australian wildlife conservancy

AWC Submission to House of Representatives Standing Committee on the Environment and Energy

***Inquiry into the problem of feral and domestic cats in Australia*, July 2020**

Our organisation

Australian Wildlife Conservancy (AWC) is a national conservation organisation. Our mission is the effective conservation of Australia's wildlife and their habitats. **AWC manages 29 properties covering 6.6 million hectares** in WA, SA, NT, NSW and Qld – alone or in partnership with government agencies, Indigenous groups and pastoralists – for conservation outcomes.

Of particular relevance to the Inquiry, **AWC is a national leader in the establishment of feral cat-free areas, with a total of eight fenced areas and one entire island supporting populations of 15 nationally-threatened mammals**. We undertake extensive research on the ecology of feral cats, with a view to better controlling them in the broader landscape; and we are currently collaborating on work to develop gene drives for feral cat control.

Summary of key points

- Feral cats occur throughout the Australian mainland and on many islands.
- **Feral cats are a major and ongoing threat to Australian wildlife**, being the primary driver of extinction for Australian mammals.
- At present, there are no methods of direct control that can effectively, reliably and permanently eradicate feral cats from the Australian mainland or large islands, sufficient to restore threatened species.
- **Conservation fences are a proven effective means of permanently excluding feral cats**, when properly designed and maintained, allowing the conservation and reintroduction of native wildlife.
- **AWC is the leading proponent of the establishment of feral cat-free areas in Australia**, with a total of 8 fenced areas (and one island in its entirety) supporting populations of a total of 15 threatened mammal species. AWC is continuing to expand our network of fenced areas and the species protected by them. We have demonstrated the outstanding success arising from this network, with ongoing exclusion of feral cats (and other pests) and consequent recovery of many threatened species.
- Secure populations of threatened species established in fenced areas have the potential to seed releases to the broader landscape, provided feral cats can be effectively controlled outside the fence.
- **Gene drive technology has the potential for continental-scale control of feral cats**, but long-term research is required to develop and deploy gene drives safely and effectively.

Recommendations

The value of conservation fencing in effectively controlling feral cats and facilitating the recovery of threatened species should be recognised in the Commonwealth's Threatened Species Strategy, in Recovery Plans, in State Government regulations, and in the design and funding of specific conservation programs.

The **network of conservation fences (and feral cat-free islands) should expand** so that there are multiple secure populations of all species currently threatened by introduced predators.

Investment in developing more effective methods for the control of feral cats, and in potential long-term solutions such as gene drive, should increase, with the aim of safely returning threatened species to the broader landscape over the medium-long term.

Dr John Kanowski,
AWC Chief Science Officer
22 July 2020

Terms of Reference of the Inquiry

This submission provides a response to the five terms of reference highlighted below.

A.	***the prevalence of feral and domestic cats in Australia;***
B.	***the impact of feral and domestic cats including on native wildlife and habitats;***
C.	*the effectiveness of current legislative and regulatory approaches;*
D.	*the effectiveness of Commonwealth action and cooperation with states and territories on this issue, including progress made under the Threat Abatement Plan, national framework and national declaration relating to feral and domestic cats in Australia;*
E.	***the efficacy (in terms of reducing the impact of cats), cost effectiveness and use of current and emerging methods and tools for controlling feral cats, including baiting, the establishment of feral cat-free areas using conservation fencing, gene drive technology;***
F.	***the efficacy of import controls for high risk domestic cat varieties to prevent the impacts of feral and domestic cats, including on native wildlife and habitats;***
G.	***public awareness and education in relation to the feral and domestic cat problem; and***
H.	*the interaction between domestic cat ownership and the feral cat problem, and best practice approaches to the keeping of domestic cats in this regard.*

AWC's conservation fence at Mt Gibson, WA. The fence is 1.8 m high, with a floppy-top, two hot-wires, finer mesh on the lower half and a skirt at the bottom to keep out feral animals. This fence is over 40 km long and protects 7,832 ha from feral cats. AWC has reintroduced 8 threatened mammals to this fenced area.

Bridled Nailtail Wallaby, AWC's Scotia Wildlife Sanctuary. This species persists in one remnant population in Qld. AWC has reintroduced the species to feral predator-free fenced areas at Scotia and Pilliga (the latter in partnership with NSW). We plan to reintroduce it to Mallee Cliffs NP (in partnership with NSW) in 2021. photo: Wayne Lawler/ AWC.

