



Australian Government  
Department of the Environment

## Threat abatement plan for predation by feral cats



2015



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# 1 Introduction

This *Threat abatement plan for predation by feral cats* establishes a national framework to guide and coordinate Australia's response to the impacts of feral cats (*Felis catus*) on biodiversity. It identifies the research, management and other actions needed to ensure the long-term survival of native species and ecological communities affected by predation by feral cats. It replaces the previous threat abatement plan for predation by feral cats published in 2008 (DEWHA, 2008a). A review of the previous threat abatement plan found some significant advances in feral cat research and control since 2008 (Department of the Environment, 2015a).

This plan should be read in conjunction with the publication *Background document for the Threat abatement plan for predation by feral cats* (Department of the Environment, 2015b). The background document provides information on feral cat characteristics, biology and distribution; impacts on environmental, social and cultural values; and current management practices and measures. The document also provides additional detail on some of the concepts and research included in the plan.

The plan is supported by the Australian Government's Threatened Species Strategy. The Threatened Species Strategy outlines an action-based approach to protecting and recovering our nation's threatened plants and animals. Its approach of 'science, action and partnership' can be used to achieve the long-term goal of reversing threatened species declines and supporting species recovery. Feral cat control is a priority area for the Threatened Species Strategy, with key actions including: deployment of Curiosity®, the new humane feral cat bait; working with protected area partners to increase feral cat management in reserves; and supporting the establishment of feral free areas and feral free islands as safe havens for threatened species. The feral cat targets in the Threatened Species Strategy drive activity that complements the objectives and actions in the plan.

## 1.1 Threat abatement plans

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the identification and listing of key threatening processes. In 1999, with the commencement of the Act, predation by feral cats was listed as a key threatening process and a threat abatement plan developed.

The Australian Government develops threat abatement plans with assistance from other governments, natural resource managers and scientific experts, and facilitates their implementation. To progress the main actions within the threat abatement plan, the Department of the Environment relies on partnerships and co-investments with other government agencies, industry and other stakeholders. An important part of implementation of the threat abatement plan is ensuring that knowledge of improved abatement methods is disseminated to potential users.

Mitigating the threat of invasive species is not only a matter of providing better technical solutions such as improved baits for pest animal management. It also involves understanding and addressing social, legal and economic factors; for example, through supporting the efforts of private landholders, leaseholders and volunteers to manage invasive species on their lands to achieve the desired outcomes for biodiversity conservation and primary production. In addition, research and development programs for managing vertebrate pest species need to integrate interests relating to both primary production and environmental conservation.

Regional natural resource management plans and site-based plans provide the best scale and context for developing operational plans to manage invasive species. They allow primary production and environmental considerations to be jointly addressed, and allow management to be integrated across the local priority vertebrate pests within the scope of other natural resource management priorities.

The national coordination of pest animal management activities occurs under the Australian Pest Animal Strategy. The Invasive Plants and Animals Committee, comprising representatives from all Australian, state and territory governments, has responsibility for implementation of the strategy. This threat abatement plan provides guidance for the management of feral cats within that broader context.

### **1.1.1 The review of the 2008 threat abatement plan**

In accordance with the requirements of the EPBC Act, the threat abatement plan for predation by feral cats (DEWHA, 2008a) was reviewed in 2014 by the Department of the Environment (Department of the Environment, 2014).

This document replaces the 2008 threat abatement plan. It incorporates the knowledge gained in the intervening years and has been modified in line with recommendations from the review. The threat abatement plan aims to guide the responsible use of public resources and the best outcome for native species and ecological communities threatened by predation by feral cats. The plan seeks to achieve these outcomes by recognising the opportunities and limitations that exist, and ensuring that field experience and research are used to further improve management of feral cats. The activities and priorities under the threat abatement plan will need to adapt to changes as they occur.

### **1.1.2 Involvement of stakeholders**

The successful implementation of this threat abatement plan will depend on a high level of cooperation between landholders, non-government organisations, community groups, individual volunteers, local government, state and territory conservation and pest management and research agencies, and the Australian Government and its agencies. Success will depend on all participants assessing cat impacts and allocating adequate resources to achieve effective on-ground control of feral cats at critical sites, improve the effectiveness of management programs, and measure and assess outcomes for threatened species and biodiversity more broadly. Various programs in natural resource management, at national, state and regional levels, can make significant contributions to implementing the plan. In particular, regional natural resource management plans can identify links and contributions between their pest animal management actions and this threat abatement plan.

## **1.2 Threat abatement plan for predation by feral cats**

Section 1.2 provides an overview of the threat, impacts and management of predation by feral cats. The background document should be referred to for further information.

### **1.2.1 The threat**

Feral cats are a serious vertebrate pest in Australia, and have severe to catastrophic effects on native fauna (Woinarski et al. 2014).

Predation of native species by feral cats is the focus of threat abatement and this plan. However, feral cats also have impacts, although lesser, through competition and disease transmission. These are incorporated into actions within the plan to ensure a holistic approach is taken to managing the impact of feral cats.

The first recorded instance of cats being brought to Australia was by English settlers in the 18<sup>th</sup> century with feral cats spreading across the continent by the 1890s (Abbott 2002, Abbot 2008). Cats were deliberately released into the wild during the 19<sup>th</sup> century to control introduced rabbits and house mice (Rolls 1969). Today feral cats are distributed through all habitats in mainland Australia and Tasmania and on some offshore islands.

It is very difficult to accurately estimate the number of feral cats in Australia because feral cat density varies significantly depending on rainfall, food availability, presence of other predators and other factors. There have been a number of estimates of the density of cats based on studies from different areas of Australia; Denny and Dickman (2010) list some published figures up to 2010. These estimates provide an idea of cat densities in that particular habitat (e.g. mallee, desert, temperate forest) and at that point in time. Some of these studies, such as Burrows and Christensen (1994), provide drought and non-drought estimates, and some, such as

Jones and Coman (1982), provide winter and summer estimates. In the past, these estimates have been extrapolated to all habitats across Australia to provide an estimate of the number of feral cats nationally. Instead of attempting to accurately estimate how many feral cats there are across all of Australia, there should instead be better estimates of the impact that feral cats are having on threatened and non-threatened native fauna. Doherty et al. (2015) state that reducing the impacts of feral cats is a priority for conservation managers across the globe, and success in achieving this aim requires a detailed understanding of the species' ecology across a broad spectrum of climatic and environmental conditions. Predation by feral cats is recognised as one of the primary factors in the decline and extinction of a number of native mammal species in Australia (Woinarski et al. 2014).

Adult feral cats weigh three to five kilograms on average (Read & Bowen 2001; Johnston et al. 2012; Johnston et al. 2012a; Johnston et al. 2013). Feral cats are carnivores and can survive with limited access to drinking water because they can consume adequate moisture from their prey: small and medium-sized mammals, birds, reptiles, amphibians, fish and invertebrates. Feral cats will also consume carrion when live prey is scarce, and some smaller amounts of vegetation.

Feral cats are solitary and predominantly nocturnal (some may be more crepuscular – that is active during twilight hours – or even diurnal in colder areas or months of the year), spending most of the day in burrows, logs or rock piles. They occupy home ranges that vary from less than one square kilometre up to 20–30 square kilometres in areas of scarce resources (Molsher et al. 2005; Moseby et al. 2009; Buckmaster 2011). Mature (one year or older) feral cats can breed in any season and may produce two litters per year (Jones & Coman, 1982), each of about four kittens, however, few kittens survive (Denny & Dickman, 2010 provide a review of all the studies estimating litter size).

Cats can be grouped into categories according to how and where they live. The definitions and categories used vary widely, so the following terms are used for the purposes of this plan:

- *feral cats* are those that live and reproduce in the wild (e.g. forests, woodlands, grasslands, deserts) and survive by hunting or scavenging; none of their needs are satisfied intentionally by humans;
- *stray cats* are those found in and around cities, towns and rural properties; they may depend on some resources provided by humans but are not owned; and
- *domestic cats* are those owned by an individual, a household, a business or corporation; most or all of their needs are supplied by their owners. If the confinement of domestic cats becomes more common, the category of a domestic cat may need to be divided to confined and unconfined cats because the potential for these two groups to impact on native fauna is different.

These categories of cats are artificial and reflect a continuum, and individuals may move from one category to another (Newsome 1991; Moodie 1995). In any given situation, the category causing the most damage to wildlife needs to be identified because management actions will depend on the type of cat causing the damage. Where domestic cats are the primary cause, management is likely to concentrate on owners and consist of promoting responsible ownership through education and local or state/territory legislation. For feral cats, the focus is on reducing numbers or inhibiting predation through the use of mechanical, chemical or biological methods. Management of stray cats often requires a combination of technical and social approaches. It is noted that in some remote Indigenous communities the complex relationships between people, families, groups and their companion animals may require a different approach to addressing the problem of predation by feral cats. The approach taken will need to be developed in consultation with the communities.

This plan focuses primarily on managing the negative impact of feral cats. Broadly, native species listed as threatened under the EPBC Act that are susceptible to cat predation affecting their populations, are located in areas where domestic and stray cats are absent or in much lower numbers. It is generally accepted that improvements in the management of domestic and stray cats are necessary near human habitation and these improvements may reduce recruitment to the feral cat population. For eradication and control efforts to be sustained, the transition of cats from domestic or stray to feral must be prevented so that feral cat populations are not enhanced or new populations established.

Feral cats occur on Commonwealth land, such as Department of Defence properties and Commonwealth-managed national parks. On a national scale, however, management of feral cats on Commonwealth land is only a small part of the larger picture of conserving threatened species affected by cat predation. Many state and territory wildlife agencies have a history of research into and practical on-ground management of feral cats. In addition, private sector and community initiatives also contribute to feral cat management activities.

### 1.2.2 The impacts

Feral cats are recognised as a potential threat to 74 mammal species and sub-species (Woinarski et al. 2014), 40 birds, 21 reptiles and four amphibians. The mammal species and subspecies are identified in the 2014 Mammal Action Plan (Woinarski et al. 2014). The birds, reptiles and amphibians are all listed as threatened under the EPBC Act, and there are 19 bird species listed as migratory or marine whose profiles identify predation by feral cats as a threat (see Appendix A). It should be noted that the impacts of predation by feral cats is not restricted to these species.

Cats have direct negative impacts on native fauna through predation (Copley, 1991; Dickman 1994; Dowling et al. 1994; Risbey et al. 2000; Coutts-Smith et al. 2007; Dickman, 2009). They prey on mammals, birds, reptiles, amphibians and invertebrates depending on resource availability. Live prey is almost the sole source of food for cats. Mammals tend to be the dominant prey item when available. They also eat introduced mammals including rabbits, hares, rats and mice (Risby et al. 1999; Read & Bowen 2001; Holden & Mutze 2002; Doherty 2014).

Feral cats have contributed to the extinction of many small to medium-sized mammals and ground-nesting birds in the arid zone, and have seriously affected or caused extinction of populations of species such as mala and woylie. (e.g. Gibson et al 1994; Start et al. 1995; Department of the Environment 2015a). The ongoing decline of small mammals across northern Australia to very low numbers is also believed to be due, in a major part, to predation by the feral cat (Gibson et al. 1994; Christensen & Burrows 1995; Fisher et al. 2013; Frank et al. 2014; Woinarski et al. 2014).

Typically, terrestrial vertebrates consumed by feral cats will weigh less than 220 grams (Dickman 1996) but individuals up to three to four kilograms (Fancourt 2015) are at risk. Birds are also a major prey item with species up to 200 grams being taken, mostly ground-dwelling birds. Reptiles are also an important dietary component, especially in arid areas (Doherty et al. 2015). Examples of other prey items include grasshoppers, centipedes, fish, frogs, freshwater crustaceans and marine turtle hatchlings (Doherty et al. 2015). Some cats become specialists in particular types of prey while others remain generalists (Dickman & Newsome 2014).

Feral cats have direct and indirect impacts on native predators. Dasyurids, such as quolls, may be killed by feral cats and have a dietary overlap. As well as quolls, other native predators such as raptors and varanids may also compete with feral cats for dietary resources (Sutherland et al. 2011; Debus, 2012).

