

chapter 1

prioritisation of high conservation status offshore islands

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1 Introduction

1.1 Background & scope

The Australian Government began the process of identifying and prioritising the biodiversity values of its offshore islands in 2005. As part of this process, the Department of Environment, Water, Heritage and the Arts (DEWHA) developed a national database with summary information about the introduced species that have been documented at some point in time on Australia's offshore islands (DEWHA 2009a,b). In March 2009, DEWHA contracted Ecosure Pty Ltd to conduct a detailed independent analysis of the conservation values (e.g. level of biodiversity) of Australia's offshore islands and to develop a priority listing of the 100 highest rated islands which:

- a. may be adversely impacted by vertebrate invasive species; or
- b. are at high risk of invasions from vertebrate invasive species.

Here we report on the results of this assessment and provide recommendations to help inform future Australian Government investment in the protection of Australia's island biodiversity and vertebrate invasive species management on individual islands.

1.2 Offshore islands

Oceanic islands have long been recognised as providing refugia for biodiversity globally (Groombridge and Jenkins 2002). With increasing human pressures internationally, including potentially destructive effects of climate change, the importance of islands as biodiversity refugia will undoubtedly increase.

Islands play a significant role in the conservation of Australia's flora and fauna (Rankmore 2005). Australia's offshore islands provide breeding sites and important refugia for many threatened species, including species that are endemic to particular islands or groups of islands (DEWHA 2009a). Some offshore islands present the last refuge for a species that is extinct on the mainland; these island populations also offer opportunities for fauna recovery programs on the mainland and/or other islands by providing founder stock for translocation to areas where the threats have been controlled. Nine species of mammal now survive only on Australia's offshore islands; without these islands these species may have added to the 19 mammal species that have become extinct in Australia over the last 200 years (Burbidge et al. 1997). Islands also provide secure sites or arks to hold species under current threat of extinction on the mainland, e.g. Rufous Hare-wallaby or Mala (DEWHA 2008a).

Some of Australia's most remote islands are pristine wilderness areas and many of the larger islands are time-capsules of human influence on the Australian continent (Robinson et al. 1996). Often sanctuaries for seabirds, turtles, seals, small mammals and other native wildlife vulnerable to invasive pests, many offshore islands are still free of introduced plants and animals. The isolated nature of islands can protect their inhabitants from threatening processes that occur on the mainland and can represent examples of mainland ecosystems that are generally less impacted

by disturbances such as fire and grazing. However, once they have arrived, invasive species and other threatening processes can have more extreme adverse impacts on resident island species than elsewhere (e.g. Burbidge and Manly 2002).

In cooperation with state and territory governments, DEWHA established its 'Islands Biodiversity' database which summarises information about the status of vertebrate invasive species recorded on Australia's offshore islands (DEWHA 2009b). Australia has more than 8 300 offshore islands under 100 000 ha (DEWHA 2008b).

1.3 Impacts of invasive vertebrates in Australia

Invasive animals cause adverse impacts, or have the potential to cause adverse impacts, on social, environmental and economic assets and values. In Australia, invasive animals are a major problem and have been estimated to cause in excess of one billion dollars in damage costs each year (McLeod 2004; Tracey et al. 2007; NLWRA and IA CRC 2008a,b).

1.3.1 Invasive vertebrates in Australia

Hundreds of exotic species of vertebrate animals have been deliberately imported into Australia during the past 200 years for a range of reasons. These include species for agricultural production, pest control and for keeping as domestic pets (Bomford and Hart 2002). In addition, a few exotic vertebrate animals have been imported accidentally, for example in cargo. Not all of the species introduced were intended for release in the wild. Some species (e.g. Red Fox and Rabbit) were deliberately and legally released into the wild, while others (e.g. Goat and Pig) escaped from domestication or captivity and some (e.g. Indian Myna) were released illegally (Bomford and Hart 2002).

Exotic animals that become established in the wild typically have a history of doing so in other places around the world and often have the following attributes (Bomford and Hart 2002):

- high fecundity
- generalised diet
- an ability to live in modified landscapes, and
- a climatic match between Australia and their native habitat.

In mainland Australia, at least 73 species of introduced vertebrates have established populations in the wild, including 25 mammal species, 20 birds, four reptiles, one amphibian and at least 23 freshwater fish (Bomford 2003). Some of these and additional introduced vertebrate species, have established wild populations on Australian offshore islands (McLeod 2004).