Greater Bilbies, Scotia Wildlife Sanctuary. The iconic Bilby is currently protected in five of AWC's fenced feral cat-free areas. photo: Wayne Lawler/ AWC.

Numbat, AWC's Scotia Wildlife Sanctuary. The Numbat has contracted from much of the semi-arid region to two small populations in south-west Western Australia. AWC has reintroduced the species to feral cat-free area on Scotia, Yookamurra and Mt Gibson wildlife sanctuaries. photo: Wayne Lawler/ AWC.

Burrowing Bettongs, AWC's Scotia Wildlife Sanctuary. This species may have once been the most common marsupial in Australia. It has been completely eradicated from the mainland by feral cats and foxes. It has been reintroduced to feral predator-free areas on AWC's Faure Island, and Scotia and Yookamurra wildlife sanctuaries. photo: Wayne Lawler/ AWC.

AWC responses to the Terms of Reference

A.	The prevalence of feral and domestic cats in Australia

In our submission, AWC is mostly concerned with the prevalence, impacts and control of **feral cats**, reflecting the location of our estate, and our mission, and that feral rather than pet cats are the primary threat affecting biodiversity in Australian natural landscapes.

Feral cats are present across Australia, from the rainforest to the desert**, being absent only from areas fenced to exclude them**, and from some islands. AWC monitors population density on our properties: our data show that densities vary between habitats (being higher in grazed and recently burnt habitat, and lower in dense vegetation and rocky country, between properties (for example, higher on Cape York Peninsula than in the Kimberley) and between years, with high rainfall leading to substantial increases in cat populations (McGregor et al. 2014, 2015, 2017; Hohnen et al. 2016; Legge et al. 2017).

B.	The impact of feral and domestic cats including on native wildlife and habitats

Cats are the primary cause of mammal extinctions in Australia and a leading threat to remaining mammals (Smith and Quin 1996; Burbidge and Manly 2002; Woinarski et al. 2011, 2014; Fisher et al. 2014; Ziembicki et al. 2015; Doherty et al. 2017). Cats are particularly serious predators of small- to medium-sized mammals (native rodents, dasyurids, bandicoots and bettongs); nevertheless, mammals up to the size of small wallabies (~4 kg) are readily taken, as are juveniles of larger species (e.g., Abbott et al. 2014; Fancourt 2015).

Cats also prey heavily on rabbits and mice, where present: these introduced species can maintain cat densities at high levels, increasing rates of predation on native species (Smith and Quin 1996; Denny and Dickman 2010). We note also that there is no compelling evidence that feral cats can effectively reduce the population size of pest species such as rabbits and house mice at a landscape scale.

Although mammals are favoured prey of cats, a wide range of prey including birds, lizards, frogs and insects are taken (Denny and Dickman 2010; Doherty et al. 2015; Woinarski et al. 2017, 2018; Murphy et al. 2019; Woinarski et al. 2020).

Evidence shows that each feral cat typically kills numerous animals in a single night. Estimated consumption rates, based on inspection of the stomach contents of cats, are five to 35 animals killed per night (Read and Bowen 2001; Kutt 2012). Video footage collected on AWC sanctuaries in the Kimberley have shown that, on average, feral cats prey on seven native animals per 24 hours (McGregor et al. 2015). Based on the estimated population size of feral cats in Australia (Legge et al. 2017), it is calculated that **feral cats kill over 1 billion native animals** each year (approximately 460 million native mammals, 270 million birds, 466 million reptiles, and 92 million frogs: Woinarski et al. 2017, 2018; Murphy et al. 2019; Woinarski et al. 2020).

Feral cats are a major and ongoing threat to conservation of Australian wildlife, with estimated kill rates noted to be "substantially higher than … land clearing" (Murphy et al. 2019). The impacts are particularly severe for small- to medium-sized native mammals, of which 89 species are (or were) considered to be 'extremely' or 'highly' vulnerable to cat predation; in fact, 26 of these species are now extinct (Radford et al. 2018).

Primarily as a result of predation by feral cats (and foxes, in southern Australia), **vast tracts of the continent have lost most of their small- to medium-sized mammal fauna**. This has consequences, not only for the conservation of the affected species, but for ecosystem processes. Australian ecosystems have evolved in the presence of a

diverse assemblage of small- to medium-sized mammals, which participate in a number of important ecological processes including herbivory, seed and spore dispersal, soil engineering and predation (e.g., Eldridge and James 2009; Fleming et al. 2014). For this reason, **effective conservation in Australia means** more than converting tenure to the protected area estate – it means **active management of feral cats** and other introduced species, the restoration of ecologically-appropriate fire regimes, and – where feasible – the reintroduction and recovery to former abundance of regionally-extinct species.

