

Brushtail Possums: “Champion of the suburbs” or “Our tormentors”?

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ABSTRACT

The common brushtail possum *Trichosurus vulpecula* poses a test for managers of urban wildlife because community attitudes towards the species vary widely from those who are prepared to live with it to those who wish it to be controlled as a pest. The New South Wales National Parks and Wildlife Service has the responsibility for protecting possums throughout the state. This raises three issues for review: 1. what is the conservation status of brushtail possums in both urban and non-urban areas of New South Wales?; 2. what is the extent, location and nature of the problem in Sydney?; and 3. how appropriate is current NPWS policy and management practice? The solution to the conundrum will require improvements to management strategies, further research and sustained education programs.

Key words: Brushtail possum; management; New South Wales; pest; policy; translocation.

Introduction

Our title was derived from two quotes that have been used to describe the common brushtail possum *Trichosurus vulpecula*: “undisputed champion of the suburbs” (Van Dyck 1994) and “our tormentors” (Devine, *Sydney Morning Herald*, 21/01/01, in an article entitled “Playing possum has ceased to be a game”). These phrases reflect the problem in Sydney; on the one hand there is an appreciation of our urban wildlife and on the other hand there is a wish to control the possums’ nuisance behaviour by removing them. In Australian cities where the brushtail possum occurs, this animal is a common inhabitant of the suburban backyard, the house roof “playground” and the ceiling cavity nesting site. As such, it is considered a pest by many residents. This requires a response from the state’s native fauna protection agency, the NSW Department of Environment and Conservation (DEC), formerly the NSW National Parks and Wildlife Service, which is responsible for the protection and management of native wildlife in NSW. However the agency’s management practices are tested when community attitudes in support of removing the possums conflict with management practices based on animal welfare and a policy of “living with wildlife”. In urban Sydney, this raises three issues in relation to brushtail possum management that require review:

1. what is the conservation status of brushtail possums in both urban and non-urban areas of New South Wales?;
2. what is the extent, location and nature of the problem in Sydney?; and
3. how appropriate is current DEC policy and management practice?.

The use of “possum” and “brushtail possum” hereafter refers to the common brushtail possum unless otherwise stated.

History and conservation status

Australia has a long history of trapping and shooting brushtail possums. “Mooning” the Opossums was described in the 1909 definitive book on Australian animals (Lucas and Le Souëf 1909, p 97) as:

“The sportsman works round the tree so as to bring the opossum between his eye and the moon. Then, with the gun in one’s hand, one fully realises for the first time the meaning of the saying, “possum up a gumtree”.”

Opossums (a term used for both the common and mountain brushtail possum *Trichosurus caninus*) were claimed to be very abundant between 1860-1870 in the southern districts of NSW, but very few were left by 1903 (The Hon. A. Ross, NSW Parliamentary Debates on Native Animals Protection Bill. Hansard, 14 October 1903, p 3308). Although possums were becoming rare in southern NSW, “heavy hunting” of possums continued in the northern districts of the state (Geo. Wilcox & Co.’s Review, 3 September 1902, p 624).

Typically, 3,000,000 opossum furred skins were exported per year to London prior to 1891 (Poland 1892). Numbers of furred skins sold through Sydney markets from 1891-1899 ranged from 400,000 to 1,500,000 (from the Sydney Wool and Produce Journal and the Sydney Wool and Stock Journal). In 1908, 873,837 opossum skins were exported from Sydney (Lucas and Le Souëf 1909).

State-wide protection of possums began in 1912 in NSW (NSW Govt. Gazette, 1911). However, Birks (1921) recorded that “Opossums are being rapidly reduced, and in spite of their protection in NSW, do not appear to be holding their own”.

Brush-tail possums were introduced to New Zealand from Australia in the 1850s to establish an animal fur industry. They are now a major pest in New Zealand and the country spends about NZ\$50 million each year to diminish their impacts and a further NZ\$20 million on research (Montague 2000).

Common brush-tail possums are protected by the NSW *National Parks and Wildlife Act 1974*, but are not listed as a threatened species under the *Threatened Species Conservation Act, 1995*. In a review of the schedules of threatened species in 1992 (Lunney et al. 2000), the number of brush-tail possums in the state was estimated to be in the range of either "10,000 to 100,000" or "greater than 100,000" and the population trend was suspected to be declining.

The brush-tail possum has disappeared from more than half of its previous range across Australia and is now common only in Tasmania, Kangaroo Island and some cities. They have disappeared from the arid areas, but even in areas where they remain, such as in the coastal forests of south-eastern NSW, they are found only in low numbers. By contrast, they are common in urban areas where their populations raise different issues to those which arise when state-wide distribution is considered (Kerle 2001).

Biology in urban areas

Brush-tail possums have benefited in urban areas because of increased food resources from plantings (e.g. fruit trees, roses and ornamentals) in suburban gardens and household scraps. Urban areas also offer increased shelters, with den sites in buildings and in roof spaces. The urban environment probably also provides a refuge from bush fires. Given these resources, it is expected that breeding would be at near optimal rates and throughout the year (Bird 1997). However, in the urban environment, one could also expect an increase in mortality from impacts such as motor vehicles, dog and cat attacks and new diseases.

There are only limited data on the density of brush-tail possums in urban areas and this is an important population parameter needed for management purposes. We do know that they are common. For example, in a study in Adelaide, nearly half (45%) of the householders reported having possums on their property (Hill 1997, in prep).