Feral cats in Australia are hosts to a number of disease-causing agents including viruses (three species), bacteria (>40 species), fungi (>17 species), protozoa (21 species), helminths (26 species) and arthropods (19 species) (Moodie 1995). Some of these can be transmitted to native species, particularly mammals, and also humans. *Toxoplasma gondii* is one significant protozoan species that uses the cat as the definitive host and is particularly concerning for native Australian mammals, and immunocompromised people and pregnant women (Gebremedin et al. 2013). Abortions or pre-natal transmission to offspring can occur in livestock following infection with *Toxoplasma gondii* (Hartley & Marshall, 1957; Buxton et al. 2007; Pam et al. 2014) and one possible impact of the disease in some native animals is the loss of a sense of fear making these animals more vulnerable to predators (Hutchinson et al. 1980; Webster et al. 1994; Berdoy et al. 2000; Vyas et al. 2007). The tapeworm *Spirometra erinacei* also parasitizes the cat as a definitive host and has been recorded in a wide range of native mammals (Adams 2003). For some livestock producing areas of Australia, sarcosporidiosis spread from feral cats can be a significant economic cost due to cysts in sheep muscles that result in carcass downgrades or rejection by abattoirs (Bomford & Hart, 2002). This organism can infect a wide range of mammals.

### 1.2.3 Managing the threat

As feral cats are so thoroughly established in Australia, the focus of management is generally on impact abatement rather than eradication. Control of cats is difficult as they are found in very low densities and have large home ranges, making them difficult to locate. They are also extremely cautious in nature, making them hard to cost-effectively control with traditional measures such as shooting and trapping. Fenced enclosures are a resource-intensive but effective way to control feral cat impacts in these restricted areas, as is the eradication of feral cats from offshore islands.

As a control technique, shooting is more effective if applied for an extended period or timed strategically. Shooting is most likely to be humane when the shooters are experienced, skilled and responsible (Sharp 2012a). However, because shooting is expensive, labour intensive and time consuming it is typically only done on a relatively small scale.

Feral cats are caught live using either leg-hold traps or cage traps. Leg-hold traps used in Australia have padded jaws. As at 2015, leg-hold traps for feral cats are not permitted in all states and territories. Cage traps can also be used for trapping stray and domestic cats around rubbish dumps and in nature reserves close to urban development. To successfully trap feral cats, the lure or attractant chosen is important, with individual feral cats preferring different styles of lure or some feral cats may not be attracted by any lures. There are other control methods in development, such as automated grooming traps, that are not dependent on a lure. Like shooting, trapping as a control method requires skilled operators, is usually expensive, labour intensive and time consuming, and is only recommended on a small scale or where eradication within an area safe from further immigration (e.g. an island or fenced area) is the objective.

Baiting for feral cats is a broad-scale technique that has potential to reduce feral cat populations over larger areas. However, feral cats prefer live prey and will only take carrion (baits) when other resources are scarce (Christensen et al. 2012). The baits must also be laid on the surface as feral cats, unlike wild dogs/dingoes or European red foxes will not dig up a bait. The Eradicat<sup>®</sup> bait is injected with 1080 and may be used in Western Australia. This bait is effective when applied strategically to target the feral cats when they are hungry (Christensen et al. 2012; Algar et al. 2013). A second type of bait, Curiosity<sup>®</sup>, with the toxin PAPP (para-aminopropiophenone) has the toxin encapsulated in a hard plastic pellet. Curiosity<sup>®</sup> bait is designed for use where there are non-target species that would be placed at risk by the Eradicat<sup>®</sup> bait and is anticipated to be available for use during the life of this threat abatement plan (Hetherington 2007; Johnston et al. 2012; Johnston et al. 2014). The PAPP toxin also has the benefit of a greater level of humaneness than 1080 toxin, but does have different non-target species risks. Research and development is ongoing into other baits, such as Hisstory (using encapsulated 1080), to ensure the availability of this control technique across all of Australia.

Predator-proof or exclusion fencing is used as an effective management technique for small populations of threatened species vulnerable to terrestrial predators, such as feral cats, European red foxes and wild dogs (Robley et al. 2007; Hayward et al. 2014). To minimise the risk of breaches to the fence integrated baiting, trapping and shooting in the area surrounding the fence may be needed to reduce the frequency of challenge to the fence by predators. Fencing also affects the movement of other wildlife, preventing their dispersal and interbreeding with other populations. Fencing is expensive and requires ongoing maintenance to ensure its predator-proof integrity.

Interactions between pest species mean that control of feral cats can have flow-on effects on other invasive animals, such as rabbits, rats and mice, that feral cats may have otherwise preyed on. For example, rabbit populations may require managing in conjunction with the feral cats. If feral cats are consuming rabbits as major prey items, rabbit numbers could potentially increase with feral cat control. The converse is also possible with rabbit control potentially affecting feral cat abundances. The interactions between the introduced predators (wild dog, European red fox, cat) and native predators may also influence the design of a control program. An understanding of these potentially complex ecological interactions is important when designing and recommending pest animal control programs, and in many situations, concurrent multi-species programs will be required. Integrating control techniques may also maximise the success of management programs.



Although total mainland *eradication* may be the ideal goal of a feral cat threat abatement plan, it is not feasible with current resources and techniques. Feral cat populations must instead be suppressed and managed to mitigate impacts in targeted areas where they pose the greatest threat to biodiversity. In doing so, care must be taken to ensure that the suppression and management techniques being employed are actually meeting the goal of improving biodiversity. In addition, eradication may be achievable in isolated areas, such as small reserves, peninsulas and offshore islands. For example, cats were eradicated from Tasman Island in 2011 (Tasmanian Parks and Wildlife Service 2011). Progress in management programs must be monitored to ensure that objectives are met and to allow management options to be adapted to changing circumstances.

Best-practice management of feral cats must involve a reduction of the threat, not only to targeted threatened species, but also to other native species that may be affected by feral cat predation. For any given area this will require a determination of the level of feral cat control required, which should be measured through monitoring of population changes and native species recovery. It may be possible in some situations to instead measure a feral cat population reduction that can be linked to threatened species recovery.

## 2 Goal, objectives and actions

The goal of this threat abatement plan is to minimise the impact of feral cats on biodiversity in Australia and its territories by:

- Protecting affected threatened species; and
- Preventing further species and ecological communities from becoming threatened.

To achieve this goal, the plan has four objectives, developed through the review (Department of the Environment 2014) of the previous threat abatement plan and consultation with experts. These objectives are to:

1. Effectively control feral cats in different landscapes;
2. Improve effectiveness of existing control options for feral cats;
3. Develop or maintain alternative strategies for threatened species recovery;
4. Increase public support for feral cat management and promote responsible cat ownership.

Each objective is accompanied by a set of actions, which, when implemented, will help to achieve the goal of the plan. Performance indicators have been established for each objective.

The sections below provide background on each objective, followed by a table listing the actions required to meet the objective. Twenty-two actions have been developed to meet the four objectives.

Priorities for each action are given in the tables below, categorised as 'very high', 'high' or 'medium'. Each action has also been assigned a timeframe within which the outcome could be achieved once the action has commenced. Timeframes are categorised as short-term (i.e. within three years), medium-term (i.e. within three to five years) or long-term (i.e. taking five years or longer). The expected output and outcome from implementation of the action is described. Where there is a clear party identified as responsible for the implementation of the action (be this a government, organisation or group of individuals) this is noted. The identification of responsibility should not be taken as excluding the involvement of other parties where needed. By articulating these actions, this threat abatement plan allows partnerships to be formed around activities that will have the greatest impact. Through partnerships between governments, non-government organisations, scientists, community groups, regional groups, and individuals, the best outcomes for threatened species under threat from predation by feral cats will be achieved.

Most actions within the plan will require investment to achieve the outcomes. Section 3.2 of the plan discusses investment in the plan and provides some estimates of costs anticipated or known at the time of the plan's development. These have been placed in a separate section because it is difficult to fully cost the implementation of each action because of unknown variables.

The actions have a strong focus on encouraging and facilitating practical interventions and providing control options for feral cats, and have been divided amongst the four objectives. However, there is overlap for some actions between the different objectives and readers may determine that an action would provide them a better outcome under an alternative objective. For example, the development of alternative strategies to conventional control will assist in effectively managing feral cats in different landscapes.

### Objective 1 Effectively control feral cats in different landscapes

Predation by cats is a threat that needs to be interpreted and managed according to the landscape type and particular pressures in the area being managed. The landscape in which feral cats are being managed will determine which tools are most effective to use (for example, management in an alpine boulder field will be quite different to a tropical floodplain). Timing of management is also critical to achieve threatened species protection (for example, timing to protect ground nesting birds, or in anticipation of or at the end of

mouse/rat/rabbit plagues when the abundant feral cats are switching to other prey resources such as small threatened mammals). Site specific characteristics also need to be taken into account including the potential for immigration of new cats to the area, other management actions that are being undertaken (for example, prescribed burning) and other predators being controlled (for example, European red foxes) or conserved (for example, dingoes). The degree of control required to achieve the desired outcome (for example, recovery of threatened species) must also be determined. Ensuring the management plan is interpreted and appropriately implemented for the area is important so that control programs for feral cats achieve the outcome of reduced predation of threatened and near-threatened native species, and other native species.

While this threat abatement plan is focused on the impact on biodiversity, feral cats also have an impact on agriculture through spreading disease and on tourism by reducing the numbers of unique Australian species to be seen.

This objective builds on two ongoing research streams: first, research into new control options that will reduce land managers' expenditure on time-intensive, skilled labour; and secondly, research on the roles of feral cats within landscapes and how a range of land management practices may be used or manipulated to exert additional control pressure on feral cats. This can include possible suppression by other predators, exploitation by feral cats of phenomena such as fire and prey irruptions, the sites to which cats and/or their prey retreat during harsh conditions such as drought, and the role of cat-borne diseases. When research and development are being undertaken, evaluation of the success of control options for feral cats needs to consider how the biodiversity outcomes can be monitored as well as knowing how many feral cats have been killed or the change in their abundance/activity.

*Action 1.1 Ensure broad-scale toxic baits targeting feral cats are developed, registered and available for use across all of Australia, including northern Australia*

Land managers require effective tools for achieving feral cat control. These have been lacking on a broad-scale for feral cats with shooting, trapping and fencing being the main options available.

In 2014, a toxic bait (Eradicat®) was made available for use on Western Australian lands managed by or in agreement with the Western Australian Department of Parks and Wildlife. Eradicat® represents an additional tool for that state. Eradicat® contains the toxin 1080 (sodium monofluoroacetate) directly injected to the sausage bait (Algar et al. 2013). The Eradicat® baits can be surface laid in southern Western Australia with minimal risk to native animals that may consume the baits because native species in this area have a degree of tolerance to the toxin. This is because some plants in Western Australia naturally contain the toxin allowing tolerance to develop in the native species.

In the rest of southern and central Australia, with the exception of Tasmania, a new bait (Curiosity®) is being developed for use. Instead of directly injecting the sausage bait, the Curiosity® bait encapsulates the toxin para-aminopropiophenone (PAPP) in a hard plastic pellet to reduce the risk to non-target native species that may eat the sausage bait. Most of these non-target species have been shown to reliably reject the hard plastic pellet while eating the bait (Department of the Environment 2015a). During the life of this threat abatement plan it is expected that the Curiosity® bait will be registered for use.

In northern Australia and Tasmania, neither Eradicat® nor Curiosity® are suitable for use due to risks to the non-target species of varaniids (goannas) and Tasmanian devils (*Sarcophilus harrisii*). However, a variation to the existing baits — Hisstory — is likely to be suitable. The Hisstory bait encapsulates the toxin 1080 instead of PAPP, because varaniids and Tasmanian devils are tolerant to it. It is intended that Hisstory will be able to be laid where varaniids and Tasmanian devils are active but still provide protection for other non-target native species. The Hisstory bait still requires additional research and development.

There is additional information on baiting for feral cats in the background document and Department of the Environment website.

It should be noted that with all of the toxic baits it will be necessary for land managers to determine the risk to valued, non-target fauna at a particular site based on guidance from bait manufacturers. As with any feral animal control tool or program, it is not possible to reduce all the risks to zero, and land managers must consider this in designing their baiting programs. Specifically, dingoes may be at risk if multiple toxic baits intended for feral cats are consumed.

As with Eradicator® baits, governments will be required to restrict access to toxic baits and areas where they may be applied in order to maximise target specificity of baiting programs for feral cats, similar to other introduced predator control programs. Bait suppliers will also need to ensure that users understand the suitable environmental conditions for putting out baits so that they are effective.