E.	**The efficacy (in terms of reducing the impact of cats), cost effectiveness and use of current and emerging methods and tools for controlling feral cats, including baiting, the establishment of feral cat-free areas using conservation fencing, gene drive technology**

Direct control measures

On mainland Australia, **there are very few examples where direct control measures – baiting, shooting, trapping – have delivered a sustained reduction in feral cat numbers**, sufficient to enable a long-term response of increase in populations of threatened native species.

Eradication of cats, or suppression to very low levels, is required for the conservation of native species that are highly or extremely vulnerable to feral cats. There are numerous examples where predation by a small number of cats has caused the extirpation of mammal populations (Gibson et al. 1994; Burrows and Christensen 1995; Copley et al. 1999; Frank et al. 2014; Woinarski et al. 2014; Lollback et al. 2015).

The limited effectiveness of direct control measures is due to a range of factors, including:

- cat hunting behaviour - cats are live prey specialists, and will reliably take baits only when hungry, such as during drought conditions; they are wary and difficult to entice into traps;

- cat movement behaviour – in northern Australia, feral cats will travel considerable distances (>10 km) to hunt in recent fire scars (McGregor et al. 2016); in southern Australia, cats are capable of travelling very large distances (>100 km) in a few days to weeks (AWC unpublished data from Scotia and Pilliga, in south-west and central-west NSW, respectively) – this leads to rapid reinvasion of sites by cats from adjoining areas if control measures are discontinued or are too localised (Algar et al. 2013);

- cat breeding biology - cats have a high reproductive potential (females mature within a year and can bear up to three litters of kittens each year) – such that very high rates of control (c. >80% of population killed per annum), sustained over a lengthy period, are required to drive a population to local extinction. Even then, given cat movements, control needs to be implemented at a regional scale.

While there has been considerable effort devoted to improving cat baits (e.g., *Eradicat*, *Curiousity*, etc), whether the new baits can suppress cats enough to allow the long-term recovery/ reintroduction of vulnerable species has yet to be demonstrated; and is unlikely given the factors listed above. Baiting also has the potential for off-target impacts.

More recently, effort has been devoted to the development of automated cat killing devices (e.g., 'Felixer': Read et al. 2019); however, there is as yet no independent review of the efficacy of these methods. AWC supports investment into improving direct control methods, and will continue to collaborate with proponents on field trials. However, AWC does not consider these technologies are yet at a point where they can be confidently deployed to protect vulnerable native species from cats at a landscape scale.