Home ranges of brush-tail possums have been reported from a number of studies and vary considerably. In Launceston, mean estimated home range was 8.61ha for males and 2.03ha for females (Statham and Statham 1997). However, one male was recorded as having a home range of 42.07ha. Males travelled a mean distance of 411m per night, while females travelled a mean distance of 315m per night. Possums used between 1 and 17 different den sites, mostly associated with buildings. Twenty-eight percent of den sites were in trees, but these were used only occasionally. Individual animals were recorded alone more often than with other radio-collared possums. Den sharing occurred most frequently between mothers and their offspring. In Adelaide (Hill in prep), mean home range was 3.58ha for males and 0.3ha for females (2.17ha combined). This is equivalent to approximately 21 house blocks (of 1000 sq m). All radiotracked possums denned in the ceiling space or attic of a house and more than six trees were used within

their home range. In Sydney, the density of possums appears to vary between sites. Aldred (1979), in a number of 0.3ha parkland sites in the eastern suburbs of Sydney, caught between 6 and 24 possums at each site.

Thus home ranges can be small (especially for females) to quite large, but the average is likely to be about two hectares. Since home ranges may overlap and they can be quite small, the density of brush-tail possums is potentially high in many urban areas.

Problems and perceptions

Possums may cause a variety of problems for urban residents that result in requests for assistance or their removal. Some of the problems that have been recorded (e.g. Coombe 1996) are 1. noise in ceiling cavities and on roofs (the most common complaint); 2. damage to garden and household items; 3. faeces, which can contaminate driveways and water supplies where possums cross roofs with water collection facilities; 4. marking of ceiling den sites with urine, which causes internal stains, unpleasant odours and, in some cases, ceiling plaster collapse; 5. disturbance of other animals, particularly causing dogs to bark; and 6. neighbourhood disputes which arise when some people feed and encourage the presence of possums against the wishes of neighbours.

Hill (1997, in prep) found that 45% of properties in Adelaide reported the presence of possums, but less than 10% had possums denning in the ceiling cavity. Sixteen percent reported damage and eight percent had possums removed. Noise disturbance was the most common reason for removal. Most removals (76%) were made by residents; contractors carried out only 17% of removals and the remainder were made by animal welfare agencies and councils. Possums returned or new individuals immigrated in 59% of houses where possums were removed. Only 23% of residents considered possums to be a nuisance.

Questionnaire to pest control licensees, July 2001

A questionnaire was distributed to all DEC pest control licensees in July 2001 in order to assess the problems caused by possums in the Sydney region and to review the current policy condition which requires their release to occur within 50m of the capture site. Twenty-three out of forty replied to the survey. Pest controllers, who had up to 20 years' experience in dealing with possums as pests (Table 1), considered that complaints about possums were either staying the same (50% of replies) or increasing (33% of replies) (Table 2).

The most common reason for possums being removed by pest controllers was noise in the ceiling, followed by smell or damage in the ceiling and noise on the roof (Table 3). It was perceived that possums were entering roofs primarily by jumping from trees and climbing house structures (Table 4). The majority of possum removals were from residences, followed by businesses and schools (Table 5). Sick or injured possums were never (46% of replies) or rarely (38% of replies) removed by pest control licensees (Table 6). Female possums with young were sometimes (42%) or often (17%) removed by pest control licensees (Table 7).

Table 1. Number of years pest control licensees have been dealing with possums as pests.

Number years	n	%
0-5	10	43
6-10	3	13
11-20	8	35
>20	2	9

Table 2. Pest control licensees perception of the trend in the number of complaints about possums.

Do you think that complaints about possums are:	n	%
Increasing	8	33
Decreasing	2	8
Staying the same	12	50
Don't know	2	8

Table 3. Reasons possums are removed by pest control licensees on a scale of 1 to 5 (where 1 = rarely, 5 = often). Values under each column from 1 to 5 are counts of the total number of responses. Values under sum total are a sum of the number of responses multiplied by its weighting on the scale.

For what reasons are possums removed?	1 (rarely)	2	3	4	5 (often)	Sum Total
Noise on roof	4	2	4	3	5	57
Noise in ceiling	0	0	0	4	18	106
Smell/damage in ceiling	3	4	6	3	4	61
Damage to property (eg. Fruit trees)	8	5	2	1	0	28
Fear of possums (eg. Scratching or disease)	13	1	2	0	0	21
Other	3	0	0	0	2	13

Table 4. How possums are entering roofs on a scale of 1 to 5 (where 1 = rarely, 5 = often). Values under each column from 1 to 5 are counts of the total number of responses. Values under sum total are a sum of the number of responses multiplied by its weighting on the scale.

How are possums entering roofs?	1 (rarely)	2	3	4	5 (often)	Sum Total
Climbing telephone cables	6	6	4	3	1	47
Jumping from trees	0	0	2	8	14	108
Jumping from neighbour's roofs	5	5	3	4	2	50
Climbing house structures (eg. Pergolas)	2	0	6	3	12	92
Other	2	1	0	1	0	8

Table 5. Location of brushtail possum removals by pest control licensees on a scale of 1 to 5 (where 1 = rarely, 5 = often). Values under each column from 1 to 5 are counts of the total number of responses. Values under sum total are a sum of the number of responses multiplied by its weighting on the scale.

Are your calls to remove possums in:	1 (rarely)	2	3	4	5 (often)	Sum Total
Residences	0	0	1	0	23	118
Businesses	5	6	5	2	0	40
Schools	10	4	4	2	0	38
Hospitals	13	1	0	1	0	19
Community centres (eg. Church)	10	4	0	0	0	18
Public land (eg. Council reserve)	8	0	0	0	0	8
Other	2	0	0	0	0	2

Table 6. Number of pest control licensees that remove sick/injured possums.