Action 1.1 seeks to ensure that toxic baits are registered and available for feral cat control across all of Australia. It should be emphasised that baiting is not the complete answer to feral cat control but rather is another promising tool which can be applied in a broad-scale manner.

*Action 1.2 Develop and register other cat control tools, including devices exploiting cat grooming habits*

Action 1.2 recognises that scientists have been investigating a number of devices for cat control utilising particular traits of cats such as their fastidiousness for grooming. The designs of these devices are able to distinguish non-target species. These tools may be particularly useful in some locations where cat activity in the landscape is restricted; for example along animal trails through thick vegetation or alongside watercourses, or where non-target species are vulnerable to other control techniques (Moseby et al. 2011). Another potential technique being investigated is using encapsulated toxin implanted in threatened species or collars on the threatened species containing a toxin to kill any feral cat or other predator that may specialise in preying upon that threatened species. As with Action 1.1, this action focuses on getting these tools to land managers for use within cat control programs. Although not an explicit action, ongoing improvements to the design and operation of existing management options for feral cats are also important. Enclosure fence designs are an example where refinements continue to be made for different situations.

*Action 1.3 Continue research into understanding interactions between feral cats and other predators: (i) in different landscapes; and (ii) any potential beneficial/perverse outcomes if other predator populations are modified*

Feral cats have natural enemies or competitors in the form of other mammalian predators – the European red fox, wild dogs/dingoes (*Canis* species) and Tasmanian devils will all kill feral cats. These species and quolls will compete with feral cats for food resources. Section 1.3 in the background document provides information on competition between feral cats and other species. For the purposes of this threat abatement plan wild dogs and dingoes are considered together because they freely inter-breed and there is a continuum of animals across the continent that contain varying degrees of dog and dingo DNA (Stephens, 2011). A great deal of recent research has focussed on interactions between feral cats and these other predators. Section 3.3 in the background document provides further information about the relationship between wild dogs/dingoes and feral cats. Although much of this work is ongoing and is not conclusive enough to make any broad-scale recommendations, an important theme is that relationships between the mammalian predators can vary in space and time. In some places European red foxes and/or dingoes seem likely to suppress feral cats (i.e. their numbers, behaviour or both) whilst in other parts of Australia one species appears to have little or no effect on the other (e.g. Fleming et al. 2012; Johnson and Ritchie 2012; Kennedy et al. 2012; Wang and Fisher 2012; Allen et al. 2014; Allen et al. 2014a; Greenville et al. 2014). Further understanding these relationships, through research, is the focus of Action 1.3 so that land managers can make informed decisions about predator interactions when designing and implementing effective local management programs.

*Action 1.4 Continue research into understanding the role of other major landscape modifiers, such as fire or grazing by introduced herbivores, in feral cat activities and control*

Other landscape modifiers such as grazing, woody weeds and introduced grasses have a less obvious impact on predation by feral cats. However, these modifiers can affect feral cat hunting behaviour and success in positive and negative ways. Cats will respond to changes in landscapes through population changes or activity changes, including in response to:

- natural phenomena (for example: prey irruptions such as plague rat (*Rattus villosissimus*) and mice (*Mus musculus*) following good rains);
- landscape management (for example: prescribed burning or land clearing); and
- management programs for other invasive species (for example: an increase in rabbit numbers due to declining effectiveness of biocontrols may provide additional food for feral cats (Doherty et al. 2015)).

Research is providing insights into these responses, such as the preferential use by feral cats of areas recently burnt with high intensity fires to get easy access to prey species that have no vegetation cover to hide in (McGregor et al. 2014). This knowledge is valuable for land managers to adapt management programs for feral cats in order to exploit these responses, although this should not be to the detriment of the overall biodiversity outcomes sought. Action 1.4 seeks to provide what is known to land managers, and continue this research and provide it to land managers. Overlaid on the responses of feral cats to landscape changes is the changing climate due to global warming, which will need to be taken into account.

*Action 1.5 Continue research into the scale, efficiency, cost-effectiveness, sustainability and risks of feral cat control options*

When designing a program for feral cat management it is important to understand the scale of control required, the cost-effectiveness of the method/s being employed and their long-term sustainability. Action 1.5 is aimed at further improving our knowledge of how much and when to undertake control; the short and long term efficiency of that control, especially with feral cats immigrating from outside the site; the cost-effectiveness of the control for the threatened species (or other matter being protected) and what combinations of control methods may work best in different locations. Included in any program must be monitoring to understand the outcome for the program, such as the recovery of a particular threatened species. An element of this research is to examine the effectiveness at a suitable scale and the comparative cost of creating a feral cat (and other predator) free area through intensive predator control in the surrounding area to prevent immigration of new animals. The potential for perverse outcomes, such as low level control leading to an increase in feral cat numbers, needs to be understood (e.g. Lazenby et al. 2015). As mentioned in the previous section, this knowledge must focus on the recovery of threatened species as well as the control of feral cats. This information on program design should be provided to land managers in order for ongoing effective delivery of the management program.

*Action 1.6 Continue development of new or enhanced attractants for cats to improve cat control and monitoring. Ensure availability of any attractants that are developed*

Robust monitoring of feral cats can be difficult because of their dispersed spread and occurrence at low densities. In some circumstances it is necessary to use lures to attract cats into monitoring locations and control locations (e.g. traps). Although a range of visual, olfactory and auditory lures have been developed to attract feral cats; all lures are only partially successful. Action 1.6 identifies the development and assessment of other lures so that land managers get better results with their monitoring or control.

*Action 1.7 Research into other control and monitoring technologies and enhancing available technology*

Action 1.7 identifies the need for ongoing research into new control and monitoring tools. Included in the new control tools is support for the development or provision of humane killing methods, particularly for small community groups where the current options (e.g. shooting, lethal injection administered by a vet) are not available or are too expensive/inhumane.

There are two elements to the monitoring tools. Firstly, there is a need for simple, low cost and low effort monitoring tools for small community groups with few resources. These monitoring tools should be accompanied by education to ensure the community groups can use them effectively. These monitoring tools should be accompanied by education to ensure the community groups can use them effectively. Secondly, there is a need to develop or enhance cost-effective monitoring technologies for feral cats more broadly and, where possible, collate the results. Further to this, a greater understanding of the links between feral cat numbers and impacts will allow land managers to know the appropriate level of control required. Unfortunately, there may be instances where the majority of the impact is caused by one or two individuals that have specialized in a particular prey item (e.g. the threatened species).

*Action 1.8 Re-investigate diseases and other potential biocontrol agents, biotechnology and immunocontraceptive options for cats, and commence research on promising options. Undertake social research on promising options to gauge community support*

Biological control agents such as cat-specific diseases have been reviewed in the past (e.g. Moodie 1995). However, with new techniques, a greater capacity to gather international information, and the possibility of other emergent diseases, it is appropriate to undertake a new review to search for biological control, and immunocontraceptive options.

In addition, the field of biotechnology has platform technologies that may be applicable to feral cat sterilization. Outlined in the background document is information about the emerging technology of RNA-guided gene drives. While this technology is still only in its infancy for applications in vertebrate pest species there is potential for population suppression through guiding changes to particular genes that alter the sex bias of new animals or sensitize a species to a particular toxin. It should be noted that this is a long-term potential technology and is not likely to be realized for feral cat control within the life time of this threat abatement plan.

These ideas are captured in Action 1.8. The search for new biological tools, and any subsequent research on promising agents or biotechnology options, will need to consider the risk to and protections for domestic cats and to other felid species internationally should the agent or technology escape from the country. In addition, the potential suffering of the feral cats must also be taken into account as a biological control that involves prolonged suffering is unlikely to be accepted for release. If a promising agent or technology is identified, social research would need to be undertaken to ensure there would be community understanding and support for a potential release. An effective method for gauging community support could be via a deliberative process of decision-making (for example an iterative approach using a focus group or citizen jury to listen to experts, discuss the rationale for their views, and modify their views following the discussion and feedback).

Captured within this action is also the concept of an indirect control for feral cats through a reduction in abundance of some of their introduced prey species (ie. rabbit, black rat, house mouse), which may be done through improved biological controls for those species.

*Action 1.9 Code of Practice and/or Standard Operating Procedures developed for new tools and agreed by governments*

There is a nationally agreed *Code of practice for the humane control of feral cats* (Sharp & Saunders 2010) and Standard operating procedures for ground-shooting of feral cats, trapping of feral cats using cage traps and trapping of feral cats using padded-jaw traps (Sharp 2012a; Sharp 2012b; Sharp 2012c). As new tools become available the code of practice will require updating and new standard operating procedures may be required.

Standard operating procedures will also require updating as technology changes (e.g. suitable firearms). In particular, standard operating procedures are required for baiting with the different toxins, 1080 and PAPP, and for feral cat-proof fencing. Note that state or territory legislation must also be complied with when managing feral cats. In developing a new code of practice or a standard operating procedure the tool should be assessed through the model for assessing the relative humaneness of pest animal control methods (Sharp & Saunders 2008). Action 1.9 seeks updates to the code of practice and updates or new standard operating procedures, in consultation with all stakeholders (government and non-government), and endorsement by all governments through the national biosecurity system.

### Performance indicators

- Additional tools, including toxic baiting, are included as elements of effective management programs for cats in all states and territories.
- Broad-scale toxic bait available for use in all Australian environments.
- Interactions between predator species are well understood and, if suitable, actively incorporated into management programs for feral cats.
- The role of other major landscape modifiers is understood and, where suitable, these are exploited in management programs for feral cats.
- New or enhanced attractants available for feral cat monitoring and used within control programs.
- New research or continuing research projects addressing the difficulties of effective and efficient control and monitoring of feral cats undertaken and published.
- Monitoring of feral cats undertaken and results nationally reported (e.g. via Feral Catscan or the Atlas of Living Australia).
- Contemporary understanding gained of potential biocontrol agents and biotechnology options for feral cats. Community support for promising options measured.
- Standard operating procedures (SOP) developed for new tools and the code of practice (COP) updated to include these. SOPs and COP agreed and adopted by governments.

Action	Priority and timeframe	Output	Outcome	Responsibility
1.1 Ensure broad-scale toxic baits targeting feral cats are developed, registered and available for use across all of Australia, including northern Australia.	Very high priority, medium term	Toxic baits available to registered users	Effective broad scale control programs using toxic baits can be undertaken in conservation areas	Bait developers and governments
1.2 Develop and register other cat control tools, including devices exploiting cat grooming habits.	Very high priority, medium term and ongoing	Tools available to registered users	Effective control programs using the tool can be undertaken	Tool developers and governments
1.3 Continue research into understanding interactions between feral cats and other predators: (i) in different landscapes; and (ii) any potential beneficial/perverse outcomes if other predator populations are	Very high priority, medium term	A clear understanding of how other predators influence and are influenced by management	If suitable, land managers are able implement management programs for cats that have regard to other	Researchers and land managers

Action	Priority and timeframe	Output	Outcome	Responsibility
modified.		programs for feral cats	predators	
1.4 Continue research into understanding the role of other major landscape modifiers, such as fire or grazing by introduced herbivores, in cat activities and control.	Very high priority, long term	An understanding of how other landscape modifiers may impact on cat predation	Land managers are able to understand the impacts of landscape modifiers to better implement cat management programs.	Researchers and land managers
1.5 Continue research into the scale, efficiency, cost-effectiveness, sustainability and risks of feral cat control options	High priority, medium term	Knowledge about effective feral cat control options suitable for different sites	Land managers are able to understand the complexities of different control method choices and implement effective options.	Researchers and land managers (including groups, NRM bodies and individuals)
1.6 Continue development of new or enhanced attractants for cats to improve cat control and monitoring. Ensure availability of any attractants that are developed.	Medium priority, medium term	New or enhanced attractants available	More effective control and monitoring for cats	Researchers for development and product manufacturers
1.7 Research into other control and monitoring technologies and enhancing available technology	Medium priority, long term - ongoing	New tools for control and monitoring of cats	Greater range of options for land managers to control and monitor cats	Researchers and product manufacturers
1.8 Re-investigate diseases and other potential biocontrol agents, biotechnology and immunocontraceptive options for cats, and commence research on promising options. Undertake social research on promising options to gauge community support.	High priority, long term - ongoing	Report outlining potential biocontrol options for cats.  If appropriate, a long-term research project commenced.	Stakeholder understanding of the potential for biocontrol for cats.  Start of research into promising biocontrol agent(s).	Government and researchers
1.9 Code of Practice and/or Standard Operating Procedures developed for new tools and agreed by	High priority, short-medium term.	Code of Practice or Standard Operating	Control of feral cats is undertaken in	Product developers and governments



Action	Priority and timeframe	Output	Outcome	Responsibility
governments	Ongoing for new tools as they are developed.	Procedures available for all control tools	an effective manner as humanely as possible	

## Objective 2 Improve effectiveness of existing control options for feral cats

Objective 2 focuses on delivering management options to land managers and ensuring they are able to conduct control programs effectively according to current best practice techniques and knowledge. Linking land managers with the outputs from research will improve programs for threatened species recovery where predation by feral cats is a contributing factor. In this threat abatement plan land managers are considered to encompass any person or group that has a responsibility for land management including individual land owners, community groups, Indigenous people caring for their country, non-government organisations, NRM bodies, and government agencies managing parks and reserves.

