSW). As part of this research, some 877 residents of the New England electorate were surveyed by post about their views. In terms of experience of horses, the survey responses indicated that:

- 67% of the rural respondents and 47% of the urban respondents had owned a horse at some time
- 14% of the rural respondents reported affiliation with a horse or equestrian association, compared to 6% of the urban respondents
- 48% of the rural respondents and 39% of the rural respondents reported having seen wild horses in Australia (although not necessarily live and/or in person).

In terms of beliefs about the impact of wild horses, the survey found that:

- the majority of the respondents recognised that wild horses are not native to Australia (although about 14% thought differently)
- just over half agreed that wild horses compete with native animals such as kangaroos, although a much higher proportion recognised that horses compete with farm animals for food
- over half agreed that wild horses cause damage to native trees (with small, but significant, differences in opinion between rural and urban residents)
- about 40% agreed that wild horses cause significant damage to soils (although about 30% disagreed).

When asked about their management preferences for wild horses in NSW, the clear preference (but not by a majority of respondents) was for them to be allowed in some national parks and to remain on private land, but in managed/limited populations. In general, this part of Ballard's study suggests that there are significant differences between rural and urban residents in NSW in terms of experience and beliefs about wild horses, and in terms of their future management.

In New Zealand research, Fraser (2001) asked survey respondents in 1994 about their views on feral horses. The survey responses revealed mixed attitudes about wild horses in the environment. For example, approximately 12% considered them to be a pest, 35% a resource, 37% as both, and 15% didn't know enough to judge. However, over 80% of respondents felt they would enjoy seeing feral horses in the bush or high country. With respect to a local problem (that of the

impact and management of wild horses in the Kaimanawa Ranges of central North Island), 7% preferred to see preservation of the horses rather than protection of native plants in the area, 30% preferred to see preservation of the plants rather than the horses, and 60% wanted preservation of both the horses and the plants.

4.8 Feral pigs

Choquenot et al (1996), in their comprehensive report on feral pig impacts and management in Australia, commented on community attitudes. Drawing on Tisdell (1982), they noted that pigs were considered by the community to be many things: an agricultural pest, an endemic and exotic disease hazard, an environmental liability, an export commodity and source of income, and a recreational resource. According to O'Brien (1987) and Izac and O'Brien (1991), these attributes can vary with location, time and observer perception, and in so doing give rise to conflict (although the feral pig's status as an agricultural pest was responsible for raising its profile initially). The multiple use of feral pigs leads to conflict in the rural community as well as in the general community. The authors note that the benefits from the 'wild boar' meat export industry and recreational hunting are attractive and appear to be a factor in people's control/management preferences for feral pigs.

In their Queensland survey, Oliver and Walton (2004) assessed the level of concern about feral pigs. Among the primary producer respondents, 16% said feral pigs were the main pest animal of concern (second only to dingoes and wild dogs), with concern being greatest in the north and central west regions of the state, and among sheep/beef farmers and croppers. In addition, over 16% of the primary producers reported they believed there had been a change in the distribution of feral pigs in the previous five years. In comparison, feral pigs were of little concern to the town residents that were surveyed. Finch and Baxter (2005), also in Queensland, found that feral pigs were seen by the landholders they surveyed as the most significant agricultural or environmental pest — 90% rating them as a 'significant' or 'very significant' pest. In a Victorian survey, while

respondents were not specifically asked about feral pigs, 7% identified them in an open-ended question as a pest species (Johnston and Marks 1997).

In his New Zealand survey, Fraser (2001) assessed New Zealanders' attitudes to feral pigs. Approximately 21% saw them as a pest, 35% as a resource, and 44% as both pest and resource, indicating that the respondents had 'some knowledge of their commercial use and economic value, as well as their recreational value to hunters', but not necessarily any particular aesthetic value (2001, p18).

Consequently, over half the respondents felt that feral pigs should be managed as a resource (rather than exterminated or controlled at low numbers). The respondents were evenly split on whether they would 'enjoy' or 'not enjoy' seeing feral pigs if visiting the high country or bush (both approximately 45%).