Do you remove possums that are sick/injured?	n	%
Often	0	0
Sometimes	4	17
Rarely	9	37
Never	11	46

Table 7. Number of pest control licensees that remove female possums with young.

Do you remove female possums with young?	n	%
Often	4	17
Sometimes	10	42
Rarely	8	33
Never	2	8

Brushtail possums in Sydney

Possums are handled by a number of individuals and agencies in urban areas. The following data give an estimate of the number of possums moved around or trapped each year throughout the Sydney region.

NPWS

A statewide survey of NPWS regional native wildlife issues identified possums as a significant issue in all Directorates, accounting for a minimum of 510 officer hours annually.

Licensed pest controllers

In the year 2000, the 40 pest control licensees of Sydney trapped 786 possums across 191 suburbs (Table 8). Possums were trapped across all months of the year, with a peak of removals occurring in May-June (Figure 1). They were also trapped across 31 local government areas (LGAs) of Sydney, with more than 50 possums trapped in each of Ku-ring-gai, Hornsby, Woollahra, Willoughby and Sutherland LGAs (Fig 2).

Public removals

Individual residents can also be licensed by DEC to remove nuisance possums. The licences are issued from local offices, and because there is not a central register, the exact number of licences issued is unknown. However, as an example, the Bobbin Head office reported that it issued approximately 100 licences per year. Traps are available from some local councils and also from some equipment hire companies. Ku-ring-gai Municipal Council reported that about 100 residents hire their traps each year. Although the exact number of possums trapped by the public is unknown it is likely to be in the hundreds per year throughout Sydney.

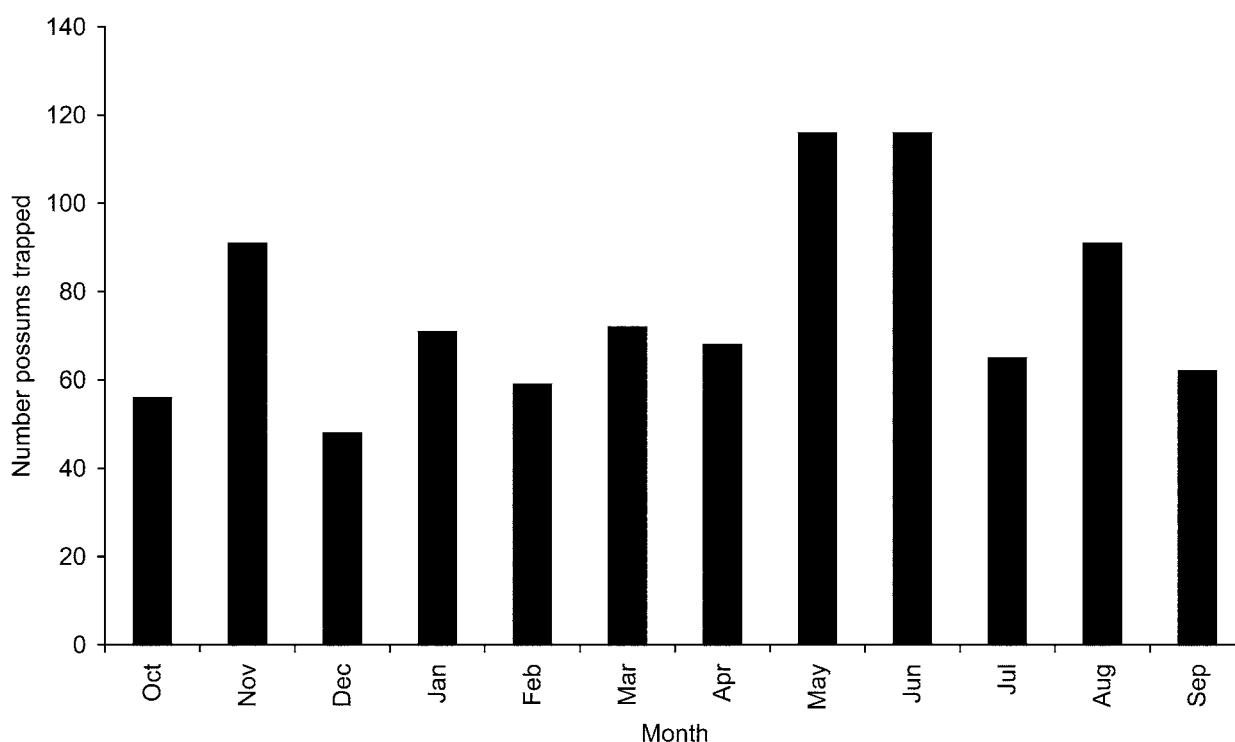


Figure 1. The number of brushtail possums trapped in Sydney by licensed pest controllers in each month during the reporting period 10/1999 to 09/2000.

Wildlife rehabilitation groups

Wildlife rehabilitation groups also rescue possums in the Sydney region. For example, the Wildlife Information and Rescue Service (WIRES) rescues about 1,000 brushtail possums per year (Table 9), many from an unsuitable environment or motor vehicle accident (Table 10). Approximately 20-30% of these possums die, a few remain in permanent care, but the remainder are released (Table 11). WIRES rescued possums from 219 suburbs in 2000, but 62% of these rescues were from just three local government areas; Warringah, Sutherland and Ku-ring-gai (Fig. 2).