*Action 2.1 Understand motivations and provide incentives for land managers to include feral cat management into standard land management for biodiversity outcomes*

Land managers are typically very busy with competing priorities for management activities and this action is intended to provide improved support for these people and groups. Action 2.1 is a behavioural science focused action to determine the motivations and best incentives (and possible penalties if necessary) to encourage land managers to include a cat management program into their many activities. Understanding what is required to build and maintain social licence and pressure to control feral cats can help governments and other agencies to provide leverage for feral cat control. This action can include groups of people across tenures or action by volunteer groups for land managers to conduct feral cat control programs. Naturally, the outcome of this action will assist in the delivery of training material in Action 2.2 below.

*Action 2.2 Provide information, in various media and through training, on best practice methods and standard operating procedures for controlling and monitoring feral cats*

Action 2.2 focuses on providing training material to land managers, community groups etc. so that they can access information on the best way to undertake both monitoring and control for feral cats in their landscape. Land managers are rarely experts on feral cats so being able to provide this information will take the guesswork out of when and how to control and monitor. The information and training should be linked not only to the control of the feral cats but also to ensuring that the outcome (for example, recovery of a particular threatened species) is going to be achieved. It also provides an opportunity for researchers and land managers to collaborate to improve the on-ground outcomes, and for land managers to form collaborative links to undertake cross-tenure control programs.

There is information on feral cats, monitoring methods, and standard operating procedures on the PestSmart Connect website (Invasive Animals CRC) that may assist in the implementation of this action. Action 2.2 also has links with action 1.5 to provide an analysis of the costs and benefits of management strategies for feral cats so that land managers have an economic understanding of their actions.

*Action 2.3 Ensure areas prioritized for feral cat management across to Australia maximize benefits to biodiversity at a local, regional and national level*

The 2008 threat abatement plan contained an action to identify priority areas based on criteria linked to threatened species and ecological communities and a national prioritisation framework was developed (Dickman et al. 2010). The outcomes from this are still relevant. Action 2.3 takes this concept a step further to make sure that the scale of prioritisation is captured. For national threatened species recovery it is important to consider populations of the species across their entire range and prioritise threat abatement actions for important populations at threat from predation by feral cats. These particular sites may or may not be identified at a regional or local level due to other factors, or vice versa. An understanding of where it is critical to undertake feral cat management for threatened species will assist in more holistic cat management across Australia and provide decision-making guidance for national funding programs. Decision making should consider the costs and benefits for the different actions that may be required for each area.

*Action 2.4 Governments agree to consistent legislation that identifies feral cats as a pest, has requirements for control, and identifies control techniques that may be used*

Feral cats are not declared as a pest in legislation in all states and territories, and requirements for control of feral cats are variable across the country. While recognising the means of achieving pest status and control requirements does not need to be uniform, it is desirable that land managers are able to legally undertake, or have legislative support to undertake, effective control programs as needed. Action 2.4 seeks to gain support from all state and territory governments to consider their legislation and, if necessary, amend it to provide a mechanism for effective and efficient control of feral cats. An element of this action will be for governments to ensure that administrative requirements are practical and efficient so as to minimise any administrative burdens on land managers undertaking feral cat control programs.

#### Performance indicators

- Training material and information widely available, including via the internet, for land managers on effective management and monitoring techniques for cats. Training programs delivered in all states and territories by government agencies, non-government organisations, natural resource management groups, Invasive Animals Cooperative Research Centre or Centre for Invasive Species Solutions, and other appropriate organisations.
- Cat management programs for biodiversity are in place in prioritised areas.
- The abundance and/or impacts of feral cats are reduced in priority areas. To be measured through the recovery of threatened species in the area and a reduction in the abundance of feral cats (specific targets will be dependent upon the particular species and monitoring ability but should be identified in the relevant program plan).
- Consistent or complimentary legislation across all states and territories enabling effective control of feral cats.

Action	Priority and timeframe	Output	Outcome	Responsibility
2.1 Understand motivations and provide incentives for land managers to include feral cat management into standard land management for biodiversity	High priority, short term	Options for providing incentives to land managers	A greater proportion of land managers undertaking effective cat	Social scientists, social psychologists, and

Action	Priority and timeframe	Output	Outcome	Responsibility
outcomes		for cat control	management	governments
2.2 Provide information, in various media and through training, on best practice methods and standard operating procedures for controlling and monitoring feral cats	High priority, medium term	Training material is available to land managers on how to effectively control and monitor feral cats and their impacts	Land managers running management programs for feral cats can effectively design and adapt the program	Researchers in association with communications or education specialists to develop the material. Delivery by government, NGOs, NRM groups, Invasive Animals CRC or Centre for Invasive Species Solutions, and other appropriate organizations. Land managers for uptake.
2.3 Ensure areas prioritised for feral cat management across Australia maximise benefits to biodiversity at a local, regional and national level	Very high (for an initial reprioritisation) to medium priority, long term – ongoing	An understanding of how management programs provide effective threat abatement on all scales	A holistic approach to cat management for threat abatement	Governments in association with land managers conducting management programs and regional groups (e.g. NRM bodies)
2.4 Governments agree to consistent legislation that identifies feral cats as a pest, has requirements for control, and identifies control techniques that may be used	High priority – short term	Consistent legislation for feral cats	Land managers in all states and territories legally able to undertake effective control of feral cats	Governments

### Objective 3 Develop or maintain alternative strategies for threatened species recovery

Objective 3 is focused on providing options where sustained control of cats using standard techniques is not possible or the degree of sustained control is insufficient to enable threatened species recovery. It is likely that any threatened species recovery program will need to incorporate a range of approaches to abate the threat. Also included in this objective is a consideration of the impact of disease transmission from feral cats to native animals and how this impact may be mitigated.

*Action 3.1 Eradicate, or control, cats on offshore islands of high, or potentially high, biodiversity value*

Action 3.1 emphasises the importance of islands in maintaining biodiversity. Cat eradication programs have been successful on a number of islands and similar programs are underway on at least two more large islands (Dirk Hartog Island and Christmas Island). These islands are or will become important refuges for reintroduced threatened species, or, in the case of Christmas Island have endemic species that are threatened. This action has the option for sustained control on off-shore islands. This is generally not cost-effective in the long-term but is included to acknowledge that there may be islands where, at the present time, it is not possible (for financial, resourcing or technical reasons) to completely eradicate feral cats. In these situations it may be worthwhile investing in a sustained control program where it enhances the survival of threatened species. Care should be taken to ensure that potential unintended consequences of cat eradication are considered for each island.

*Action 3.2 Establish, enhance or maintain biosecurity measures for cat-free offshore islands to prevent incursions*

Establishing or maintaining biosecurity measures for islands that do not have feral cats is critical. This may need to be reinforced through state or territory legislation. Action 2.2 addresses issues of provision of appropriate training and information to support and undertake biosecurity.

*Action 3.3 Establish and maintain further fenced reserves ("mainland islands") for threatened species where it is identified cats cannot be controlled to the level required for threatened species recovery*

Cats are present almost everywhere in the mainland Australian landscape so there are no natural mainland refuges that can be exploited for threatened species recovery. Instead, where a threatened species population is sufficiently threatened it may be possible to fence an area of habitat with a predator-proof fence. Action 3.3 recognizes predator-proof fencing as an important option for some of the most threatened species that are unlikely to survive without such action. Predator-proof fence designs are now standard but are expensive to build and require significant ongoing monitoring and maintenance. Note though that the ongoing monitoring and maintenance costs may be similar to other ongoing feral cat control methods. There may also be a requirement to manage overpopulation by some species confined to the fenced area.

*Action 3.4 Research methods to understand thresholds of cat abundance required to improve survival rates for threatened species heavily preyed upon by feral cats. Research ways in which adaptation by threatened species may improve survival rates*

Action 3.4 focuses on further research into alternatives to direct killing or complete exclusion of feral cats that can help threatened species populations to recover. Examples of alternatives may include research into how habitats can be manipulated (e.g. increase the structural complexity of vegetation, introducing plants containing toxins that native herbivores are tolerant to but will impact on feral cats preying upon those species), the use of guardian dogs (e.g. Marrema breed) or trained hunting dogs to protect threatened species populations, and the training or selection of traits within a species to make them more predator savvy. Directly linked to this action is Action 1.7 on understanding feral cat abundance and impact on threatened species in the landscape. As mentioned in Action 1.7, this research should be based on the understanding that some feral cats specializing in particular prey (e.g. Dickman & Newsome, 2014).

*Action 3.5 Continue research into cat diseases, including *Toxoplasma gondii* and *sarcosporidiosis*, their prevalence, ability to transmit to other species (including livestock and humans) their impacts, and ways to mitigate the impacts*

Cats in Australia carry a number of diseases that are transmissible to other species. The best known of these is toxoplasmosis, caused by a protozoan parasite called *Toxoplasma gondii*, of which felids are the only definitive host. In addition, other diseases including sarcosporidiosis are carried by cats, affect livestock and are important to understand. Action 3.5 acknowledges that the transmission of diseases from feral cats can have a deleterious impact on social and economic values, as well as biodiversity. While investigating diseases that also impact on livestock, and communicating the risk from feral cat-borne diseases to primary producers, it is also important to be mindful that the overall risk to the international disease-free reputation of Australian agricultural produce is not compromised. Through this action, the plan seeks to focus research into the impacts of these cat-borne diseases on other species including threatened species, other native animals, livestock and humans.

### Performance Indicators

- Additional offshore islands cat-free or under sustained control programs.
- Implementation of effective biosecurity programs for all islands that are currently cat-free and at risk of a cat incursion.
- Further fenced reserves (“mainland islands”) created for threatened species most affected by predation.
- Research conducted into alternative ways to assist threatened species to avoid predation and published.
- Results of research into alternative ways to assist threatened species to avoid predation adopted by land managers as demonstrated through plans and reported techniques and outcomes.
- Cat borne diseases and their impact on other species, including native species and livestock, are better understood.
- The prevalence of cat borne diseases in native species is measured. Where there is a significant impact on a threatened species mitigation measures are instigated, and results measured and reported.
- The review by Moodie (1995) summarising the potential for biological control of feral cats including diseases is publicly available.

Action	Priority and timeframe	Output	Outcome	Responsibility
3.1 Eradicate, or control, cats on offshore islands of high, or potentially high, biodiversity value	Very-high priority, long term	Cats eradicated or under sustained control on offshore islands	Cat-free islands where threatened species can be recovered	Island owners or managers, including governments where they are managers
3.2 Establish, enhance or maintain biosecurity measures for cat-free offshore islands to prevent incursions	Very high priority, short term	Cat-free offshore islands have biosecurity measures	Cat-free islands remain cat free	Island owners or managers and all visitors
3.3 Establish and maintain further fenced reserves (“mainland islands”) for threatened species where it is identified cats cannot be controlled to the level required for threatened species recovery	Very high priority, medium term	Fenced reserves created and maintained for key threatened species populations	Preventing localised extinctions. Threatened species recovery for species under greatest pressure by predation by feral cats	Government and non-government conservation land managers

Action	Priority and timeframe	Output	Outcome	Responsibility
3.4 Research methods to understand thresholds of cat abundance required to improve survival rates for threatened species heavily preyed upon by feral cats. Research ways in which adaptation by threatened species may improve survival rates.	High priority, long term - ongoing	Use of alternative methods (to cat management actions or exclusion fencing) for threatened species protection	More resilient populations of threatened species to the effects of cat predation	Researchers
3.5 Continue research into cat diseases, including <i>Toxoplasma gondii</i> and sarcosporidiosis, their prevalence, ability to transmit to other species (including livestock and humans) their impacts, and ways to mitigate the impacts.	High priority, medium term	An understanding of cat diseases and their impacts	Impact of disease transmission from feral cats is mitigated	Researchers and land managers

## Objective 4 Increase public support for feral cat management and promote responsible cat ownership

Objective 4 is particularly important for a species that is also highly valued as a domestic companion by many in the community. To gain or maintain support from the community to manage feral cats it is important to have ongoing education campaigns to raise awareness and change attitudes (as necessary) about the impact of predation by feral cats on threatened species and ecological communities. One of the significant challenges to overcome with this type of education is engaging different audiences in the right way. It is also important that the messages are believable, the source trustworthy and an emphasis placed on the contribution from the individual being valuable. This message must also include the emphasis that the threat is from predation of threatened species by feral cats, rather than cats intrinsically being bad.