1.3.2 Invasive vertebrates listed as key threatening processes

Several exotic vertebrates have been listed as a Key Threatening Process in the Commonwealth of Australia under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The assessment of a threatening process as a key threatening process is the first step to addressing the impact of a particular threat under Commonwealth legislation. A process can be listed as a

Key Threatening Process under the EPBC Act if it could:

- cause a native species or ecological community to become eligible for inclusion in a threatened list, or
- cause an already listed threatened species or threatened ecological community to become more threatened (e.g. endangered), or
- adversely affect two or more listed threatened species or threatened ecological communities.

Key threatening processes involving invasive vertebrates in Australia include (DEWHA 2009c):

- predation by the European Red Fox (Red Fox)
- predation by feral cats (Cat)
- competition and land degradation by rabbits (Rabbit)
- competition and land degradation by unmanaged goats (Goat)
- predation, habitat degradation, competition and disease transmission by feral pigs (Pig)
- the biological effects, including lethal toxic ingestion, caused by the cane toads (Cane Toad)
- predation by exotic rodents on Australian offshore islands of less than 100 000 ha (Black Rat, Brown Rat, Pacific Rat and House Mouse).

1.3.3 Invasive vertebrates on Australian offshore islands

Each of the vertebrate pests listed as an EPBC Key Threatening Process have been introduced or have successfully invaded some of Australia's offshore islands (see Appendix A). In recognition of the importance of offshore islands in safeguarding Australia's biodiversity, a high priority has been allocated to island related activities in Threat Abatement Plans (TAPs) for the above mentioned vertebrate pest threatening processes. The high priority actions identified in these TAPs (DEH 2005; DEWHA 2008b,c,d,e,f) include:

- 1 the collation of data on offshore islands and isolated mainland 'islands'
- 2 evaluating an island's conservation value
- 3 assessing the likelihood of significant biodiversity impacts from a specific vertebrate pest, and
- 4 ranking the level of risk of any specific vertebrate pest being introduced and establishing populations, in places where it is not already present.

Rodents: In 2006 the Australian Government listed four exotic rodents (Black Rat, Brown Rat, Pacific Rat and House Mouse) as a Key Threatening Process on offshore islands. The consequent

TAP for four exotic rodent species on islands of less than 100 000 ha in area was adopted on 3 July 2009 following public comment on a draft (DEWHA 2008b). A key action in this TAP is prioritising islands for eradication or management of rodents (DEWHA 2008a).

Internationally, the four species of rodents addressed in this TAP (Black Rat, Brown Rat, Pacific Rat and House Mouse) have variously invaded over 80% of the world's major island archipelagos. They have been responsible for many of the worldwide species' extinctions and ecosystem changes that have occurred on these isolated refuges for native biodiversity. While exotic rodents continue to invade islands, the rate at which they have been eradicated has exceeded the rate of invasion of new islands (DEWHA 2008b). This is a result of the development and successful deployment of eradication techniques, begun in New Zealand in the 1980s (King 2005). Invasive rodents have now been eradicated from about 350 islands across 21 countries (DEWHA 2008b).

At least 113 of Australia's offshore islands have one or more species of exotic rodent in residence; typically the House Mouse and/or Black Rat. The house mouse and black rat have so far been eradicated from 39 Australian offshore islands, almost all of these in Western Australia (DEWHA 2008b).

Cat: Today there are about 18 million feral cats in Australia (McLeod 2004). They are distributed throughout almost all habitats in mainland Australia and Tasmania, the exception being some of the wettest rainforests, and are found on many offshore islands (DEWHA 2008c).

Although total mainland eradication may be the ideal goal of a Cat TAP, it is not feasible with current resources and techniques. Cat populations must instead be suppressed and managed to mitigate impacts in targeted areas where they pose the greatest threat to biodiversity. However, feral cat eradication has been achieved within fenced reserves, and on many offshore islands where sufficient biosecurity measures are also in place (King 2005; DEWHA 2008c).

Red Fox: The European Red Fox was first brought to Australia by English settlers in the 19th century. Wild fox populations had become established by the 1870s. Today, foxes are widely distributed across the Australian mainland and have been reported on Tasmania. However, the Red Fox has not yet colonised the tropical far north and is not established on Kangaroo Island or on many other offshore islands (DEWHA 2008d).

As foxes are so widely established in Australia, the focus of management is on abating impacts of established populations, except for fenced reserves and offshore islands that are currently Red Fox free, and Tasmania where eradication is being attempted (DEWHA 2008d).