Current management practice

Prior to 1998, DEC management practices included the recommendation that possums be released in native bushland within 8km of the capture site. Reviews conducted by Queensland and Victoria in 1997 identified that as relocated urban possums were experiencing competition with resident possums at bush sites they were unlikely to survive and recommended that all captured animals be released at the capture site. Consequently, in 1998 the NPWS changed its management strategy in line with Queensland and Victoria and required that possums be released within 50m of the capture site. "Possums in your roof?", a new NPWS information pamphlet detailing the change, was prepared at that time.

Members of the public are provided with the following information/advice/options by DEC:

- members of the public are informed that possums are native wildlife protected under the *National Parks and Wildlife Act 1974* and it is an offence to harm them (including trap) without an appropriate licence;

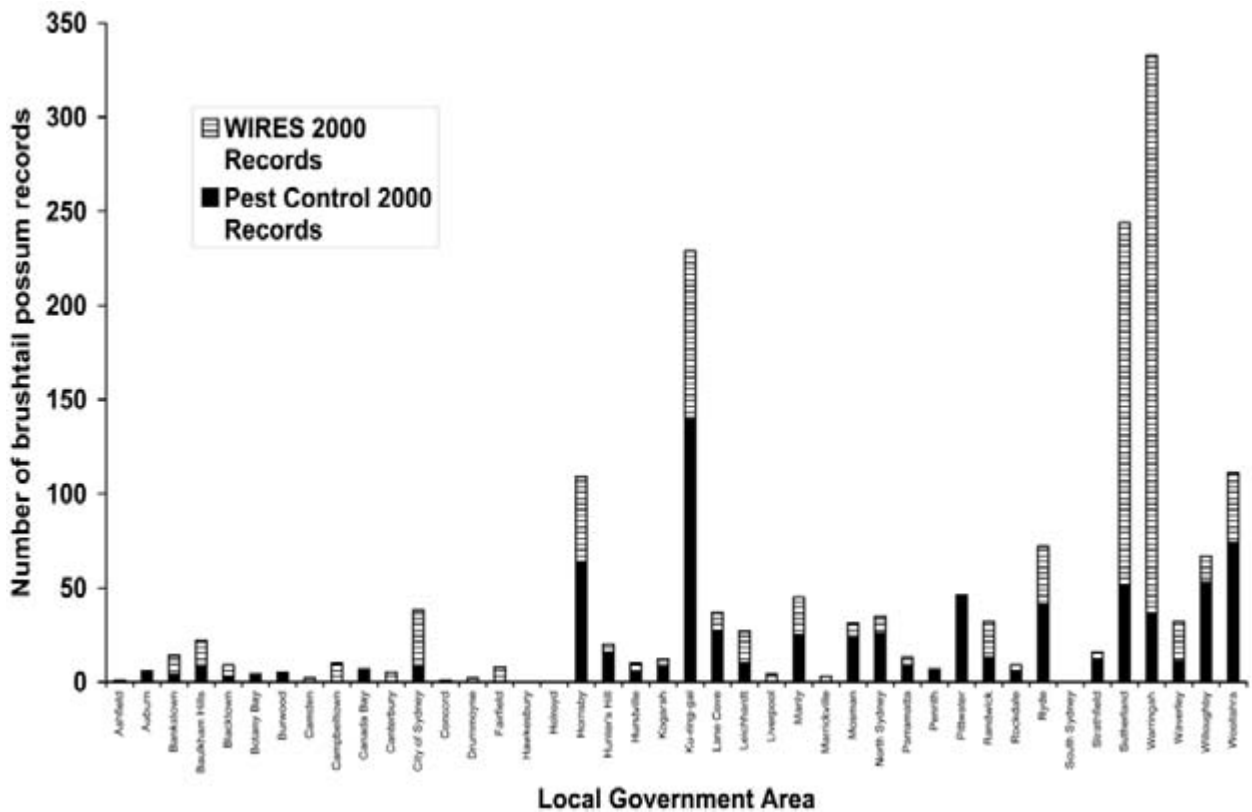


Figure 2. The number of brushtail possums trapped by pest control licensees and WIRES in Sydney Local Government Areas during 2000.

Table 8. NSW National Parks and Wildlife Service pest control licensee data.

	1999	2000
Number of active licensees	15	17
Number locations trapped	279	615
Number possums trapped	372	786
Number suburbs	132	191

Table 9. Number of possums taken into care by WIRES in Sydney.

Month	1999		2000	
	n	%	n	%
Jan	56	4	98	10
Feb	66	5	90	10
Mar	87	6	103	11
Apr	117	9	134	14
May	149	11	42	4
Jun	156	11	41	4
Jul	108	8	55	6
Aug	164	12	70	7
Sep	157	12	108	12
Oct	132	10	89	9
Nov	81	6	75	8
Dec	89	7	32	3
Total	1362		937	

Table 10. Reasons for brushtail possums taken into care by WIRES in Sydney.

CAUSE	1999		2000	
	n	%	n	%
Unsuitable Environment	181	13	151	16
Motor vehicle	138	10	92	10
Disease	71	5	64	7
Dog attack	35	3	29	3
Cat attack	24	2	26	3
Fallen	88	6	69	7
Unknown	714	52	404	43
Other	111	8	102	11

Table 11. The fate of brushtail possums taken into care by WIRES in Sydney.