Internationally, Adams et al (2005) conducted a survey to ascertain perceptions of feral hogs in Texas in the United States. This survey, with 775 participants, showed that most respondents viewed feral hogs negatively (in terms of their impact on the landscape) rather than positively (promoting recreational hunting or providing some other kind of economic gain). Respondents talked about feral hogs as an agricultural pest (89% of respondents), an economic liability in terms of damage done to vegetation, soil, and property (50%), an environmental liability (45%), and a disease hazard (34%).

4.9 Feral deer

Finch and Baxter's (2005) Queensland survey mainly focused on landholder attitudes towards feral deer management. This involved a purposive sample survey of 583 landholders, with over 75% conducting some form of primary production on their land, and 65% of these having feral deer on their properties at least some of the time. Among the survey respondents, attitudes tended to be comparatively positive (and often utilitarian) towards wild deer. For example, 49% said they enjoyed having deer on their property, 64% saw them as a game species, 50% saw them as similar to native species, and 56% felt that it was important to maintain wild deer populations for future generations to enjoy. On the other hand, only 25% agreed that wild deer caused environmental damage on their property, 30% that they caused agricultural damage, 18% that they

significantly competed with livestock, 23% that they were a management problem, 39% that they were similar to other feral pests, and 35% said they did not like having deer on their property. It follows then that only 29% of respondents rated wild deer as a ‘significant’ or ‘very significant’ environmental or agricultural pest. The study indicates that among Queensland landholders with wild deer on or near their properties, deer are generally not regarded as a problem animal, and that there is little support for active control.

Similarly in New Zealand, Fraser (2001) found that approximately 44% of the public he surveyed regarded deer as a resource, 4% as a pest, and 50% as both pest and resource. Consequently, a clear majority (about 90%) felt that they would find pleasure in seeing deer in the wild, and that wild deer should be managed as a resource, rather than exterminated or controlled at low numbers. Nevertheless, 45% considered that the agricultural value of wild deer (as a source of stock for deer farming) was not an acceptable trade-off for their environmental impacts, while 42% believed it was an acceptable trade-off.

Our scan of the literature noted a considerable number of studies of public and stakeholder attitudes towards white-tailed and other deer in the United States and elsewhere; however, these were too numerous to review here.

4.10 Feral goats

Parkes et al (1996) provided a series of best practice national guidelines for managing the agricultural and environmental damage caused by feral goats in Australia. The attitudes of conservationists, animal welfare groups, commercial and recreational hunters, Aboriginal peoples and other interest groups were sought during the development of the guidelines. Most landowners and land managers viewed feral goats as pests and wished to remove them. They were supported in this view by conservation groups and major animal welfare groups. Some pastoralists saw goats as both a pest and a resource that could bring in extra cash. Many people who viewed feral goats mainly as pests preferred to eradicate them, though it was usually acknowledged that this is generally not achievable, and that control to low densities may be the only feasible alternative.

Opposition to the view of goats as pests to be eradicated or controlled came from some groups seeking to harvest the animals as a commercial resource. They argued that goats in the right place at tolerable densities should not be classed as pests. Others simply sought to harvest a resource while it existed, but did not oppose feral goat control. The multiple use of feral goats (as with wild deer and feral pigs) lead to differences of opinion within the rural and the general communities about the appropriate type and level of management.

Oliver and Walton's (2004) Queensland survey found that compared with other pest animals, feral goats provoked little concern among property holders. In New Zealand, Fraser (2001) found that approximately 27% of the respondents in his survey saw feral goats as a pest, 25% as a resource, and 45% saw them as both pest and resource—that is, they were seen in a similar light to feral pigs, horses and deer. Over half of the respondents felt that they would find pleasure in seeing goats in the wild. In terms of allocating pest animal control effort, the survey respondents regarded feral goats as having a much lower priority than other pest animals such as possums and rabbits. Preferences were for managing goats as a resource (43% of respondents), then controlling them at low numbers (36%) and, least favoured, exterminating them (15%).