### *Action 4.1 Quantify the proportion of the domestic and stray cat population that transitions to the feral cat population*

All cats are the same species and may transition from domestic to feral and vice versa. However, it is poorly known what the contribution of domestic and stray cats are to the feral cat population, and the degree to which this has a significant impact on the threat of predation on threatened species. This is particularly the case for more remote communities or places where domestic cats are actively encouraged to hunt (e.g. farms for rodent control). A clearer understanding of how many domestic and stray cats make the transition will inform public education about responsible ownership or the control of stray cats.

It is noted that for some Indigenous communities the definitions of what is a domestic, stray and feral cat may be different, and a different approach to the management of these cats may be needed. However, these communities may also be able to quantify the transition of cats from domestic to feral in their area if consulted appropriately.

*Action 4.2 Promote to and seek engagement of the community in: an understanding of the threat to biodiversity posed by cats and support for their management; an understanding of the transitions between domestic, stray and feral cats, and the need for responsible ownership; and support for the containment of domestic cats where their roaming may impact on identified conservation areas*

Action 4.2 focuses on gaining community support on three elements. Firstly, as outlined above, an understanding of the biodiversity impacts posed by cats. Secondly, an understanding that all cats may transition from domestic to feral and vice versa. Incorporated into this understanding is the concept of responsible ownership, including responsibility for stray cats. An element of the need for responsible ownership is to investigate what the effective motivators are to enhance responsible domestic cat ownership in the community. Thirdly, while many de-sexed domestic cats tend to be more passive, domestic cats do negatively impact on native animals (e.g. Grayson & Calver 2004; Dickman & Newsome 2014). The last element seeks support for expansion of 24-hour containment requirements for domestic cats, particularly close to identified conservation areas of significance. Introduction of containment requirements must be done in such a way (e.g. implemented over time) that it does not cause an unnecessary financial burden on those who cannot afford the containment options, or lead to dumping of domestic cats as an unintended consequence. As with all types of government regulation, education and enforcement should necessarily accompany any changes.

Beyond our more urban areas, containment may not be an option in some more remote communities due to a general lack of infrastructure or resources, or different cultural attitudes towards cat-keeping. It is also acknowledged that in some rural settings, domestic cats are kept or stray/feral cats allowed to remain because they prey on mice and rats. For people living, visiting or moving to offshore islands, an understanding of the biosecurity risks and requirements related to cats is also required.

It must be noted that the Australian Government does not have the jurisdiction to legislate to require the control of domestic cats (or feral cats) as this is the responsibility of state, territory and local governments. However, as domestic cats may be a source of cats entering into the feral population and recognizing that they have impacts on native wildlife as domestic cats it is important to identify actions that can contribute to reducing this problem.

*Action 4.3 Promote and seek community engagement on the reduction of food and other resources to stray cats*

Action 4.3 considers stray cats' exploitation of human resources. These include refuse from rubbish tips, food outlets and some small-holdings. Minimising or stopping the availability of food for both cats, and the mice and rats on which the stray cats prey, may slow the rate of population increase and this may lead to reduced numbers of feral cats. For example, effective fencing of community dumps may remove this food and shelter source. The deliberate feeding of stray cats should be discouraged on animal welfare grounds. The concept of trapping, neutering and releasing stray cats as a method of population control should also be discouraged on animal welfare grounds and because it is not effective, except where populations are truly isolated and all females are neutered. As noted above for domestic cats, the Australian Government does not have the jurisdiction to legislate with respect to stray cats.

*Action 4.4 Develop specific communication campaigns to accompany the release of new broad-scale cat control techniques and other current/new cat control techniques and management programs*

Action 4.4 builds on the requirement to gain community support for feral cat management. In particular, the release of new toxic baits for feral cats, even with restrictions on their availability and use, may be of concern to elements of the community. An effective communications campaign will be essential for the successful roll out of such products.

Across all of the actions in Objective 4 is the need for consideration of Indigenous peoples and their particular cultural values for and beliefs about feral cats. This is particularly the case in central and northern Australia

where the land tenure by Indigenous people is high. These areas often have a rich diversity of threatened species requiring protection from cat predation. Culturally appropriate communication and education materials will be required.

#### Performance indicators

- Measurable increase in community support and engagement for feral cat management. The increase to be measured from a baseline study by researchers and governments on commencement of the threat abatement plan.
- Increase in effective management for domestic cats by communities in all states and territories through confinement regulations.
- A measured and reported reduction in stray and feral cat abundances in areas around human habitation.

Action	Priority and timeframe	Output	Outcome	Responsibility
4.1 Quantify the proportion of the domestic and stray cat population that transitions to the feral cat population	Medium priority, short term	An understanding of the transition between domestic, stray and feral populations	Factors affecting the transition between domestic, stray and feral populations understood and addressed.  Information for communities to understand the links between domestic and feral animals.	Researchers and governments
4.2 Promote to and seek engagement of the community in: - an understanding of the threat to biodiversity posed by cats and support for their management; - an understanding of the transitions between domestic, stray and feral cats, and the need for responsible ownership; - support for the containment of domestic cats where their roaming may impact on identified conservation areas	High priority, short term - ongoing	Further education materials developed and utilised	Community support for the control of feral cats.  Community ownership and responsibility for domestic and stray cats.	Governments and community (including community leaders such as pest control officers, vets, NRM bodies)
4.3 Promote and seek community engagement on the reduction of food and other resources to stray cats	High priority, medium term	Education material developed and utilised	Reduced availability of resources for stray cats	Governments and community



Action	Priority and timeframe	Output	Outcome	Responsibility
4.4 Develop specific communication campaigns to accompany the release of new broad-scale cat control techniques and other current/new cat control techniques and management programs	High priority, short term	Communication campaign undertaken	Community understanding of the need for feral cat control and are supportive	Government

### 3 Duration, cost, implementation and evaluation of the plan

#### 3.1 Duration

This plan reflects the fact that the threat abatement process is likely to be ongoing, as there is no likelihood of nationally eradicating all feral cats in the life of this plan. The plan lays out measures that should be taken in the next five years to reduce the impact from the key threatening process of predation by feral cats and from the additional threats that feral cats pose through indirect impacts such as disease transmission and ecological changes. Within the life of this threat abatement plan the focus necessarily must be on suppressing and managing the impacts of feral cats in targeted areas where they pose the greatest threat to biodiversity.

Threat abatement plans have a statutory review point within five years but have a formal life of ten years. Dependent on the degree of implementation and success of that implementation some or many of the objectives and actions in this plan may be valid for the full ten years.

#### 3.2 Investment in the plan

Investment in many of the threat abatement plan actions will be determined by the level of resources that stakeholders commit to management of the problem. The Commonwealth is committed, via the EPBC Act, to *implement the threat abatement plan to the extent to which it applies in Commonwealth areas*. However, it should be noted that the Australian Government is unable to provide funding to cover all actions in this threat abatement plan across all of Australia and requires the financial and implementation support from stakeholders. Partnerships amongst and between governments, non-government organisations, community groups and individuals will be key to successfully delivering significant reductions in the threats posed by feral cats.

Outlined below are some estimates of costs of implementation of the actions within the plan. These have been placed in this section instead of against each objective because it is difficult to fully cost the implementation of each action because of unknown variables. In particular, research or field project costs are going to be highly variable dependent on the subject and location. A more remote location, or one with difficult access, will cost more than an accessible site. Other actions are contingent on particular prior actions (e.g. identification of high priority sites) and cannot be accurately costed until the prior action is undertaken. What is presented here are estimates of different elements to actions within the plan to provide a guide to governments, researchers, land managers, island owners, community and others when considering what actions they may be able to implement. Anyone looking to implement an action is strongly recommended to undertake their own budget exercise for their particular circumstances and outcomes sought.

Action	Costs anticipated or known at the time of TAP development for action items	Estimated total cost across TAP
Baiting for feral cats Bait development – new bait Field baiting (including permits, preparation, bait cost, aerial delivery, ground staff and monitoring)	\$3 million for a variation on existing baits suitable for new areas. \$6 million to develop a new bait. \$30,000–40,000 to aerial bait 200km <sup>2</sup> . Note costs will not scale exactly by area.	\$1 million – Curiosity available \$3 million – modified Curiosity bait – Hisstory - for northern Australia Annual cost of \$1.5-\$2 million to bait 1 million hectares.
Grooming trap development	\$1 million to fully develop.	

Action	Costs anticipated or known at the time of TAP development for action items	Estimated total cost across TAP
Other current control methods Ground shooting Trapping	\$5,000–10,000 per week for ground shooting at a single site using professional shooters. Use of volunteer shooters (e.g. SSAA National) would cost considerably less than this. \$3,000-4,000 per week for a single trap line.	Annual cost of \$250,000 – \$800,000 for 8 weeks of control at 10 sites across Australia. Less if volunteers are utilised.
Exclusion fencing	\$12,500 per kilometre for material costs (Moesby & Read, 2006). Requires installation costs to be included. \$25,000 per year per enclosure for ongoing maintenance and monitoring (Moseby & Read, 2006).	\$625,000 for material costs for fences around 5 areas of 10 km <sup>2</sup> . \$625,000 for ongoing maintenance of these 5 areas for 5 years.
Island eradications	This could range from \$4 per hectare for a smaller uninhabited island such as Faure Island to \$50-\$100 per hectare for larger, inhabited such as Kangaroo Island.	Per island: \$18,000 for small, uninhabited to \$22–44 million for large, inhabited.
Island Biosecurity Ranging from signage to a quarantine officer	\$500 – signs per island \$60,000 per year – part time quarantine officer. A quarantine officer may be able to cover multiple smaller islands where they are in a group.	\$300,000 quarantine officer salary for one island or island group over 5 years.
Social research Including community attitudes, incentives for control.	\$200,000 per six-month project involving community engagement.	\$600,000 across 3 actions.
Research projects Includes research into new tools, attractants, ecological modifiers, diseases, biocontrols, monitoring techniques Development and registration of cat control devices.	\$250,000 per year per researcher, including field costs \$15,000 per year to monitor internationally for new diseases.	To be determined for each project.
Prioritisation of cat control areas	\$100,000 for an initial broad prioritisation across all of Australia.	\$100,000 + additional for finer scale prioritisation.
Community education general promotion of feral cat issues promotion of stray cat issues campaign for releases of new control techniques	\$200,000 per state/territory for general promotion per year. This amount may decline as material can be reused and education levels rise. \$100,000 per state/territory for stray cat issues per year. This amount may decline as material can be reused and education levels rise. \$200,000 per state/territory for releases of new tools per release.	\$1.2 million per state/territory over 5 years for general education.
Training materials Including materials using different media and courses	1. \$10,000 to \$100,000 to develop different materials 2. \$2,000 to \$200,000 for delivery	1. \$500,000 over 5 years 2. \$300,000 over 5 years

This threat abatement plan provides a framework for undertaking targeted priority actions. Budgetary and other constraints may affect the achievement of the objectives of this plan, and as knowledge changes, proposed actions may need to be modified over the life of the plan. Australian Government funds may be available to implement key national environmental priorities, such as relevant actions listed in this plan and actions identified in regional natural resource management plans.

### **3.2 Implementing the plan**

The Department of the Environment will work with other Australian Government agencies, state and territory governments, industry and community groups, to facilitate the implementation of the plan. There are many different stakeholder interests and perspectives to take into account in managing cats. For example, Indigenous communities' views need to be fully considered. It will be important to consult and involve the full range of stakeholders in implementing the actions in this plan.

The Australian Government will implement the plan as it applies to Commonwealth land.