FATE	1999		2000	
	n	%	n	%
Number died/euthanased	248	18	267	28
Number released/relocated	232	17	242	26
Long-term rehab/permanent care	5	0	2	0
No fate/unknown	718	53	242	26
Other	159	12	184	20

- members of the public are provided with information on possum ecology to help them understand the problem they may be experiencing;
- members of the public are advised on how to reduce human/animal conflict without harming either, e.g. blocking entrances into roof cavities, trimming overhanging tree branches and erecting a nest box on the property;
- a s121 (Occupier's) Licence may be issued to members of the public to capture urban possums that are a nuisance in homes and buildings. These licences are issued from regional offices at the discretion of staff and do not have consistent conditions attached, but they should note that possums must be released within 50m of the capture site. There has been no requirement for a report of activities under these licences;
- wildlife care groups (e.g. WIRES) will assist with injured animals and may assist in trapping problem animals;
- in extreme circumstances, where the resident cannot release the animal on the property, the licence may permit the possum to be euthanased by a veterinarian at the expense of the licensee;
- members of the public are provided with information on where to hire traps for capturing possums or with contact details of pest controllers who have licences to capture possums for the public;
- s120 (General) Licences are issued by the Wildlife Licensing Unit, Head Office to pest controllers to capture urban possums and contain the following conditions:
 - report of activities under the licence must be provided to DEC prior to licence renewal or upon licence termination;
 - traps must be set in a stable, level and protected position;
 - possums must be live-trapped, provided with food and water and not left in traps more than 24 hours. Traps must be checked before 10:00 am, except where temperatures will exceed 30° C [then traps to be checked earlier to prevent heat stress];
 - following capture possums must be removed from the roof cavity in the trap and transferred to an appropriate container provided with food and water and adequate ventilation and shelter;
 - possums must be released unharmed after sunset on the property or within 50m of the property on which it was captured.

Public response to current policy

There is much public objection to the 50m rule, and the issue has been captured by the press. Miranda Devine (*The Daily Telegraph*, 21/02/01) commented that, “desperate people will do anything, and the kitchen stove is within the 50m possum zone of most suburban blocks”. This line was captured by the *Sydney Morning Herald* on 7/04/01 with the headline “The possums are stirring –

time to add the hoisin sauce”. This article declared that “The National Parks and Wildlife Service has ridiculous rules about dealing with possums, as if they were some rare, vanishing species instead of teeming suburban pests. If you trap one, you must release it no more than 50 metres away, provide comfortable alternative accommodation and offer it counselling”.

These sentiments are also echoed by the public who pay to have their possums removed. In our questionnaire to pest control licensees, most reported that their clients objected to the 50m rule for release (67% of replies); only 29% were satisfied with this condition (Table 12). Some clients (8%) were not aware of the 50m rule (Table 13). When asked whether pest controllers thought that the 50m rule was successful at removing the possum problem, only 28% stated that it was mostly successful. Most thought that it was sometimes successful (48% replies) and it was not uncommon to revisit places to remove possums, while 24% considered it to be rarely successful, in most instances having to revisit places to remove possums (Table 14). Forty-two percent of pest control licensees erect possum boxes as part of their service (Table 15) and most (74%) were willing to participate in a monitoring program on relocated possums (Table 16).

Translocation studies

If brushtail possums were to be translocated, what would be the impact? Radiotracking and marking studies of translocated brushtail possums have been carried out in the eastern suburbs of Sydney (Aldred 1979), in the Dandenong Ranges 40 km east of Melbourne (Pietsch 1994), in Launceston (Statham and Statham 1997) and in Adelaide (Hill in prep.). Similar studies of ringtail possums have been carried out in Ku-ring-gai Chase National Park, Sydney (Augee et al. 1996) and Coranderk Reserve, Healesville (Shaw 1979). Each of these studies has come to similar conclusions.

Table 12. Client opinion of the 50m rule for release of brushtail possums, from a survey of NPWS pest control licensees in July 2001.

Do your clients have an opinion on the 50m rule?	n	%
They object	16	67
They are satisfied	7	29
They have no opinion	1	4

Table 13. Client awareness of the 50m rule for release of brushtail possums, from a survey of NPWS pest control licensees in July 2001.

Are your clients aware of the 50m rule for release when you remove the possum?	n	%
Yes	24	92
No	2	8

Table 14. Pest control licensees perception of the success of the 50m rule for removing the possum problem.

Do you consider the 50m rule to be successful at removing the problem?	n	%
Mostly - I rarely need to revisit places where possums have been removed	7	28
Sometimes - It is not uncommon to revisit places to remove possums	12	48
Rarely - In most instances I have to revisit places to remove possums	6	24

Table 15. Number of pest control licensees that erect possum boxes.

Do you erect possum boxes as part of your service?	n	%
Yes	10	42
No	14	58

Table 16. The willingness of pest control licensees in participating in a monitoring program on brushtail possum relocations.

Would you be willing to mark possums (eg. By bleach on the fur) as part of a monitoring program on brushtail possum relocations?	n	%
Yes	17	74
No	6	26

Effects of handling

Aldred (1979) and Augee *et al.* (1996) examined the effects of handling on brushtail and ringtail possums respectively by comparing possums caught or hand-reared and relocated to possums caught and returned to the same area. In both studies, wild-caught possums returned to the same site survived better than relocated possums. Further, Augee *et al.* (1996) found no difference between hand-reared and relocated possums.

Site fidelity

No brushtail possum ($n = 4$) returned to its former home range in Launceston after being translocated approximately 5 km away (Statham and Statham 1997). In Sydney, 17% of possums relocated within 1-4 km of their former home range returned, while no animals relocated greater than 5km returned (Aldred 1979).