4.11 Kangaroos

While kangaroos are native to Australia, there are widely differing attitudes towards them. In Victoria, Johnston and Marks (1997) found that 26% of their survey respondents regarded kangaroos as pests, with those with farming background more likely to consider them as such. A majority felt that some form of management of kangaroo was needed, with the most favoured option being to manage them as a resource (51% of respondents), followed by controlling them at low numbers (27%).

In Queensland, Oliver and Walton (2004) found that many primary producers regarded kangaroos and wallabies as pests—16% rating them as the pest animal causing them most concern, with concern being greatest among sheep and beef farmers (ie graziers). Town residents were far less concerned about

these animals, with just over 1% rating them as the animal of most concern. Finch and Baxter (2005) found that among landholders (in areas of Queensland where wild deer occur) 26% rated kangaroos as a significant or very significant pest, while 31% felt they were not a pest species at all.

Ballard (2005) looked at attitudes of people in six residential areas in coastal NSW where kangaroos are found⁵. Most of the respondents reported having quite close contact with kangaroos, commonly seeing them in their yards, in yards in their street, and in nearby empty lots. Generally, the kangaroos are reported as eating the grass or resting, and to a lesser extent eating other plants or drinking available water. Most of the respondents had moved into their area knowing that kangaroos already lived there, and most reported that, in retrospect, they would not have changed their decision to move to the area. In four of the six communities, the majority of the respondents felt that it was important to have the kangaroos in their area, and likewise they felt that the kangaroos should be able to roam freely. In most of the communities, the majority felt that dogs should be constrained (rather than the kangaroos) to prevent dog–kangaroo conflicts. The survey also revealed that, in these areas, a clear majority of the residents were concerned about the prospect of collisions between motor vehicles and kangaroos, even though the majority had never had such an accident. Threat of accident was seen as being best dealt with by erecting warning signs and implementing speed limits on local roads. In terms of perceived risks to the public, the survey respondents were more concerned about the possibility of motor accidents, snake bites, dog attacks, and people hurting wildlife than they were about possible kangaroo attacks. Likewise, kangaroos were not seen as presenting a disease risk. The majority of respondents felt that aggressive or problem kangaroos, if they occur, should be relocated away from the area rather than destroyed. When it comes to accommodating free-ranging kangaroos in the various areas, the most favoured option was to leave vacant lots in the neighbourhood as linking and kangaroo grazing space.

In general, Ballard (2005) noted that in almost all of the communities surveyed, in Kellert's terms, naturalistic, ecologicistic, moralistic and humanistic values tended

⁵ Details of the sample size were not provided by the author, except for one area.

to prevail. However, he noted that the various communities surveyed varied in terms of the residents' experiences, values, attitudes, and preferences with respect to kangaroos and their management. As FitzGibbon and Jones (2006) found in suburban Brisbane, most residents generally enjoy having and seeing native animals in their local environments. Franklin (2007) also found in his Australia-wide survey that, where kangaroos occur on or near peoples' properties, the majority of people (71%) either 'tolerate' or 'encourage' them in the area. In the same study, Franklin reported that the majority of people (60%) disagreed with the proposition that 'it is wrong to use native animals such as kangaroo and wallaby as food', which the author feels is indicative of 'a degree of ambiguity surrounding the position of native animals in Australia' (2007, p24).

4.12 Possums

Possums are native to Australia, however a number of Australian studies have identified that these animals can be a problem in leafy suburban areas. The situation is different in New Zealand, where the Australian brushtail possum was introduced to create a fur industry and has since become a major environmental and agricultural problem.

Johnson and Marks' (1997) survey of the public in Victoria found that a clear majority (73%) of the 822 respondents did not regard the brushtail possum as a pest, 10% thought it was a pest, and 17% were undecided. Also in Victoria, Miller et al (1999), in a survey of residents of suburban Melbourne, found that attitudes toward possums were spread evenly (26% positive, 37% neutral, and 33% negative). In this survey, greater knowledge about possums was correlated with holding a positive attitude toward them. Oliver and Walton's (2004) survey of primary producers and town residents in regional Queensland found that possums barely rated as a pest of concern (with less than 1% of the towns' folk and none of the primary producers rating them as the animal of most concern). In FitzGibbon and Jones' (2006) survey, possums were mentioned as an animal that suburban residents most like seeing in their local bushland, and unlike other native species, were not mentioned as causing problems. The published results of Franklin's (2007) nationwide survey of Australians' attitudes to animals indicate

that of the 58% of respondents who said they had had possums in their area, 53% tolerated them coming near the home, 26% tried to keep them away, and 20% encouraged them⁶.