Rabbit: The European Rabbit was deliberately released on the Australian mainland in the mid to late 1800s. This invasive species is now widely distributed over a large part of the Australian mainland and Tasmania, as well as on many of Australia's offshore islands (DEWHA 2008e). Rabbits are well adapted to the climatic conditions that occur in much of Australia, and now inhabit all states and territories. Along with Red Fox and Cat, the Rabbit is considered to be among Australia's most serious vertebrate pests. Furthermore, with the possible exception of the introduced House Mouse, rabbits are Australia's most abundant small mammal. Rabbits severely affect native flora and fauna, vegetation communities, landforms, geomorphic processes and sensitive sites, as well as impacting upon primary industries.

As rabbits are so widely established in Australia, the focus of management is generally on abating their impacts rather than prevention or eradication. However, eradication has been achieved on several offshore islands in New Zealand and in other parts of the world (King 2005), and a program for the eradication of rabbits and rodents from Macquarie Island has been initiated by the Tasmanian government (DEWHA 2008e).

Pig: Populations of feral pigs in Australia have resulted from releases and escapes of various breeds of domestic pigs dating back to the 1700s (DEH 2005). Pigs have been released into the wild for recreational hunting. Although widely distributed on mainland Australia and on Tasmania, feral pigs have established populations on only a few of the larger offshore islands, such as Kangaroo Island in South Australia. Feral pigs have been successfully eradicated from the smaller Lord Howe Island in NSW (Global Invasive Species Database 2007), and many other islands internationally, including several New Zealand islands (King 2005).

Goat: Goats are found across approximately 2 million square kilometres of Australia. They are present in all states, the Australian Capital Territory and some offshore islands, including islands that are part of the Northern Territory, although they are not present on the Northern Territory mainland (DEWHA 2008f).

Eradication from offshore islands, or from mainland areas that have similarly isolated populations, is feasible and has been achieved by various methods since the 1910s (King 2005; DEWHA 2008f).

Cane Toad: The Cane Toad has been present in Australia for nearly 70 years, following their deliberate release as a notoriously unsuccessful pest control agent for the sugar cane beetle in 1935. Since about 3 000 young toads were released in Gordonvale, near Cairns in Far North Queensland, cane toads have spread south and west across the continent and now occur throughout Queensland, in the Northern Territory and in New South Wales. Cane toads are also present on some smaller offshore islands, such as Dunk Island, off the far north coast of Queensland (Global Invasive Species Database 2006a).

Other vertebrate pests: In addition, many other exotic introduced vertebrate species and native translocated species are regarded as feral species on Australia's offshore islands and are potential pests (see Appendix A for the full list of species included as being present, or having been present, on offshore islands considered in this assessment). Other invasive vertebrate pests which are not listed as a Key Threatening Process under the EPBC Act, but which also impact on native biodiversity in Australia, and inhabit offshore islands include the Indian Myna, which is present on islands in the Torres Strait (Global Invasive Species Database 2006b) and is known to impact on many cavity-dwelling vertebrates (Pierce 2005).

Livestock such as European Cattle and Sheep have been introduced onto many of Australia's offshore islands at some point since European settlement, and if unmanaged, grazing by these species can cause extensive land degradation. Horse, Donkey and Water Buffalo are regarded as vertebrate species of 'major concern' when unmanaged in Australia (DEWHA 2008g). Predation by the Dingo and stray or feral populations of Domestic Dog (i.e. wild dogs) can have devastating impacts on ground-dwelling mammal and bird populations (Fleming et al. 2001).

1.4 Impacts on island biodiversity

Invasive vertebrate animals impact on native species directly by predation, competing for food and shelter, destroying habitat, and spreading diseases. Feral animals can also cause land erosion and wild populations have caused a major impact on Australia's soil and waterways, in turn affecting native flora and fauna. In Australia, feral animals typically have few natural predators and little or no exposure to fatal diseases. Furthermore, many invasive vertebrates have high reproductive rates. As a result, their populations have not naturally diminished and they can multiply rapidly if conditions are favourable (DEWHA 2008g).

Feral animals such as rabbits and goats graze or degrade vegetation. The burrowing activities of rabbits can also cause substantial land erosion and landslides that further impact on native species (e.g. Macquarie Island; WWF Australia 2009). On Pacific islands rabbits can destroy the nesting cover for birds and trample eggs and chicks of burrowing seabirds, including the endangered Phoenix Petrel, *Pterodroma alba* (Pierce et al. 2006).

Feral cats and foxes hunt and kill native birds, mammals, reptiles and insects. All four invasive rodents are omnivorous, eating most plant parts, insects, molluscs, snails, reptiles and their eggs, birds and their eggs, and other animals. Size is not always a limiting factor; rodents sometimes predate animals much larger than themselves (e.g. mice predated albatross chicks on Gough Island in the Atlantic Ocean; Wanless et al. 2007). By eating the seeds and fruit of native plants, exotic rodents can limit regeneration of some species (Caughley et al. 1998). They may also compete directly for food with native species of rodents and marsupials which occupy the same niche on many Australian islands. In Australia, Black Rat invasion is known to have caused the extinction of five bird species on Lord Howe Island and two bird species on Norfolk Island (DEWHA 2008b).