Survival

In all studies, most translocated possums emigrated from their release site and had a low or reduced survival rate. In Sydney, translocated possums showed a sudden and dramatic emigration, with 87% of possums emigrating within two days. A greater proportion of males emigrated, and more rapidly, than females (Aldred 1979). In the Dandenong Ranges, translocated possums rapidly disappeared following release (most within four days), with only 1 of 64 animals remaining more than 10 weeks (Pietsch 1994). Eight of 12 radio-collared possums died, seven of these within the first week after release. Survival was random with respect to sex

(Pietsch 1994). In Launceston, one of two males was killed on a road six weeks after release, the fate of the other was unknown. One female was tracked for 3.5 months, having moved 5.5km before the signal was lost (Statham and Statham 1997). In Ku-ring-gai Chase NP, relocated ringtail possums survived for an average of 101 days compared with 182 days for resident animals (Augee *et al.* 1996).

Behaviour

Translocated possums were observed significantly more often on the ground and more often travelling than resident possums. They also denned frequently on the ground (Pietsch 1994) which made them more susceptible to predation.

Causes of mortality

Predators (dogs and foxes), motor vehicles and nutritional stress were the most common causes of mortality. In Sydney, 15 possums were found dead with injuries consistent with those made by a dog (Aldred 1979). In the Dandenong Ranges, five mortalities were attributed to predation by canids, probably foxes, two were presumed to be related to stress (heat and nutritional stress), and one was attributed to a motor vehicle (Pietsch 1994). In Ku-ring-gai, most ringtail mortality (93%) was caused by predators; of these, 52% were killed by foxes and 29% by cats (Augee *et al.* 1996). In Launceston, one of four animals was killed on a road after release, the fate of the others was unknown (Statham and Statham 1997).

Population effects of removal

Following the removal of possums, immigration occurred over four weeks that completely offset the effect of the removal (Aldred 1979). Thus, neighbouring possums quickly replaced those removed.

Population effects of translocation

Pietsch (1994) found no significant change in the relative abundance of resident arboreal mammals following the release of 64 possums over 13 weeks.

The future: management, research and education

Given the results of these studies, the original intent of the 50 m rule, *i.e.* to release the possum within its home range, is unlikely to be changed although the distance may be revised. This creates a dilemma for future possum management and poses the question “what else can be done?”. There is scope for improvement to current management practice, and some suggestions are detailed below.

Potential for improvements to management

DEC could produce a Service policy and procedural guidelines on possum management to ensure the problem is addressed consistently across the state. This would entail the issuing of standard licences and attached conditions which should contain the following:

- provisions for translocation of an animal if it is in danger of harm, e.g. inappropriate habitat, presence of aggressive dogs, housing development;

- the condition on all s121 licences issued to members of the public that the licensee must return a report on the activity undertaken under the licence, e.g. date of any captures, species, release location and date, other techniques employed to reduce the problem and success of these measures;
- development and maintenance of records for the issuing and receipt of reports on all s121 licences issued by each regional office. This information should be collated annually and reviewed by the Coordinator Wildlife Management to assess the extent of the problem and the success, or otherwise, of the current management strategy. All licences should be issued through a single database that would be available to all regional offices to allow statistical analysis at any time.

Some of the recommendations of South Australia, which has adopted a “learn to live with brushtails” approach to management (Paton *et al.* 1996), could be considered for application in NSW. For example, the Fauna Management Coordinating Committee recommended that the South Australian “*National Parks and Wildlife Act, 1972* be amended to enable the trapping of brushtails for removal from roof spaces and release on the same property within 50 m of capture site without requirement for a permit” and “if brushtails cannot be relocated within 50 m of the capture site, a destruction permit must be sought from the Department of Environment and Natural Resources (DENR)”. One drawback to this approach would be that where no licences are required, there would be no feedback of information on trapping and possum activity. This would deprive wildlife managers of a useful database and a means of monitoring and assessing the issue.

Other management techniques have been described by Coombe (1996), including management techniques for dealing with trees near buildings, power lines, destroying scent, deterring possums from roof spaces inside houses, trapping, nest boxes and protecting plants.

Although brushtail possum management in New Zealand differs in many respects from the urban Australian situation, there is still much to learn from the extensive studies conducted in New Zealand and the success of their management strategies. The species in New Zealand is a vector of bovine tuberculosis (Tb), which poses a large economic threat to the dairy and beef industries (Montague 2000). There have been no cases of Tb occurring in brushtail possums in Australia, and given the length of time it has been in New Zealand, there is little concern that it will appear here (S. Hemsley pers. comm. Dec 2001, University of Sydney veterinary pathologist). Nevertheless, both wildlife managers and veterinarians need to remain alert to the small possibility of Tb arriving in Australia and infecting urban possums. Management in Australia may benefit from considering the health aspects of the possum population and from investigating or trialing possum management techniques successful in New Zealand, including trapping, chemical repellents and physical barriers (e.g. Montague and Warburton 2000). Humane pest control is an important consideration in these techniques (Littin 1999).

Potential research projects

Urban possums provide an ideal opportunity for research because they are a large marsupial, are located near many universities and research institutes and are sufficiently common to satisfy the requirements of standard experimental approaches (eg. Aldred 1979; Gresser 1996). The major interest groups are wildlife managers, population ecologists, marsupial biologists, wildlife carers, pest controllers, veterinarians, council officers and those interested in living with wildlife. Some suggestions for future research ranging from basic biology, population control and management techniques to social research include:

- assessment of population size and demographics of possums in urban areas;
- marking studies to determine whether trapped and released possums (to within 50m) return to the trapping site and are subsequently recaptured;
- monitoring animals released at sites other than the capture site, e.g. those under threat, or injured and rehabilitated, or orphans hand-raised by care groups;
- habitat use and habitat preference studies in the urban environment;
- health status studies of urban possums;
- feasibility study of a long-acting contraceptive implant, such as Deslorelin (manufactured by Peptech Animal Health Pty Ltd, Australia which has been successful in clinical trials on other marsupials), for population control;
- social research to include the positive values of brushtail possums as well as the problems encountered (e.g. Davies *et al.* 2004).
- development of a brushtail possum management strategy in conjunction with the major land owners / managers e.g. councils, state government departments, and community wildlife groups.