There is a good body of work about public attitudes towards possums in New Zealand, where they are officially considered a pest. Fraser (2006) provides an overview of this research and notes that it reveals several coexisting perceptions of possums amongst New Zealanders. One view is that possums are an environmental threat; that is, they are perceived as a major pest, a destroyer of native forests and a threat to native birds and other biota (Fitzgerald et al 1994, 1996b). People are, however, uncertain about the extent and severity of the problems that possums cause (OPCE 2000). Another view is that possums are a commercial threat, being perceived as a risk to the farming industry because they carry bovine tuberculosis (BTb). While the possum as a BTb vector is national in scope, it is mainly seen as an issue for the primary sector. This perception is more likely to be held by farmers and primary production workers (Fitzgerald et al 1996b). Overlapping with both pest ‘images’, is the view that possums are a commercial resource. Regardless of the threats they pose, possums are also considered to be sentient beings and therefore deserving of humane treatment (Fitzgerald et al 1994, 1996b). The findings of some of the studies reviewed by Fraser (2006) are presented in more depth below.

Attitudes to the seriousness of the possum problem in New Zealand have remained fairly stable over the period 1990–2005. In 1990, 90% of people in Sheppard and Urquhart’s (1991) national survey of the general public considered possums to be a ‘very serious’ or ‘serious’ pest. In 1994, 93% of people considered possums to be a problem in New Zealand and 95% considered them to be a threat to native bush (Fitzgerald et al 1996b).

Fitzgerald et al’s *Public Perceptions and Issues in the Present and Future Management of Possums* (1996b) presents the results of a study of the social issues associated with, and public attitudes towards, the potential use of biological methods to control possums, and bovine tuberculosis in New Zealand

⁶ Calculated from Franklin’s table of results, rather than the text commentary.

(see also Fitzgerald et al 1994). The research involved 11 focus groups (with the general public and stakeholder groups) and a telephone survey of 1127 New Zealand residents, randomly selected. All the focus groups in this study saw possums as a major pest, a carrier of BTb and therefore an economic threat, and a destroyer of native forest and an unwanted nuisance, but some members of all groups also felt that possums are aesthetically attractive ('soft', 'cuddly' or 'fluffy', 'cute', 'nice brown eyes'). Beyond this, the image of the possum varied depending on the composition (and interests) of the group. For example, farmer/primary production groups mainly saw the possum as a BTb carrier and therefore an economic threat to themselves and to New Zealand; the environmental group saw it as a destroyer of native forest; and the production forestry group saw it as threat to forest production and therefore the economy. Some groups also identified possums as a source of fur, employment and income, or as a recreational opportunity, and others saw them as an animal out of control.

This focus group study also identified a wide range of perceived possum impacts. In all groups, the main impact of the possum was seen to be on the environment, although people were generally unaware of the scale and nature of the problem. As they learned more about the possum problem from their fellow focus group members and from information provided by the facilitators, the participants' perceptions of the animal became increasingly less favourable, and their level of concern increased. In general, the focus group research of 1994 found that most respondents believed that possums were a problem in New Zealand, and threaten the country's birdlife, native bush, and, to a lesser extent, overseas trade.