Conservation fences

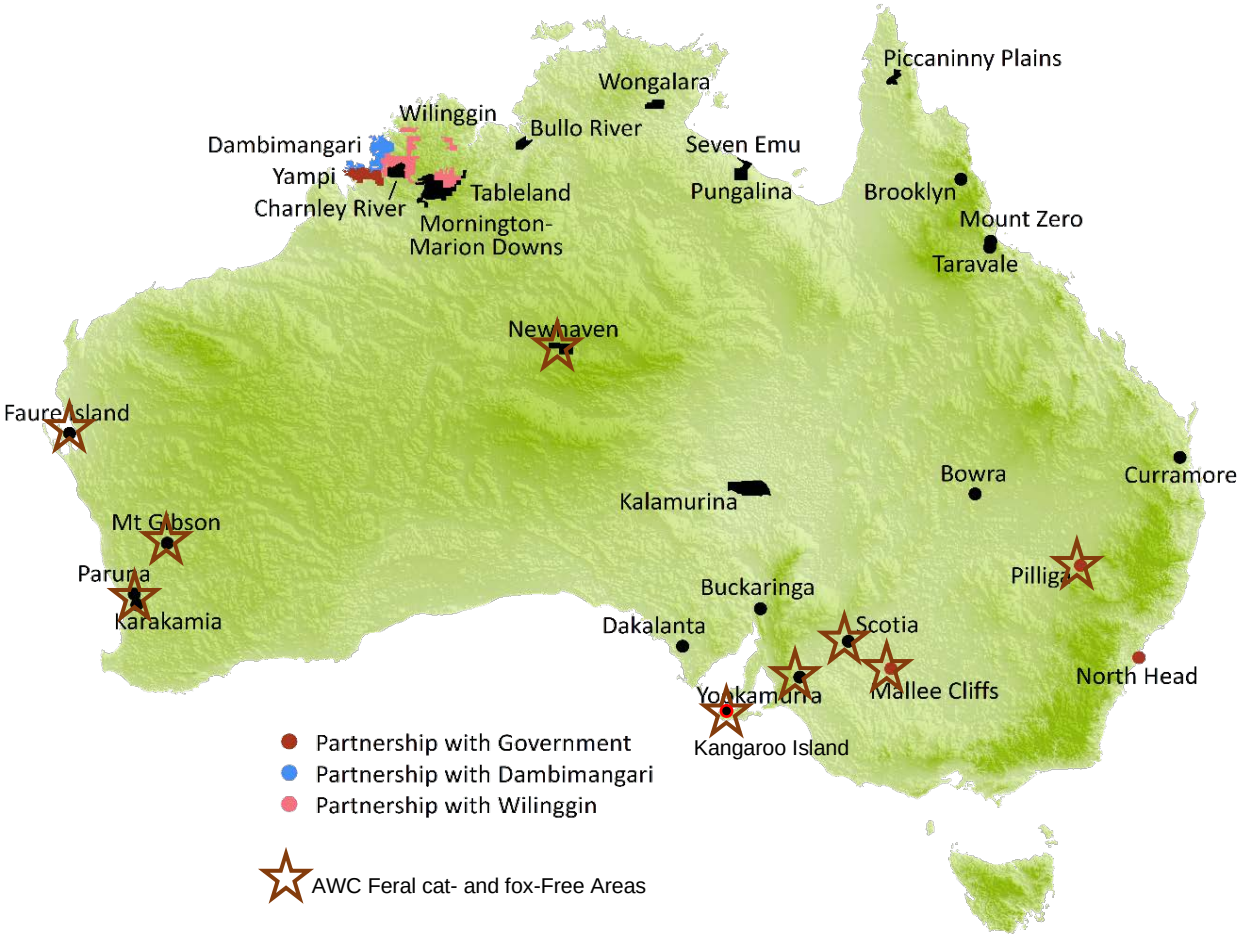
Well-designed and maintained conservation fences are highly effective in protecting and recovering small- to medium-sized mammals vulnerable to feral cats. Conservation fences are substantial pieces of infrastructure requiring careful planning and competent, long-term management, as well as scientific capacity for planning and managing populations/genetic integrity over the long-term. Fences have relatively high capital costs and up-front feral predator eradication costs, but modest running costs. Key points around the implementation of conservation fencing, the advantages and some disadvantages of this approach, are listed in Table 1, below.

Table 1. Conservation Fences: Implementation, Advantages and Disadvantages

Issue	Assessment
Time to construct	Typically, minimum of 3 years from initiation to feral predator-free status: 1 year for each of planning, fence construction and feral eradication.
Cost	Initial capital cost c. $50,000/km fencing, requires ongoing monitoring and maintenance (checking 2-3 times/week), fence material replacement after 20-50 years. Feral eradication from within the fenced area estimated to cost c. $400,000 for 8,000 ha (Ruykys and Carter 2019).
Effectiveness	Completely effective at excluding cats (and foxes) permanently if properly designed/maintained.
Advantages	**Efficacy** - at present, conservation fences area the only proven method for conserving and reintroducing species highly vulnerable to predation by feral cats on the mainland and large islands. **Security** - fences secure populations of threatened species, allowing more risky control measures to be attempted in adjacent areas 'outside the fence'. **Ecological understanding** - conservation programs associated with fences enable research on otherwise locally-extinct species and their ecological interactions; and allow for ready comparison of animal communities and environments with and without the distortion due to introduced predators. **Cost-effectiveness** - long-term cost savings, compared with on-going direct control. **No requirement for long-term poison baiting,** with its accompanying risks of non-target impacts. **Exclusion of other feral pests** (e.g., goats, donkeys) also excluded, with benefits to ecosystems. **Community engagement** – reintroduction programs in fenced exclosures allow the public to realise that Australian mammals can and should be abundant, and offer hope and a basis for a restored future.
Disadvantages	Scale - the largest completely feral predator-free fenced areas on the Australian mainland are 95 km^2. While large enough to support viable populations of many threatened species, and larger than many protected areas, nevertheless this is a tiny proportion of the Australian continent. Landscape suitability - limitations on fence construction in steep, high rainfall and/or flood-prone landscapes Connectivity - fences may constrain the movement of terrestrial species. Collision/entanglement - potential impacts on some birds and reptiles. Predator naivete - removes opportunity for populations to adapt to introduced predators, although (i) evidence that such adaptation may occur in vulnerable Australian species is extremely limited; and (ii) some animals in fenced areas can be exposed to feral cats to develop predator awareness (e.g. West et al. 2018) 'Overabundance' – in the absence of feral predators, native mammals may reach relatively high densities, with knock-on effects for vegetation/habitat. These issues appear mostly to be associated with small enclosures and arid environments. Densities in AWC large fenced areas generally appear similar to remnant 'wild' populations, and respond to resource availability (increase/decrease with rainfall, etc).
Regulatory	Fence clearing is subject to environmental impact studies, regulated by government agencies, who in some cases only consider potential negative impacts, rather than net benefit to the environment.