Education

The DEC promotes living with possums and suggests tactics that will make this possible, such as blocking access to roof spaces and encouraging the erection of nest boxes. The NPWS web site (www.nationalparks.nsw.gov.au) provides information that is readily available to the public, and is regularly updated. Further, up-to-date information could be provided to councils and veterinarians because they are often a first point of contact for public inquiries.

In July 1997, the Department of Natural Resources and Environment, Victoria, undertook an extensive education campaign on “Living with Possums”. Eighteen months later, in December 1998, they evaluated the impact of the education campaign by issuing a questionnaire to municipal staff, veterinarians, licensed wildlife controllers, nest box suppliers, trap makers or sellers and the RSPCA. The results indicated a significant lack of knowledge among veterinarians and municipalities of the legal position and rules outlined in the “Living with Possums” brochure (Temby undated). This highlights the need for sustained communication of information on this issue as well as exploring alternative approaches to management.

Miller *et al.* (1999) studied attitudes towards possums in the City of Knox, Melbourne. They found that members of the community generally had a poor knowledge of basic possum biology. Interestingly, they also found veterinary surgeons to have a poor knowledge of possum biology. They found that respondents with a high knowledge of possum biology had a more positive attitude towards possums than respondents with a comparatively low level of knowledge. This supports the need for ongoing communication and education programs on all aspects of possum biology, ecology, conservation and management.

Conclusion

From the welfare point of view, the 50m condition for release of possums is appropriate. However, it is recognised that this is unlikely to solve the nuisance problem for many people. Wildlife licences for control will deal with individual problems including euthanasia of possums. There should always be an option for the disaffected property owner who cannot resolve a possum problem by

simply releasing the animal within 50m. If relocation to a more distant location (i.e. over 5km) is not available, euthanasia of the animal causing the problem should be considered. Managing the balance between possum control, welfare and sound population management policies will remain a matter under regular review as possum populations change and society's values shift.

As wildlife managers, we do not have an estimate of the size or trends of the brushtail possum population in Sydney. Neither do we know whether the distribution of the problems reflects the distribution of possums. Further, while we have a reasonable estimate of the nature, extent and location of the problems, we do not have a corresponding measure of the aesthetic and other values that people place on having possums in their backyards. In this context, the opportunities for research are manifold and the outcomes would not only be of immediate benefit to wildlife managers but would also enable some basic biological questions to be investigated that would ultimately benefit marsupial conservation.

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References

- Aldred, J. 1979. Field experiments on population regulation in the brush-tailed possum, *Trichosurus vulpecula* (Kerr). Hons Thesis, University of Sydney.
- Augee, M.L., Smith, B. and Rose, S. 1996. Survival of wild and hand-reared ringtail possums (*Pseudocheirus peregrinus*) in bushland near Sydney. *Wildlife Research* 23: 99-108.
- Bird, P.L. 1997. A review of the ecology of the common brushtail possum *Trichosurus vulpecula* in south-eastern Australia. Pp. 4-10 in *The Common Brushtail Possum in South Australia*, edited by J.B. Paton, P.J. Alexander, P.L. Bird, F. Dal Piva, R.W. Inns, D.K. Kelly and R.F. Storr. Fauna Management Coordinating Committee, Departments of Primary Industries and Environment and Natural Resources, Adelaide.
- Birks, E.N. 1921. *Brief History of Wilcox Mofflin Ltd and Present Day Organization*. Radcliffe Press, Sydney.
- Coombe, G.N. 1996. Problems caused by common brushtail possums and management options. Pp. 32-4 in *The Common Brushtail Possum in South Australia*, edited by J.B. Paton, P.J. Alexander, P.L. Bird, F. Dal Piva, R.W. Inns, D.K. Kelly and R.F. Storr. Fauna Management Coordinating Committee, Departments of Primary Industries and Environment and Natural Resources, Adelaide.
- Davies, R. G., Webber, L. M. and Barnes, S. G. 2004. Urban wildlife management - it's as much about people. Pp. 38-43 in *Urban Wildlife: more than meets the eye*, edited by D. Lunney and S. Burgin. Royal Zoological Society of NSW, Mosmon NSW.
- Department of Natural Resources and Environment, Victoria. 1997. *Living with Possums*. Available at www.nre.vic.gov.au/animals/possums/index.htm.
- Gresser, S. 1996. Anti-predator behaviour of the common brushtail possum (*Trichosurus vulpecula*) at Burrendong Dam, New South Wales. Hons Thesis, University of Sydney.
- Hill, B.M. 1997. The ecology and management of the common brushtail possum in metropolitan Adelaide. Pp. 11-4 in *The Common Brushtail Possum in South Australia*, edited by J.B. Paton, P.J. Alexander, P.L. Bird, F. Dal Piva, R.W. Inns, D.K. Kelly and R.F. Storr. Fauna Management Coordinating Committee, Departments of Primary Industries and Environment and Natural Resources, Adelaide.
- Hill, B. in prep. The ecology and management of the common brush-tailed possum in the Adelaide metropolitan region. Draft MSc Thesis, University of Adelaide.
- Kerle, J.A. 2001. *Possums: the Brushtails, Ringtails and Greater Glider*. UNSW Press, Sydney.
- Littin, K. 1999. Research on humane pest control and new ideas about suffering. Pp. 108-12 in *The Use of Wildlife for Research*, edited by D. Mellor and V. Monamy. ANZCCART, Glen Osmond.
- Lucas, A.H.S. and Le Souëf, W.H.D. 1909. *The Animals of Australia. Mammals, Reptiles and Amphibians*. Whitcombe and Tombs Limited, Melbourne.
- Lunney, D., Curtin, A.L., Ayers, D., Cogger, H.G., Dickman, C.R., Maitz, W., Law, B. and Fisher, D. 2000. The threatened and non-threatened native vertebrate fauna of New South Wales: status and ecological attributes. Pp. 1-132. *Environmental and Heritage Monograph Series No. 4*. NSW National Parks and Wildlife Service, Hurstville.
- Miller, K.K., Brown, P.R. and Temby, I. 1999. Attitudes towards possums: a need for education? *The Victorian Naturalist* 116: 120-7.
- Montague, T.L. (ed.) 2000. *The Brushtail Possum. Biology, Impact and Management of an Introduced Marsupial*. Manaaki Whenua Press, Lincoln, New Zealand.