In the national telephone survey that followed the focus groups, Fitzgerald et al (1996b, 1994) found that a clear majority of respondents agreed that possums were a threat to New Zealand's native bush (95% of respondents), that possums were a problem in New Zealand (93%), that possums were a threat to New Zealand bird life (80%), and that possums carried bovine tuberculosis. The respondent's level of experience of possums did not appear to be closely related to the way the animal was perceived. The perception that possums are a threat to overseas trade seemed to be the best predictor of an overall negative perception

of possums (measured by disagreement with the ‘harmless’ and ‘native to New Zealand’ propositions, and agreement with the propositions that ‘possums are carriers of BTb’ and present various ‘threats to New Zealand’). A small minority of respondents (about 10%) thought that possums were ‘basically harmless’. While most respondents thought possums were a problem, a significant minority (35%) still thought they were ‘cute and fury’. Even though many respondents may have had favourable views of possums (in that they saw possums as basically harmless, cute, or native to New Zealand), most such respondents still considered possums to be a problem or a threat to New Zealand. Respondents’ attitudes to possums were found to vary significantly by gender (with males regarding them more negatively than females), and age (older people having more negative attitudes), by rural/urban residence, and occupation.

The Office of the Parliamentary Commissioner for the Environment’s (OPCE, 2000) *Caught in the Headlights: New Zealanders' reflections on Possums, Control Options and Genetic Engineering* explored the range of perceptions, views and values of the New Zealand public about the use of biocontrol methods to control possums, and included looking at attitudes to possums. This was done through a series of nine focus groups (including the public, Maori, and a range of particular stakeholders and interested parties) which were conducted and written up by Fitzgerald and Wilkinson. This research demonstrated that there is a range of different worldviews, paradigms (or frameworks of perception), values, and expectations around ‘pests’. This was evident in the kinds of criteria with which people made their assessments of acceptability of the animal and the control technology, the weighting given to different kinds of information, and the kinds of language and approaches to communication adopted. As a result, the OPCE report argues that addressing public concerns about biocontrol technologies for possums will require researchers and decision makers to recognise and take into account a broad range of factors — including: social, philosophical, ethical and economic aspects; the values and rights of tangata whenua (Maori); and the wider global contexts — in addition to the quantification of benefits and risks by science.

Finally, in a follow up to their focus group study for the OPCE in 2001, Wilkinson and Fitzgerald (2006) conducted a national level telephone survey of a representative sample of 1002 members of the New Zealand public to assess their attitudes to a range of possum control technologies, especially genetically engineered fertility controls. In the survey, 96% of respondents agreed that possums were a problem, and only 2% of respondents thought possums were not a problem. These findings are consistent with the researcher's 1994 research. Respondents were also asked to rate the extent to which possums were a problem in various domains. Only in one case — damage to New Zealand native bush and birds — did the majority of the respondents (87%) consider possums to be a problem. With respect to possum damage to overseas trade from BTb, and damage to people's gardens, respectively 44% and 25% rated possums to be a problem. In general, compared to the 1994 survey work, the 2001 survey found that the public still considered possums to be mainly an environmental problem, but that the perceived threat to agricultural trade was lower.

4.13 Stoats

Stoats are an introduced pest, and biodiversity threat in New Zealand. Fitzgerald et al (2002, 2005) reported on a two-phase study of New Zealanders' attitudes to stoats, their impacts, and the acceptability of various forms of stoat control. The first phase (qualitative research) involved seven focus groups conducted with members of the public and particular stakeholder groups. The second phase (quantitative research) involved a national telephone survey of 1002 members of the public.

The focus group study (Fitzgerald et al 2002) found that very few participants had any direct personal experience of stoats. Nevertheless, negative reactions to stoats were the norm among the groups. Stoats were described as 'tough little critters', 'hoha' (nuisance), 'koretake' (good for nothing), 'pest', 'killers', 'cute', 'unpleasant', 'ferocious', and 'nasty mongrels'. At the same time, some participants had a fascination and/or respect for stoats, describing them alternatively as 'beautiful', 'sleek', 'slender', 'agile', 'cunning', 'highly intelligent', and 'fascinating'. A few participants from different groups made statements such

as ‘I respect them, even though I have trapped and killed many’, or ‘pretty cool animal actually, amazing’, showing interest in, and even respect for, some of the traits that make stoats such effective killers, in particular their intelligence and tenacity. Some participants were clear that they had enmity towards the animal itself but were concerned about the effects of the stoats’ actions. When asked what they knew of stoats, these respondents talked about the damage that stoats are capable of, saying they are a biodiversity threat, ‘destructive’ and ‘kill for fun’.