The Department of the Environment, via the Threatened Species Commissioner's Office, will establish a Feral Cat Taskforce. The Taskforce will bring together government officials and key stakeholders to ensure effective implementation, monitoring and reporting on progress towards the goals of the threat abatement plan and targets related to feral cat predation.

It is acknowledged that many of the actions in this threat abatement plan are rated as very high or high priority, reflecting the need to tackle the problem of predation by feral cats from multiple angles. Everyone implementing the plan will need to identify the specific actions that can be tackled first in their area — either land jurisdiction or area of expertise.

### **3.3 Planning links**

This threat abatement plan will tie in with other complementary planning processes and strategies for threat abatement and threatened species recovery. These will include other threat abatement plans where there is a clear overlap in issues (for example the *Threat abatement plan for predation by the European red fox* (DEWHA 2008c), recovery plans and the Threatened Species Strategy. The intersection between recovery plans and threat abatement plans is where there are threats to a native species which need to be addressed on a broader scale than on an individual species level or group-of-species level (where there are regional recovery plans). An example of this is the development of broad-scale baits for feral cats.

This threat abatement plan can also provide the basis to develop targets or a source of justification for funding of scientific research or management actions.

### **3.4 Evaluating implementation of the plan**

It may be difficult to assess directly the effectiveness of the plan in abating the impacts of feral cats on Australia's biodiversity. However, performance indicators have been provided against each of the objectives to provide an indication of the level of threat abatement that has been achieved.

Measurements in the improvement of threatened species populations or conditions can be monitored particularly where the primary threat is feral cat predation. However, in many situations, feral cat management is only an element of a complete recovery plan so being able to accurately assess impact of feral cat control may be difficult. Individual feral cat control programs with comprehensive monitoring may be able to see a recovery in the threatened species populations.

### **3.5 Threatened species adversely impacted by feral cats**

Appendix A lists threatened species that are known to, or may, be adversely affected by predation by feral cats. The threatened species included are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or, in the case of mammals, identified as being threatened by feral cat predation in *The Action Plan for Australian Mammals 2012* (Woinarski et al. 2014). Information for species listed under the EPBC Act is available from the Species Profile and Threats Database: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.

## Appendix A: Species affected by feral cats

**Table A1** outlines the various statuses of mammals which may be affected by feral cats and the relative risk of feral cat predation on those species. These species were determined from *The Action Plan for Australian Mammals 2012* (Woinarski et al. 2014) and from profiles which identified predation by feral cats as a threatening process in the Australian Government's Species Profile and Threats Database (SPRAT) (Department of the Environment, 2015). The Action Plan status is the conservation status assigned to a species by Woinarski et al. (2014) and has been based on the International Union for Conservation of Nature's (IUCN) Red List criteria. The overall threat rating considers both the severity and extent of feral cat predation and has been developed from *The Action Plan for Australian Mammals 2012* (Woinarski et al. 2014). For example, the threat is considered to be high risk where there may be a moderate consequence over the entire range, a severe consequence across a large extent of the range, or a catastrophic consequence across a moderate extent of the range (Woinarski *pers. comm.* March 2015). The number of other threats and those which are an equal or greater threat to feral cat predation are also from Woinarski et al. (2014).

**Table A1:** Threatened mammal species that may be adversely affected by feral cats.

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Bettongia lesueur lesueur</i>	Burrowing Bettong (Shark Bay), Boodie	Vulnerable	Near Threatened (Conservation dependent)	Near threatened <sup>1</sup>	Moderate	6	Climate change/severe weather events (moderate); predation by European red foxes (moderate) <sup>2</sup> ; predation by black rats (moderate) <sup>2</sup> ; novel disease (moderate) <sup>2</sup> .
<i>Bettongia penicillata ogilbyi</i>	Woylie	Endangered	Critically endangered	Critically endangered <sup>1</sup>	High - very high	6	Predation by European red foxes (high - very high); inappropriate fire regimes in presence of cats and foxes (high)
<i>Burramys parvus</i>	Mountain Pygmy-possum	Endangered	Critically endangered	Critically endangered	Very high	7	Inappropriate fire regimes (very high); predation by European red foxes (very high); habitat loss and fragmentation (very high)
<i>Conilurus penicillatus</i>	Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma	Vulnerable	Vulnerable	Near threatened	High - very high	6	Inappropriate fire regimes (high); habitat loss and fragmentation (high)

<sup>1</sup> IUCN Red List Status provides the status at species level and is taken to include the subspecies (a separate assessment at the subspecies level has not been completed at this stage).

<sup>2</sup> This threat rating is based on the introduction and establishment of the pest species to islands within the range of the mammal species. At present, the pest species has either been eradicated, is not present, or has not established in large enough numbers to threaten the mammal within its current range.

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Crocidura trichura</i>	Christmas Island Shrew	Endangered	Critically endangered (Possibly Extinct)	Critically endangered	Very high	8	Novel disease (extreme)
<i>Dasyercus cristicauda</i>	Crest-tailed Mulgara	Vulnerable	Near Threatened	Least Concern	High	4	Predation by European red foxes (high); habitat change due to livestock and feral herbivores (high)
<i>Dasyuroides byrnei</i>	Kowari	Vulnerable	Vulnerable	Vulnerable	High	9	Predation by dingoes/wild dogs (high); climate change (high)
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	Vulnerable	Near Threatened (Conservation dependent)	Near threatened	Moderate	6	Predation by European red foxes (very high); consumption of toxic feral cat baits (very high);
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered	Endangered	Near threatened	High	9	Inappropriate fire regimes (high); poisoning by cane toads (very high)
<i>Dasyurus maculatus gracilis</i>	Spotted-tailed Quoll or Yarri (North Queensland subspecies)	Endangered	Endangered	Near threatened <sup>1</sup>	Moderate	7	Habitat loss and fragmentation (moderate); climate change/severe weather events over several decades (very high); poisoning associated with control of non-native predators (moderate); predation by wild dogs (moderate)
<i>Dasyurus maculatus maculatus</i> (SE mainland population)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (south-eastern mainland population)	Endangered	Vulnerable	Near threatened <sup>1</sup>	Moderate	10	Inappropriate fire regimes (moderate); predation by European red foxes (very high); predation by dingoes/wild dogs (high); habitat loss and fragmentation (moderate);
<i>Dasyurus maculatus maculatus</i> (Tasmanian population)	Spotted-tail Quoll, Spot-tailed Quoll, Tiger Quoll (Tasmanian population)	Vulnerable	Vulnerable	Near threatened <sup>1</sup>	Moderate	9	Habitat loss and fragmentation (high); timber production (high)

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Hipposideros semoni</i>	Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat	Endangered	Near Threatened	Data deficient	Minor	5	Disturbance at roost sites (minor); destruction or reduced accessibility of roost sites (minor); extensive, frequent and intense fires (minor); habitat change due to pastoralism (minor); habitat loss and fragmentation (minor)
<i>Isodon auratus auratus</i>	Golden Bandicoot (mainland)	Vulnerable	Vulnerable	Vulnerable <sup>1</sup>	Moderate	4	Inappropriate fire regimes (moderate)
<i>Isodon obesulus nauticus</i>	Southern Brown Bandicoot (Nuyts Archipelago)	Vulnerable	Near Threatened	Least Concern <sup>1</sup>	Moderate - high	10	Predation by European red foxes (high); habitat loss and fragmentation (high)
<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot (Eastern)	Endangered	Near Threatened	Least Concern <sup>1</sup>	Moderate - high	10	Predation by European red foxes (high); habitat loss and fragmentation (high)
<i>Lagorchestes hirsutus</i> unnamed subsp.	Mala, Rufous Hare-Wallaby (central mainland form)	Endangered	Endangered	Vulnerable <sup>1</sup>	Moderate (extreme if species introduced on islands <sup>2</sup> )	5	Inappropriate fire regimes (very high); predation by foxes (extreme) <sup>2</sup> ; predation by black rats (very high - extreme) <sup>2</sup> ; novel disease (moderate - very high) <sup>2</sup>
<i>Lagostrophus fasciatus fasciatus</i>	Banded Hare-wallaby, Merrnine, Marnine, Munning	Vulnerable	Vulnerable	Endangered <sup>1</sup>	Moderate (extreme if species introduced on islands)	3	Predation by European red foxes (moderate); climate change/severe weather events (very high); novel disease (moderate)
<i>Leporillus conditor</i>	Wopilkara, Greater Stick-nest Rat	Vulnerable	Near Threatened (Conservation dependent)	Vulnerable	Moderate <sup>2</sup>	3	Predation by European red foxes (moderate)
<i>Macrotis lagotis</i>	Greater Bilby	Vulnerable	Vulnerable	Vulnerable	Very high - extreme	5	Predation by European red foxes (extreme);
<i>Mesembriomys macrurus</i>	Golden-backed Tree-rat, Koorrawal	Vulnerable	Near Threatened	Least Concern	Moderate	2	Inappropriate fire regimes (high)
<i>Myrmecobius fasciatus</i>	Numbat	Vulnerable	Endangered	Endangered	Very high	4	Predation by European red foxes (very high - extreme); Predation by raptors (high - very high)
<i>Notomys aquilo</i>	Northern Hopping-mouse, Woortrentinta	Vulnerable	Vulnerable	Endangered	Very high	2	Inappropriate fire regimes (very high)



Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Notomys fuscus</i>	Dusky Hopping-mouse, Wilkiniti	Vulnerable	Vulnerable	Vulnerable	High - very high	4	Habitat change due to livestock and feral herbivores (high - very high)
<i>Notoryctes caurinus</i>	Kakarratul, Northern Marsupial Mole	Endangered	Least Concern	Data deficient	Moderate	5	Predation by European red foxes (moderate); predation by dingoes/wild dogs (moderate)
<i>Notoryctes typhlops</i>	Itjaritjari, Southern Marsupial Mole, Yitjarritjarri	Endangered	Least Concern	Data deficient	Moderate	5	Predation by European red foxes (moderate); predation by dingoes/wild dogs (moderate)
<i>Onychogalea fraenata</i>	Bridled Nail-tail Wallaby	Endangered	Vulnerable	Endangered	Very high	10	Predation by European red foxes (very high); climate change/severe weather events (very high); predation by dingoes/wild dogs (very high); habitat loss and fragmentation (very high); Habitat degradation and resource depletion due to livestock and feral herbivores (very high)
<i>Parantechinus apicalis</i>	Dibbler	Endangered	Endangered	Endangered	High	4	Inappropriate fire regimes (high); predation by European red foxes (high); habitat degradation due to <i>Phytophthora cinnamomi</i> (high)
<i>Perameles bougainville bougainville</i>	Western Barred Bandicoot (Shark Bay)	Endangered	Vulnerable	Endangered	Moderate (extreme if species introduced on islands <sup>2</sup> )	3	Predation by European red foxes (moderate); climate change/severe weather events (high); novel disease (moderate)
<i>Perameles gunnii gunnii</i>	Eastern Barred Bandicoot (Tasmania)	Vulnerable	Vulnerable	Near threatened <sup>1</sup>	Very high	10	Novel disease (very high)
<i>Perameles gunnii</i> unnamed subsp.	Eastern Barred Bandicoot (Mainland)	Endangered	Endangered	Near threatened <sup>1</sup>	Very high	10	Predation by European red foxes (extreme); loss of genetic diversity (very high)
<i>Petaurus gracilis</i>	Mahogany Glider	Endangered	Endangered	Endangered	Minor	7	Inappropriate fire regimes (high - very high); habitat loss and fragmentation (very high); barbed wire fencing entanglement (minor); vehicle mortality (minor); predation by wild dogs (minor); habitat change due to livestock (minor); habitat change due to weeds (minor)