Feral cats are considered a threat to 36 species of mammals, 35 birds, 7 reptiles and 3 amphibians listed as threatened under the EPBC Act (DEWHA 2008c). On mainland Australia feral cats prey upon terrestrial mammals weighing up to 3 kg, although smaller individuals (< 200g), including sub-adults and juveniles of larger prey species, are predominantly taken (Dickman 1996). However, on offshore islands feral cats have been documented to target unusual prey species, depending upon availability. In the New Zealand and broader Pacific region, cats impact on birds up to 3.5 kg but have greatest effects on birds < 1kg. In the Phoenix Islands, burrowing seabirds were entirely absent from islands that had supported cats for a long period of time, but were recolonising one island where cats had died out (Pierce et al. 2006). In the New Zealand region the burrow-dwelling White-faced Storm-petrel has been heavily impacted by feral cats and rats. Feral cats are considered a particularly serious threat to birds on islands, especially where other introduced species such as rodents and rabbits provide alternative prey. Exotic prey populations can sustain cat populations which can then have increased impact on native fauna during troughs in exotic prey numbers. If these staple food (exotic species) populations are eliminated or controlled, it can result in serious cat predation pressure on threatened species (Gillies 2001).

1.5 Eradication & biosecurity issues

Eradication of invasive vertebrate pests is an attractive alternative to continuing control because, once achieved, it requires no further commitment of resources other than for monitoring and

surveillance and developing pest contingency plans. Successful and sustained feral pest eradication for long-term benefits requires environmental biosecurity measures to prevent reinvasion and/or reintroduction of the pest species. Bomford and O'Brien (1995) argue that the following conditions must apply to achieve successful eradication:

- rate of removal exceeds rate of increase at all population densities
- immigration is zero, and
- all reproductive animals are at risk (e.g. all females in the population are eliminated).

These three conditions are more likely to be met on offshore islands than on mainland Australia or in Tasmania; areas that are too vast for the capacity of available techniques and resources to achieve eradication (DEWHA 2008c). Nogales et al. (2004) indicate that feral cats have been removed from at least 48 islands globally. In Western Australia feral cats were recently eradicated from the Montebello Islands Conservation Park and Faure Island, using aerial baiting and trapping, with the aim of reintroducing threatened native mammals (Algar et al. 2002). However, many similar islands have no control or eradication programs for feral cats or other invasive vertebrate pests, and re-invasion is possible on some islands, i.e. immigration is not necessarily zero. For these islands, biosecurity measures must go hand-in-hand with eradication efforts to ensure long-term absence of the target vertebrate pests.

Black Rat and especially Brown Rat are adept swimmers and will cross channels of hundreds of metres in width (DEWHA 2008a). In New Zealand, Black Rat has colonised islands over 500 m offshore and Brown Rat up to about 1 km. Burbidge (2004) reports distances of 1.4 km for Black Rat crossings among the Montebello Islands group, possibly with tidal current assistance. Black rats are also the most arboreal of the exotic rodents. About 27% of the 113+ offshore islands with at least one exotic species of rodent are connected to, or within easy swimming distance (for a Black Rat), of mainland Australia (DEWHA 2008b). Many pests, especially rodents can hitch-hike on vessels and thus potentially invade islands. Many 'pest-free' islands tens of kilometres off the New Zealand coast have received pest incursions in this way. Thus, eradication of such vertebrate pests will be difficult on any (nearshore) subset of islands unless efforts are adequately backed by effective biosecurity; 'border' control, quarantine measures and contingency plans developed in order to respond to reported incursions. Novel solutions will be required to keep such rodents and other pests from invading these islands.

1.6 The need to prioritise islands

With in excess of 8 300 offshore islands under 100 000 ha, the Australian Government needs to direct funds towards management of those islands where conservation benefits and eradication impacts will be greatest. A preliminary prioritisation exercise based on land area (at least 200 ha) identified approximately 1 200 islands (Wayne Gregson, Environmental Biosecurity Section DEWHA, pers. comm.); still too many for the allocation of limited funding and resources for protection from invasive vertebrate pests. Accordingly, DEWHA required an independent assessment of the conservation status of Australia's offshore islands, using the Department's 'Islands Biodiversity' database as a guide to targeting, and objectively reviewing, the literature for information that is applicable to pest management on a priority list of offshore islands.