What this research makes clear is that stoats both benefit and suffer from their association in the public’s mind with ferrets and weasels. The participants who saw ferrets as potential pets were more likely to see stoats in a positive light (and vice versa). In contrast, most participants had negative associations with weasels (and noted that the word has a pejorative meaning in everyday use⁷). In this regard, the use of these mustelid names within the English language has already helped shape people’s attitudes, although it was noted that the word ‘stoat’ was never used in the same way as ‘ferret’ or ‘weasel’. The fact that stoats and other mustelids are introduced animals in New Zealand was widely understood, and even in the groups where little was known about stoats, most individuals understood (or guessed) that mustelids were introduced for rabbit control. The knowledge that stoats were a deliberately introduced predator seems to strongly influence people’s negative opinions of them. Even where they had little direct experience of stoats, participants thought it was ‘obvious’ that stoats preyed on endangered wildlife, especially birds. They also were aware of the impacts of stoats on native fauna through media and education campaigns. A common thread coming through in these discussions was the difficulty in separating the impacts of each of the many introduced pests in New Zealand.

Fitzgerald et al’s (2005) survey of the public that followed on from the focus groups paints a picture of an animal that is regarded very negatively by the New Zealand public. This research found that attitudes towards stoats generally aligned with assumptions about their appearance or their character. Attitudes towards stoats differed between males and females, between urban and rural

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A teacher from the Women’s group noted the number of ‘nasty weasels’ that appear in children’s stories

respondents, and between those respondents who worked in agriculture and those that worked in other sectors. Comments on the stoat's 'character' tended to focus on the animal as a predator and hunter, and were negative in tone, as revealed in the use of the terms 'vicious', 'nasty', 'aggressive', 'killer', 'mean', 'sneaky' and 'cunning'. Just over 5% of the respondents noted that stoats eat birds, eggs, and other wildlife, or described the animal as a pest. On the other hand, 18% thought that stoats were 'cute animals', and 3% thought they were 'basically harmless'. Overall, 71% of the respondents said that stoats were a concern to them, with rural residents having a greater likelihood than urban residents of being concerned. In terms of perceived impacts, 97% believed that stoats were a threat to New Zealand's birdlife, and 91% believed that they were a problem for the environment.

4.14 Other species

Our scan of the literature revealed studies of attitudes to a range of other animal species, many of which are of little interest to the work of the IACRC. A number of studies, including some mentioned above, examine attitudes to native species that periodically cause problems in suburban areas or in agricultural areas. In Australia, these species include bandicoots, flying foxes and snakes. Elsewhere, the species include wolves, prairie dogs, beaver, elk, thar, chamois and hares. We briefly touch on two of these studies below.

Bandicoots

Fitzgibbon and Jones' (2006) survey of community attitudes towards wildlife among residents of suburban Brisbane showed that a small minority of residents (3%) disliked bandicoots, owing to the holes they dig in lawns and gardens in search of food, and their potential as vectors of ticks. In general, this research shows that even native animals that are not regarded as invasive may still be disliked by some people.

Flying Fox

Another of Ballard's (2005) case studies looked at flying fox management in NSW. In addition to conducting public and stakeholder discussion groups, he

surveyed 120 members of growers' organisations in NSW and 1588 members of the public living in three coastal zones of the state. The results indicate that the vast majority of growers and the public had heard of flying foxes and seen them in the wild; however, the growers were much more likely than the general public to have handled a flying fox (61% compared with 21%). Likewise, the growers were twice as likely as the public to report being woken up at night by flying foxes on their property (69% compared with 31%). Based on scores obtained from 19 attitude question items, Ballard concluded that the public respondents in each of the three coastal zones were generally positive towards flying foxes, with more positive attitudes indicated in areas where flying fox were less abundant. In comparison, the grower respondents generally had negative views of flying foxes.

The public respondents generally agreed that:

- flying foxes are intelligent animals
- they are a significant problem for the fruit industry in NSW
- they are important in NSW forest ecosystems
- they are threatened by habitat removal in NSW
- they should not be confined to zoos and reserves in the future
- government should subsidise fruit crop protection measures such as netting
- flying fox natural habitat and food sources should be replaced in order to protect commercial fruit crops
- flying foxes do not warrant special conservation status.