AWC has established a national network of feral predator-free areas to protect and restore populations of Australia's most vulnerable mammals. AWC began its program 25 years ago, when Martin Copley (AWC's founder) fenced 275 ha on Karakamia Wildlife Sanctuary near Perth, WA, and reintroduced Woylies and several other threatened mammals. Subsequently, AWC has established a network of nine feral predator-free areas, including seven fenced areas on the mainland, a fenced area on Kangaroo Island (constructed in 2020 to help protect the Kangaroo Island Dunnart after the bushfires), as well as the entirety of Faure Island, WA.

Currently, AWC is in the final stages of planning the construction of a 1,100 ha fenced area to protect the endangered Northern Bettong in north-east Queensland. AWC is also scoping work on a very large (c. 100,000 ha) fenced area at Newhaven, central Australia (refer to Map 1 and Table 2, below).



Map 1. AWC Sanctuaries and Partnership Sites, showing location of feral predator-free areas.

Table 2. Overview of AWC's Feral Predator-free Area Program

Property	Area (ha)	Start Date	No. Reintroduced/Threatened Mammal Species Current (+ Planned)
Karakamia, WA	250	1994	4
Yookamurra, SA	1,100	1990's	4
Faure Island, WA	4,600	2001	4
Scotia, NSW	8,000	Stage 1 2004 Stage 2 2007	5
Mt Gibson, WA	7,800	2015	8 (+2)
Pilliga, NSW	5,800	2018	2 (+4)
Mallee Cliffs, NSW	9,600	2019	1 (+9)
Newhaven, NT (Stage 1)	9,500	2019	2 (+8)
Kangaroo Island, SA	c. 300	2020	2
Mount Zero-Taravale, Qld (Planned)	1,100	2021	(+2)

AWC's feral predator-free projects currently support a total of 15 nationally threatened mammal species (Table 3, below). For some species, such as the Bridled Nailtail Wallaby, Greater Bilby, Burrowing Bettong, Mala and Numbat, the populations in AWC's reintroduction program represent a substantial proportion of individuals remaining on the planet (e.g., 10-15% of Bilby populations; 30% of Burrowing Bettong populations; 10-25% of Numbat populations). AWC plans to reintroduce additional species to the network in the next few years, including threatened mammals not currently represented in any secure (predator-free) area, such as the Central Rock Rat and Northern Bettong.

In addition, while the primary focus of the fenced areas is on the recovery of threatened mammals, the exclosures also provide collateral benefits to many other animals susceptible to feral cats and foxes. For example, monitoring by AWC has shown that native mammals already present on Scotia have increased inside the fenced area since its establishment (Roshier et al. 2020). Evidence also suggests that ground-active birds such as Malleefowl also benefit from the establishment of feral predator exclosures (AWC unpublished data).

Table 3. Threatened mammals protected on AWC feral cat- and fox-free areas

Species	EPBC Status	Scot	Yook	Kara	Faur	Mt G	New	Pilli	Mall	KI	MZT
Kangaroo Island Echidna	E									x	
Northern Quoll	E										(x)
Western Quoll	V					(x)	(x)	(x)	(x)		
Red-tailed Phascogale	V					x	x		(x)		
Kangaroo Island Dunnart	E									x	
Numbat	E	x	x			x	(x)		(x)		
Golden Bandicoot	V						(x)				
Western Barred Bandicoot	E				x	x		(x)	(x)		
Greater Bilby	V	x	x			x	(x)	x	x		
Western Ringtail Possum	CE			x							
Burrowing Bettong	V	x	x		x		(x)		(x)		
Woylie	E	x	x	x		x	(x)	(x)	(x)		
Northern Bettong	E										(x)
Mala	E	x					x				
Banded Hare-wallaby	V				x	x					
Bridled Nailtail Wallaby	E	x						x	(x)		
Black-footed Rock-wallaby	V						x				
Greater Stick-nest Rat	V					x			x		
Plains Mouse	V							(x)			
Shark Bay Mouse	V				x	x	(x)				
Central Rock-rat	CE						(x)				