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Petrogale lateralis</i> MacDonnell Ranges race	Warru, Black-footed Rock-wallaby (MacDonnell Ranges race)	Vulnerable	Vulnerable	Near threatened <sup>1</sup>	High	6	Inappropriate fire regimes (high); predation by European red foxes (extreme); habitat degradation due to weeds (high)
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Vulnerable	Vulnerable	Near threatened	Minor	7	Predation by European red foxes (very high); habitat change due to livestock and feral herbivores (high); predation by wild dogs (minor); Small subpopulation size (minor); habitat degradation and resource depletion due to native herbivores (minor); habitat loss and fragmentation (minor); inappropriate fire regimes (minor)
<i>Petrogale persephone</i>	Proserpine Rock-wallaby	Endangered	Endangered	Endangered	Moderate	6	Predation by wild dogs (moderate); habitat loss and fragmentation (high)
<i>Petrogale xanthopus xanthopus</i>	Yellow-footed Rock-wallaby (SA and NSW)	Vulnerable	Near Threatened	Near threatened	High	5	Predation by European red foxes (extreme); habitat change due to livestock and feral herbivores (high)
<i>Phascogale calura</i>	Red-tailed Phascogale	Endangered	Near Threatened	Near threatened	Very high	4	Habitat loss and fragmentation (very high); climate change/severe weather events (very high)
<i>Phascogale pirata</i>	Northern Brush-tailed Phascogale	Vulnerable	Vulnerable	Vulnerable	High	7	Inappropriate fire regimes (high); poisoning by cane toads (high); climate change (high)
<i>Potorous gilbertii</i>	Gilbert's Potoroo	Critically Endangered	Critically endangered	Critically endangered	High - very high	2	Inappropriate fire regimes (extreme); predation by European red foxes (high - very high)
<i>Potorous longipes</i>	Long-footed Potoroo	Endangered	Vulnerable	Endangered	High	6	Inappropriate fire regimes (high); predation by European red foxes (very high); predation by dingoes/wild dogs (high)
<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo (SE mainland)	Vulnerable	Near Threatened	Least Concern <sup>1</sup>	High	7	Inappropriate fire regimes (very high); predation by European red foxes (very high); predation by dingoes/wild dogs (high); habitat loss and fragmentation (very high)

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Pseudantechinus mimulus</i>	Carpentarian Antechinus	Vulnerable	Near Threatened	Endangered	Moderate	4	Inappropriate fire regimes (high)
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum, Ngwayir	Vulnerable	Critically endangered	Vulnerable	Very high - extreme	6	Inappropriate fire regimes (very high); predation by European red foxes (very high - extreme); climate change/severe weather events (very high - extreme)
<i>Pseudomys fieldi</i>	Shark Bay Mouse, Djoongari, Alice Springs Mouse	Vulnerable	Vulnerable	Vulnerable	Moderate (very high if cats establish on islands <sup>2</sup> )	4	Predation by European red foxes (moderate) <sup>2</sup> ; predation by black rats (moderate) <sup>2</sup>
<i>Pseudomys fumeus</i>	Konoom, Smoky Mouse	Endangered	Vulnerable	Endangered	Very high	7	Nil
<i>Pseudomys novaehollandiae</i>	New Holland Mouse, Pookila	Vulnerable	Vulnerable	Vulnerable	Very high	7	Inappropriate fire regimes (very high)
<i>Pseudomys oralis</i>	Hastings River Mouse, Koontoo	Endangered	Vulnerable	Vulnerable	High	6	Predation by European red foxes (high); disjunct, genetically distinct populations (moderate)
<i>Pseudomys pilligaensis</i>	Pilliga Mouse, Poolkoo	Vulnerable	Least Concern	Data deficient	Unknown	Unknown	Unknown
<i>Pseudomys shortridgei</i>	Dayang, Heath Rat	Vulnerable	Near Threatened	Near threatened	High	6	Inappropriate fire regimes (high); habitat loss and fragmentation (moderate - high)
<i>Rhinolophus philippinensis</i> (large form)	Greater Large-eared Horseshoe Bat	Endangered	Near Threatened	Least Concern	Minor	6	Inappropriate fire regimes (minor); habitat loss and fragmentation (minor); destruction or reduced accessibility of roost sites (minor); disturbance at roost sites (minor); habitat change due to pastoralism (minor)
<i>Sminthopsis aitkeni</i>	Kangaroo Island Dunnart	Endangered	Endangered	Critically endangered	Very high	3	Inappropriate fire regimes (very high)
<i>Sminthopsis butleri</i>	Butler's Dunnart	Vulnerable	Vulnerable	Vulnerable	Moderate	4	Inappropriate fire regimes (moderate - high); habitat loss and fragmentation (moderate); poisoning by cane toads (moderate)

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Sminthopsis douglasi</i>	Julia Creek Dunnart	Endangered	Near Threatened	Near threatened	Very high	4	Nil
<i>Sminthopsis psammophila</i>	Sandhill Dunnart	Endangered	Vulnerable	Endangered	Very high	3	Inappropriate fire regimes (very high); predation by European red foxes (very high)
<i>Xeromys myoides</i>	Water Mouse, False Water Rat, Yirrkoo	Vulnerable	Vulnerable	Vulnerable	Moderate	12	Habitat loss and fragmentation (moderate); habitat degradation due altered hydrology (moderate)
<i>Zyzomys maini</i>	Arnhem Rock-rat, Arnhem Land Rock-rat, Kodjper	Vulnerable	Vulnerable	Near threatened	High	3	Inappropriate fire regimes (very high)
<i>Zyzomys palatalis</i>	Carpentarian Rock-rat, Aywalirroomoo	Endangered	Critically endangered	Critically endangered	Very high	4	Inappropriate fire regimes (very high); climate change (very high)
<i>Zyzomys pedunculatus</i>	Central Rock-rat, Antina	Endangered	Critically endangered	Critically endangered	Very high	4	Inappropriate fire regimes (very high)
<i>Antechinus bellus</i>	Fawn Antechinus	<i>Not listed</i>	Vulnerable	Least Concern	High	4	Inappropriate fire regimes (Very high); poisoning by cane toads (high)
<i>Antechinus godmani</i>	Atherton Antechinus	<i>Not listed</i>	Near threatened	Near threatened	High	3	Climate change in the near future (high)
<i>Bettongia gaimardi</i>	Tasmanian Bettong, Eastern Bettong	<i>Not listed</i>	Vulnerable	Near threatened	High	4	Nil
<i>Bettongia tropica</i>	Northern Bettong	<i>Not listed</i>	Endangered	Endangered	High - very high	8	Climate change/severe weather event (high - very high); small, relictual subpopulations (high); habitat change due to changed fire regimes (high); predation by European red foxes if establish in range in the future (extreme)
<i>Dasyurus viverrinus</i>	Eastern Quoll	<i>Not listed</i>	Endangered	Near threatened	High	7	Novel disease if one establishes on Bruny Island; climate change (high) Fancourt et al. (2015a); predation by European red foxes if establish on Bruny Island as well as Tasmania main island (very high); 1080 poisoning if foxes establish on Bruny Island. Fancourt et al. (2015a)
<i>Hipposideros inornatus</i>	Arnhem Leaf-nosed Bat	<i>Not listed</i>	Endangered	Vulnerable	Minor	3	Inappropriate fire regimes (high); disturbance at roost sites (moderate);

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
							Destruction or reduced accessibility of roost sites (moderate)
<i>Lagorchestes conspicillatus</i>	Spectacled Hare-wallaby	<i>Not listed</i>	Near threatened	Least Concern	Moderate	5	Predation by European red foxes (moderate); novel disease (moderate)
<i>Macropus parma</i>	Parma Wallaby	<i>Not listed</i>	Near threatened	Near threatened	Moderate	4	Inappropriate fire regimes (high); predation by European red foxes (high)
<i>Mastacomys fuscus</i>	Broad-toothed Rat, Tooarrana	<i>Not listed</i>	Near threatened	Near threatened	High	8	Inappropriate fire regimes (high); predation by European red foxes (high); climate change/severe weather events (high)
<i>Mesembriomys gouldii</i>	Black-footed Tree-rat, Djintamoonga	<i>Not listed</i>	Vulnerable	Near threatened	High	7	Inappropriate fire regimes (very high)
<i>Notomys cervinus</i>	Fawn Hopping-mouse, Ooarri	<i>Not listed</i>	Near threatened	Vulnerable	High	4	Nil
<i>Petaurus australis</i>	Yellow-bellied Glider	<i>Not listed</i>	Near threatened	Least Concern	Moderate	5	Inappropriate fire regimes (moderate); habitat loss and fragmentation (high); timber production (moderate)
<i>Petrogale burbidgei</i>	Warabi	<i>Not listed</i>	Near threatened	Near threatened	High	3	Inappropriate fire regimes (high)
<i>Petrogale coenensis</i>	Cape York Rock-wallaby	<i>Not listed</i>	Endangered	Near threatened	Moderate	2	Nil
<i>Petrogale concinna</i>	Nabarlek	<i>Not listed</i>	Near threatened	Data deficient	High	5	Inappropriate fire regimes (high)
<i>Petrogale godmani</i>	Godman's Rock-wallaby	<i>Not listed</i>	Near threatened	Least Concern	High	4	Habitat change due to livestock and feral herbivores (high)
<i>Petrogale purpureicollis</i>	Purple-necked Rock-wallaby	<i>Not listed</i>	Near threatened	Least Concern	High	4	Habitat change due to livestock and feral herbivores (high)
<i>Petrogale sharmani</i>	Mount Claro Rock Wallaby, Sharman's Rock Wallaby	<i>Not listed</i>	Vulnerable	Near threatened	Moderate	4	Habitat change due to livestock and feral herbivores (moderate)
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	<i>Not listed</i>	Near threatened	Near threatened	High	7	Nil
<i>Pseudomys australis</i>	Plains Rat, Palyoora	<i>Not listed</i>	Vulnerable	Vulnerable	Very high	3	Predation by European red foxes (very high)
<i>Pseudomys calabyi</i>	Pinti	<i>Not listed</i>	Near threatened	Vulnerable	High	4	Inappropriate fire regimes (very high)

Scientific Name	Common Name(s)	EPBC Act Status	Action Plan Status	IUCN Red List Status	Overall Threat Rating of feral cat predation	Number of other threats	Other threats which are of equal or greater risk than feral cat predation
<i>Pseudomys occidentalis</i>	Western Mouse, Walyadji	<i>Not listed</i>	Near threatened	Least Concern	High	3	Habitat loss and fragmentation (high); climate change/severe weather events (high)
<i>Pteropus natalis</i>	Christmas Island Flying-fox	<i>Not listed</i>	Critically endangered	Vulnerable	High	6	Novel disease (high)
<i>Sminthopsis archeri</i>	Chestnut Dunnart	<i>Not listed</i>	Near threatened	Data deficient	High	3	Nil
<i>Sminthopsis bindi</i>	Kakadu Dunnart	<i>Not listed</i>	Near threatened	Least Concern	High - very high	4	Inappropriate fire regimes (high)
<i>Wyulda squamicaudata</i>	Scaly-tailed Possum	<i>Not listed</i>	Near threatened	Data deficient	High	2	Inappropriate fire regimes (very high)

Table A2 outlines the threatened bird, reptile, amphibian and migratory/marine species which may be affected by predation by feral cats. These species were determined from profiles in the Australian Government's Species Profile and Threats Database (SPRAT) (Department of the Environment, 2015) that identified predation by feral cats as a threatening process. Note: species listed as marine or migratory are only threatened by feral cats when on shore. This includes predation of juveniles from on shore nests.