On the other hand, the public generally had mixed or neutral views on the benefits to humans from protecting flying foxes, on the banning of killing flying foxes, on the nuisance cost of having them in the environment, on whether they deserve to be protected from harm, and on whether they presented a significant disease risk to the public.

Ballard noted that the views of fruit growers and the public about flying foxes were different in key respects, most especially on directions to take in dealing with the impacts. He suggests that, while flying foxes are not generally considered attractive and are a problem for fruit industry, there is no clear public mandate for culling or increased conservation protection.

5. Overall, what do we know about attitudes to invasive animals?

This review makes it clear that attitudes towards invasive animals are inherently complex. This complexity exists because there are a number of dimensions along which attitudes are likely to vary. At one level, the attitudes within a given human population are likely to be segmented along conventional demographic lines, such as gender, age, and residence. Taking this segmented view, the review of the literature suggests the following patterns exist with attitudes to invasive animals:

- **Attitudes vary with age:** Older people are more likely than younger people to regard an animal as a pest, and to be a more serious problem.
- **Attitudes vary with gender:** Males are more likely than females to consider invasive animals a ‘serious’ problem, and more likely to support intervention and the use of lethal controls.
- **Attitudes vary with residential patterns:** Rural residents, who are typically likely to be involved in farming and other types of primary production, are more likely than urban residents to think that invasive animals are a ‘serious’ threat (especially to economic activity), and that the threat is more extensive. Rural residents are also more likely to support intervention and the use of lethal controls.

In addition to these conventional ‘market segments’, there is also a situational element influencing attitudes. As well as varying according to different sections of society, attitudes towards invasive animals also vary according to the species involved and the situation being assessed. In general:

- **Attitudes vary with species:** Animals that are capable of being (or are) companion animals or are large, attractive mammals, are considered more favourably than, for example, rodents or non-mammalian species, and attitudes to management and control activities vary accordingly. Although

smaller species of introduced wildlife are much more likely than the larger species to be seen simply as useless pests, there are clear differences in perceptions of smaller species. For instance, in New Zealand, rabbits are seen as less of a problem, and more aesthetically pleasing, than possums and stoats. Also, in general, species that are considered 'native' are thought of in more favourable terms than those perceived to be exotic or introduced.

- **Attitudes vary with situation:** Attitudes towards invasive animals vary according to both the scale and proximity of the problems they engender. Attitudes towards those species that are seen as a pressing national problem, or a pressing local problem, tend to be more negative than those that are seen as being less pressing, or farther from home. For instance, research into attitudes towards possums in New Zealand reveals concerns relating to both the perceived direct *and* indirect threat posed by possums. Likewise, rural people generally see animals that compete with farm production and rural livelihoods as more of a pest problem than urban residents see them.
- **Attitudes vary with interest group:** Perhaps most obviously, different interest groups (such as people with ethical or conservation interests, animal industry practitioners, conservation groups, scientists and health professionals) have different attitudes towards invasive animals. These differences are interesting, however, because in some instances these groups do not disagree about the nature of the problem (that is, the pest status of the species) but disagree considerably on the cause of the problem and acceptable solutions. Much research into the communication of information about pest species and how to control them has focused on the way different interest groups interpret and make use of that information.

In addition to the demographic segments and situational influences outlined here, there is also a broader sociocultural context that influences attitudes towards invasive animals. This context can be thought of as the background to the

segmental and situational drivers outlined above, notwithstanding the role this background can play in subtly influencing those drivers. This background includes:

- **The role of culture:** Some research highlights the different attitudes held by indigenous people and the settler societies. For instance, in New Zealand, the research is careful to canvass the attitudes of tangata whenua (Maori, the indigenous people) as well as pakeha (Europeans). However, as Australia and New Zealand become increasingly multicultural, it is likely that attitudes towards invasive animals are becoming more diverse. This is because certain species of animals are seen as companion animals in one culture but as pests and/or food in other cultures. Equally, different cultures tell different stories about animals, creating culturally specific archetypes that influence attitude formation. So far, there has been little Australian research focused on cultural attitudes to pest animals.
- **The role of social change:** There is a school of thought that argues attitudes towards animals and the environment change as societies become more affluent. This shift into what are known as ‘post materialist’ values sees people’s attitudes towards the environment (and animals) becoming less traditional (ie more ‘protectionist’ and less ‘utilitarian’) as their society becomes richer.
- **National differences:** This summary has outlined a number of factors that seem to influence attitudes towards invasive animals. However, much of the attitude research has been carried out in the United States and not Australasia. The assumption that similar patterns will be found locally is challenged by a number of local researchers who note some of those patterns (such as the split in rural and urban attitudes) is less apparent locally than in the United States research. The potential impact of these national differences suggests all generalisations about attitudes towards invasive animals need to be treated with caution.

With all of these caveats in mind, the studies covered in this review suggest that attitudes towards invasive animals vary among segments of the population, in different situations, and within broader social contexts. The research is clear that these differences are significant because, often, there is no simple way to resolve them. In other words, these competing attitudes are incommensurate. For instance, a species of animal that is regarded as a pest by one segment of the population might be seen as a valuable economic and recreational resource to another, and as a sentient creature that has a right to be treated humanely by yet another, or as a native animal that has more (ecological) rights than an introduced animal. Moreover, an individual might hold two or more of these attitudes simultaneously, all the time knowing that they conflict.

Attitudes to invasive animals are generally not held in isolation, but in the context of a range of other attitudes around invasive species, and especially proposed ways of managing the different species and their impacts, and the technologies to be employed. However, attitudes towards management and control of invasive species lie outside the scope of the current review.

6. General observations

Keeping in mind that this review of the research into attitudes to pest animals and their impacts has not attempted to be exhaustive, several features of the available Australasian literature can be discerned:

- The research is generally split between, on the one hand, more academic work focusing on underlying public and stakeholder value sets with respect to wildlife in general or particular species, and on the other, baseline attitudinal studies conducted as part of policy and program planning for pest management, or to understand particular problem situations. Consequently, approaches, methodologies, and attitude measurement tools vary considerably.

- The research has been patchy in geographical terms, making it difficult to get a national-level picture of attitudes to pest species. For instance, in Australia there appears to have been few, if any, national-level studies (even at the single species level), and there appears to have been little if any systematic attitudinal research done in Western Australia, South Australia, the Australian Capital Territory, and the Northern Territory. Elsewhere, most studies have been generally confined to particular stakeholder groups, sections of the wider population (such as primary producers), and/or residents of particular regions, districts or types of neighbourhood.
- Within these various studies, attitudes to a wide range of introduced and indigenous animal species have been canvassed, and it is possible to discern some patterns of attitudes from these. Mostly commonly, the studies indicate the extent to which particular populations or groups consider various animals to be pests, and the level of concern held about them. However, apart from a few notable exceptions, most studies have not involved a structured and in-depth examination of people's knowledge, experience, perceptions, beliefs, and value sets of the various pest species.
- There appears to have been little research done on attitudes to the actual or claimed impacts of pest animals — understanding these attitudes is important if a public mandate for interventions on particular species is being sought.
- Most studies seem to have been ad hoc and not part of a systematic or sustained program of research which might otherwise enable development of the field and improvement of research methodologies. It is not surprising, then, that a number of the available studies do not seem to be explicitly informed by attitude theory or the emerging field of the human/social dimensions of wildlife. In addition, they generally do not seem to have use of preceding Australasian research efforts.

Despite these various limitations, which are by no means universal, the available research studies reveal some of the subtlety, multidimensionality, motivational complexity, and situational factors in people's attitudes to pests and other animals. Where there are limitations, they can be largely attributed to the newness of the field and the relatively recent recognition of the importance of the need to understand the human factors in pest and other wildlife management.

Based on these observations, we recommend that a national-level survey of the Australian public's attitudes towards and understandings of the main invasive animals be undertaken. We also recommend that a review of the literature on social attitudes to pest control methods be done to complement the current review.

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