Notes:
EPBC Status = Commonwealth Conservation status Listing: CE=Critically Endangered; E=Endangered; V=Vulnerable.
AWC Properties: Yook = Yookamurra; Kara = Karakamia; Faur = Faure Island; Mt G = Mt Gibson; New = Newhaven; Pilli = Pilliga; Mall = Mallee Cliffs; KI = Kangaroo Island; MZT = Mount Zero-Taravale.
x = established; x = in progress; (x) = planned

Ecosystem management

Research by AWC in northern Australia (Kimberley and Cape York Peninsula) has shown that cat behaviour and hunting success varies with ecosystem management, with cats travelling to intensely burned areas to hunt, and having greater hunting success in burnt and other structurally-open (e.g. heavily grazed) areas (McGregor et al. 2014, 2015, 2016, 2017; Leahy et al. 2015). For these reasons, **ecologically-appropriate fire management and control of feral herbivores can be expected to reduce the impact of feral cats**. AWC research has demonstrated a positive response of small mammals to improved fire management and destocking in the Kimberley, with this effect most likely to be realised through the reductions in the population size and hunting efficiency of feral cats arising from these targeted environmental management actions (Legge et al. 2019).

However, the extent to which ecosystem management can deliver a sufficiently large reduction in the density and/or impact of feral cats – enough to bring about a sustained increase in the populations of native species, particularly the most vulnerable species – is still largely unknown. It is possible that additional suppression (or complete exclusion) of cats will be required to conserve highly vulnerable species. AWC's research, cited above, has not yet been able to address this question, because mammal species highly vulnerable to cats, such as the Golden Bandicoot, Mala and large native rodents, are no longer present in the central Kimberley where most of the research was conducted.

Gene drive

Engineered gene drives have the potential to be a powerful tool for the control of invasive species and/or mitigation of their impacts on native species. Gene drives offer a potentially safe, humane, effective approach to the control of invasive species over regional to continental scales. By contrast, current methods of direct control for feral cats are generally ineffective at the landscape scale, require ongoing effort, and have issues with safety and/or welfare.

Functional gene drives that control invasive vertebrates have not yet been developed. On current estimates, the development of an effective gene drive to control mice may take at least 2-5 years; the development of a drive to control rats may take at least 5-8 years, while it may take over 10 years to develop a gene drive to control feral cats. Once developed, a gene drive then needs to be deployed in the field – the time required depending on the size of the population, its population dynamics and release strategies, with a considerable number of generations likely to be required. **Hence, deployment of a gene drive to effectively control feral cats across Australia is likely to take several decades**, even with a dedicated research program.

Given the potential continental-scale efficacy of gene drives, AWC is collaborating with CSIRO and a consortium of science and conservation organisations with a view towards developing genetic control of feral cats in Australia. As a proof-of-concept, the consortium is currently focused on developing and deploying gene drives in feral house mice (Prowse et al. 2017).

The very attribute that makes gene drives potentially a powerful tool to control invasive species – their ability to self-propagate throughout a population – also makes the technology a potential risk to wild populations of a species in their natural environment, should there be deliberate or inadvertent dispersal of individuals carrying the gene drive to a wild population (Esvelt et al. 2014). Effective management of such risks is a fundamental component of research on gene drives (Dronov and Howard 2017).

F. The efficacy of import controls for high risk domestic cat varieties to prevent the impacts of feral and domestic cats, including on native wildlife and habitats;

AWC strongly opposes the importation of any additional domestic cat varieties (especially cross-breeds with larger species), given that any introduction of cat genetics can be expected to eventually escape into the feral population, with the potential to exacerbate current impacts of feral cats on native wildlife.

G. Public awareness and education in relation to the feral and domestic cat problem; and

AWC has run a long-term campaign to educate the public about the impacts of feral cats on our wildlife, with, for example, numerous articles in our magazine *Wildlife Matters*, posts on our website and stories in the media. Based on feedback we have received in response to this campaign, **AWC considers the Australian public have a relatively good understanding of the adverse impacts of feral cats on native wildlife, and as a result are (generally) supportive of efforts to effectively control feral cats**.

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