**Table A2:** Threatened species other than mammals that may be adversely affected by feral cats

S <sup>3</sup> species type	Scientific Name	Common Name(s)	EPBC Act Status	IUCN Red List Status
<b>Bird</b>	<i>Accipiter hiogaster natalis</i>	Christmas Island Goshawk	Endangered	Least concern <sup>1</sup>
	<i>Amytornis barbatus barbatus</i>	Grey Grasswren (Bulloo)	Vulnerable	Least concern <sup>1</sup>
	<i>Amytornis modestus</i>	Thick-billed Grasswren	Vulnerable	Not listed
	<i>Botaurus poiciloptilus</i>	Australasian Bittern	Endangered	Endangered
	<i>Cacatua pastinator pastinator</i>	Muir's Corella (southern), Western Long-billed Corella (southern)	Vulnerable	Least concern <sup>1</sup>
	<i>Calonectris leucomelas</i>	Streaked Shearwater	Migratory	Least concern
	<i>Cinclosoma punctatum anachoreta</i>	Spotted Quail-thrush (Mt Lofty Ranges)	Critically Endangered	Least concern <sup>1</sup>
	<i>Cyanoramphus cookii</i>	Norfolk Island Parakeet, Tasman Parrot	Endangered	Near threatened
	<i>Cyclopsitta diophthalma coxeni</i>	Coxen's Fig-Parrot	Endangered	Least concern <sup>1</sup>
	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	Endangered	Endangered
	<i>Epthianura crocea macgregori</i>	Yellow Chat (Dawson)	Critically Endangered	Least concern <sup>1</sup>
	<i>Epthianura crocea tunneyi</i>	Yellow Chat (Alligator Rivers)	Endangered	Least concern <sup>1</sup>
	<i>Fregata andrewsi</i>	Christmas Island Frigatebird, Andrew's Frigatebird	Vulnerable	Critically endangered
	<i>Gallirallus philippensis andrewsi</i>	Buff-banded Rail (Cocos (Keeling) Islands)	Endangered	Least concern <sup>1</sup>
	<i>Gallirallus sylvestris</i>	Lord Howe Woodhen	Vulnerable	Endangered
	<i>Geophaps scripta scripta</i>	Squatter Pigeon (southern)	Vulnerable	Least concern <sup>1</sup>
	<i>Geophaps smithii blaaui</i>	Partridge Pigeon (western)	Vulnerable	Vulnerable <sup>1</sup>
	<i>Hylacola pyrrhopygia parkeri</i>	Chestnut-rumped Heathwren (Mt Lofty Ranges)	Endangered	Least concern <sup>1</sup>
	<i>Lathamus discolor</i>	Swift Parrot	Endangered	Endangered
	<i>Leipoa ocellata</i>	Malleefowl	Vulnerable	Vulnerable
	<i>Lichenostomus melanops cassidix</i>	Helmeted Honeyeater, Yellow-tufted Honeyeater (Helmeted)	Critically Endangered	Least concern <sup>1</sup>
	<i>Malurus coronatus coronatus</i>	Purple-crowned Fairy-wren (western)	Vulnerable	Least concern <sup>1</sup>

<sup>1</sup>IUCN Red List Status provides the status at species level and is taken to include the subspecies (a separate assessment at the subspecies level has not been completed at this stage).

S <sup>3</sup> pecies type	Scientific Name	Common Name(s)	EPBC Act Status	IUCN Red List Status
	<i>Malurus leucopterus leucopterus</i>	White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren	Vulnerable	Least concern <sup>1</sup>
	<i>Neochmia ruficauda ruficauda</i>	Star Finch (eastern), Star Finch (southern)	Endangered	Least concern <sup>1</sup>
	<i>Neophema chrysogaster</i>	Orange-bellied Parrot	Critically Endangered	Critically endangered
	<i>Ninox natalis</i>	Christmas Island Hawk-Owl, Moluccan Hawkowl	Vulnerable	Vulnerable
	<i>Ninox novaeseelandiae undulata</i>	Southern Boobook (Norfolk Island), Norfolk Island Boobook Owl	Endangered	Least concern <sup>1</sup>
	<i>Pachycephala pectoralis xanthoprocta</i>	Golden Whistler (Norfolk Island)	Vulnerable	Least concern <sup>1</sup>
	<i>Pachycephala rufogularis</i>	Red-lored Whistler	Vulnerable	Vulnerable
	<i>Pachyptila turtur subantarctica</i>	Fairy Prion (southern)	Vulnerable	Least concern <sup>1</sup>
	<i>Pardalotus quadragintus</i>	Forty-spotted Pardalote	Endangered	Endangered
	<i>Petroica multicolor multicolor</i>	Pacific Robin (Norfolk Island)	Vulnerable	Least concern <sup>1</sup>
	<i>Pezoporus flaviventris</i>	Western Ground Parrot, Kyloring	Critically Endangered	Not listed
	<i>Pezoporus occidentalis</i>	Night Parrot	Endangered	Endangered
	<i>Phaethon lepturus fulvus</i>	White-tailed Tropicbird (Christmas Island)	Endangered	Least concern <sup>1</sup>
	<i>Pterodroma leucoptera leucoptera</i>	Gould's Petrel	Endangered	Vulnerable <sup>1</sup>
	<i>Sternula nereis nereis</i>	Australian Fairy Tern	Vulnerable	Vulnerable <sup>1</sup>
	<i>Stipiturus malachurus intermedius</i>	Southern Emu-wren (Fleurieu Peninsula), Mount Lofty Southern Emu-wren	Endangered	Least concern <sup>1</sup>
	<i>Stipiturus mallee</i>	Mallee Emu-wren	Endangered	Endangered
	<i>Turnix melanogaster</i>	Black-breasted Button-quail	Vulnerable	Near threatened
<b>Reptile</b>	<i>Anomalopus mackayi</i>	Five-clawed Worm-skink, Long-legged Worm-skink	Vulnerable	Vulnerable
	<i>Aprasia rostrata</i>	Ningaloo Worm Lizard, Monte Bello Worm-lizard	Vulnerable	Vulnerable
	<i>Bellatorias obiri</i>	Arnhem Land Egernia	Endangered	Not assessed
	<i>Christinus guentheri</i>	Lord Howe Island Gecko, Lord Howe Island Southern Gecko	Vulnerable	Vulnerable
	<i>Cryptoblepharus egeriae</i>	Christmas Island blue-tailed skink	Critically Endangered	Not assessed
	<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	Endangered	Not assessed
	<i>Delma impar</i>	Striped Legless Lizard	Vulnerable	Vulnerable
	<i>Emoia nativitatis</i>	Christmas Island forest skink, Christmas Island whiptail skink	Critically endangered	Critically endangered
	<i>Eretmochelys imbricata</i>	Hawksbill Turtle	Vulnerable	Critically endangered
	<i>Eulamprus leuraensis</i>	Blue Mountains Water Skink	Endangered	Endangered
	<i>Eulamprus tympanum marnieae</i>	Corangamite Water Skink	Endangered	Not assessed



S <sup>3</sup> pecies type	Scientific Name	Common Name(s)	EPBC Act Status	IUCN Red List Status
	<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	Vulnerable	Vulnerable
	<i>Lepidodactylus listeri</i>	Christmas Island Gecko, Lister's Gecko	Critically Endangered	Vulnerable
	<i>Liasis olivaceus barroni</i>	Olive Python (Pilbara subspecies)	Vulnerable	Not assessed
	<i>Liopholis guthega</i>	Guthega Skink	Endangered	Not assessed
	<i>Liopholis kintorei</i>	Great Desert Skink, Tjakura, Warrarna, Mulyamiji	Vulnerable	Vulnerable
	<i>Oligosoma lichenigera</i>	Lord Howe Island Skink	Vulnerable	Vulnerable
	<i>Ramphotyphlops exocoeti</i>	Christmas Island Blind Snake	Vulnerable	Vulnerable
	<i>Rheodytes leukops</i>	Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver	Vulnerable	Vulnerable
	<i>Tympanocryptis pinguicolla</i>	Grassland Earless Dragon	Endangered	Vulnerable
	<i>Uvidicolus sphyrurus</i>	Border Thick-tailed Gecko, Granite Belt Thick-tailed Gecko	Vulnerable	Lower risk/Near threatened
<b>Amphibian</b>	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Vulnerable	Vulnerable
	<i>Litoria aurea</i>	Green and Golden Bell Frog	Vulnerable	Vulnerable
	<i>Litoria castanea</i>	Yellow-spotted Tree Frog, Yellow-spotted Bell Frog	Endangered	Critically endangered
	<i>Philoria frosti</i>	Baw Baw Frog	Endangered	Critically endangered
<b>Migratory/ Marine</b>	<i>Amaurornis moluccana</i>	Pale-vented Bush-hen, Bush hen	Marine	Least Concern
	<i>Anous minutus</i>	Black Noddy	Marine	Not assessed
	<i>Anous stolidus</i>	Common Noddy	Migratory: CAMBA; JAMBA. Marine	Least Concern
	<i>Apus pacificus</i>	Fork-tailed Swift	Migratory: CAMBA; JAMBA; ROKAMBA. Marine	Least Concern
	<i>Ardenna grisea</i>	Sooty Shearwater	Migratory: CAMBA; JAMBA. Marine	Near threatened
	<i>Ardenna pacifica</i>	Wedge-tailed Shearwater	Migratory: JAMBA. Marine	Least Concern
	<i>Ardenna tenuirostris</i>	Short-tailed Shearwater	Migratory: JAMBA; ROKAMBA. Marine	Least Concern
	<i>Calonectris leucomelas</i>	Streaked Shearwater	Migratory: CAMBA; JAMBA; ROKAMBA. Marine	Least Concern
	<i>Cuculus saturatus</i>	Oriental Cuckoo	Migratory: CAMBA; JAMBA; ROKAMBA. Marine	Not assessed
	<i>Esacus magnirostris</i>	Beach Stone-curlew	Marine	Near threatened

S <sup>3</sup> pecies type	Scientific Name	Common Name(s)	EPBC Act Status	IUCN Red List Status
	<i>Gygis alba</i>	White Tern	Marine	Least Concern
	<i>Monarcha melanopsis</i>	Black-faced Monarch	Migratory: Bonn. Marine	Least Concern
	<i>Onychoprion fuscata</i>	Sooty tern	Marine	Least Concern
	<i>Phaethon rubricauda</i>	Red-tailed Tropicbird	Marine	Least Concern
	<i>Procellaria aequinoctialis</i>	White-chinned Petrel	Migratory: Bonn. Marine	Vulnerable
	<i>Procelsterna cerulea</i>	Grey Ternlet	Marine	Least Concern
	<i>Pterodroma nigripennis</i>	Black-winged Petrel	Marine	Least Concern
	<i>Puffinus assimilis</i>	Little Shearwater	Marine	Least Concern
	<i>Sternula albifrons</i>	Little Tern	Migratory: CAMBA; JAMBA; ROKAMBA. Marine	Least Concern

## **Definitions:**

### ***Migratory species***

Migratory bird species are those species which migrate to Australia and/or its external territories, or pass through or over Australian waters during annual migrations and require conservation. Under the EPBC Act, migratory bird species are taken to be those species which are: listed on the Appendices of the Bonn Convention, in the Annexes to Australia's bilateral migratory bird agreements; or any other relevant international agreement. The listing of the species as migratory under the EPBC Act makes it an offence to kill, injure, take, trade, keep or move that species without a permit.

### ***Bonn Convention***

The Bonn Convention, also referred to as the Convention on the Conservation of Migratory Species (CMS), lists threatened species that cyclically and predictably cross one or more national jurisdictional boundaries (migratory species) and where concerted conservation efforts and effective management of those species is required by range States. Australia is a Party to the Bonn Convention and implements requirements for species listed under its Appendices under the EPBC Act.

### ***Bilateral migratory bird agreements***

Australia's bilateral migratory bird agreements provide for the protection and conservation of migratory birds and their important habitats, protection from take or trade except under limited circumstances, the exchange of information, and building cooperative relationships. The following agreements are currently in place:

- CAMBA agreement: China-Australia Migratory Bird Agreement
- JAMBA agreement: Japan-Australia Migratory Bird Agreement, and
- ROKAMBA agreement: Republic of Korea-Australia Migratory Bird Agreement.

The annexes to JAMBA, CAMBA and ROKAMBA identify species known to be regular and predictable migrants between the agreement countries. JAMBA also refers to endangered bird species of each country, but none of these species are regular migrants between Australia and Japan.

### ***Marine species***

Under the EPBC Act, a listed marine species is a species that occurs naturally in a Commonwealth marine area and requires long-term conservation. Its listing under the EPBC Act makes it an offence to kill, injure, take,

trade, keep or move that species in a Commonwealth area without a permit and without notification of the action having occurred

# Glossary

Critically endangered	Under the EPBC Act, a native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	Under the EPBC Act, a native species is eligible to be included in the endangered category at a particular time if, at that time, (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Endemic	A species that is present in a particular place.
Eradicate	To remove all animals from a population, with no prospect for any moving into the area.
Exclosure/exclusion (fencing)	An area that is fenced to protect the native species within and to prevent the entry of introduced predators.
Feral	An introduced animal, formerly in domestication, with an established, self-supporting population in the wild.
Invasive species	A species occurring as a result of human activities beyond its accepted normal distribution and which threatens valued environmental, agricultural or personal resources by the damage it causes (Beeton et al. 2006).
Key threatening process	Under the EPBC Act, a process that threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community.
Performance indicator	A criterion or measure that provides information on the extent to which a policy, program or initiative is achieving its outcomes.
Threat abatement plan	Under the EPBC Act, a plan providing for the research, management and any other actions necessary to reduce the impact of a listed key threatening process on affected species and ecological communities.
Threatened species	A species under the EPBC Act listed as critically endangered, endangered, vulnerable or conservation dependent.
Vulnerable	Under the EPBC Act, a native species is eligible to be included in the vulnerable category at a particular time if, at that time, (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

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