Montague, T. and Warburton, B. 2000. Non-toxic techniques for possum control. Pp. 164-74 in *The Brushtail Possum. Biology, Impact and Management of an Introduced Marsupial*, edited by T.L. Montague. Manaaki Whenua Press, Lincoln, New Zealand.

Paton, J.B., Alexander, P.J., Bird, P.L., Dal Piva, E., Inns, R.W., Kelly, D.K. and Storr, R.F. (eds) 1996. *The Common Brushtail Possum in South Australia*. Fauna Management Coordinating Committee, Departments of Primary Industries and Environment and Natural Resources, Adelaide.

Pietsch, R.S. 1994. The fate of urban common brushtail possums translocated to sclerophyll forest. Pp. 239-46 in *Reintroduction Biology of Australian and New Zealand Fauna*, edited by M. Serena. Surrey Beatty and Sons, Chipping Norton.

Poland, H. 1892. *Fur-bearing Animals in Nature and Commerce*. Gwney and Jackson, London.

Shaw, J. 1979. The introduction of captive hand-reared ringtail possums (*Pseudocheirus peregrinus*) into Coranderk Reserve, Healesville. *Australian Mammal Society Bulletin* 5(2): 27-8.

Statham, M. and Statham, H.L. 1997. Movements and habits of brushtail possums (*Trichosurus vulpecula* Kerr) in an urban area. *Wildlife Research* 24: 715-26.

Temby, I. Undated. Urban possum management in Victoria – a case study. Report to the Department of Natural Resources and Environment, Victoria.

Van Dyck, S. 1994. Brushtail business. *Australian Natural History* 24(8): 16-7.

QUESTIONS & ANSWERS

CILLA NORRIS: Chair of the Sydney Possum Advisory Committee with WIRES. One of the things, I think, that might be able to be done for the public is to improve the image of the brushtail possum. I mean, I have a vision of TV infomercials, “You, too, can have your own brushtail possum living in your garden, not on your roof”. That’s where they should be, and if there was a big campaign, seriously, to get them out of your roof and encourage people to have this lovely animal in their garden and watch it grow and things, I don’t know whether that could be done.

ALISON MATTHEWS: I totally agree. When I talked about promoting living with possums, I think aspects of their ecology are important. Interestingly, there has been a study in Melbourne which has shown that people who had a greater knowledge of brushtail possums also had a more positive attitude towards them. So that was a really interesting study, and so I think, yes, every aspect of possum biology is important in providing that information to the public.

GWEN PARRY-JONES: From Wambina Flying-fox Education and Research Centre. Just two questions; I’m not a possum person. How many babies do they have a year, first?

ALISON MATTHEWS: One to two. They can breed throughout the year. They have a peak of breeding in autumn and in spring.

GWEN PARRY-JONES: They can have two babies a year, right. Second problem: the 120 and 121 licence, what does it say on the licence that has to happen to these possums that are captured, and is there any central register where you can find out exactly where they go and what happens to them?

ALISON MATTHEWS: The 120 licences to the pest controllers are issued from head office. So they have a set of conditions. One of them is that they must report what possums they’ve caught and where they’ve caught them. They have the condition that they must release them to within 50 metres, and a few other conditions as well. The 121 licences to the general public are issued from regional offices, and each put its own conditions on it. They generally have the condition to release it on the property. They don’t have reporting, which is something that we want to do.

That’s why I mentioned in changing of our management, as we want to try and make it more consistent across the state. So this is one of the things that we need to do, so that licences that are issued by the regions come into head office into a central register; but also one of the conditions on the licence should be that they need to report on the possum that was trapped after it has occurred. If we can get that information as well, then we’ll have a much better grasp on the issue.

JANET UDEN: From Wildlife Ark. I live up on the Central Coast and I’m in a pole home, and we have visiting possums all the time. In fact, we have two types: the brushtail and the mountain. I’ve noticed in my observation of them that the babies seem to remain in the area and the adults move on, and that’s in both cases, both kinds. What happens to the adults, I don’t know, but the babies seem to occupy the space and the adults go onto another area. I don’t know whether that means that they’re going out there and being killed, but certainly the numbers have gone down and we’re left with the young ones. I just thought I’d let you know about that.

ALISON MATTHEWS: Thank you.

BRAD LAW: Thanks, Alison.