Australian Government

Director of National Parks

THE EFFECTIVENESS OF THREATENED SPECIES AND ECOLOGICAL COMMUNITIES PROTECTION IN AUSTRALIA

SUBMISSION BY THE DIRECTOR OF NATIONAL PARKS TO THE INQUIRY BY THE SENATE ENVIRONMENT AND COMMUNICATIONS REFERENCES COMMITTEE

19 December 2012

EXECUTIVE SUMMARY

Protected areas such as national parks are the primary tool globally for conserving biodiversity and, properly resourced and managed, are an efficient and effective way of protecting biodiversity, including threatened species and ecological communities. This is exemplified by the terrestrial reserves managed by the Director of National Parks through Parks Australia.

Parks Australia is committed to conserving the rich biodiversity within the six Commonwealth national parks—Booderee, Kakadu, Uluṟu-Kata Tjuṯa, Christmas Island, Norfolk Island and Pulu Keeling—and the Australian National Botanic Gardens.

Each park uses a combination of ecosystem-wide and species-specific approaches to meet its conservation objectives. This mix is essential for the effective management of protected areas.

Effective monitoring is a crucial management tool across our parks, however monitoring alone is not enough. What counts is the action taken as a result of research and monitoring—that is, adaptive management. We work closely with researchers and incorporate the lessons learned from research and monitoring into new tools, techniques and management actions within our parks and reserves. We draw on expert advice through a number of park-specific research advisory committees, and from a wide array of researchers and research institutions through partnerships, consultancies and specific projects.

Science is fundamental to good decision-making across our parks. Through our partnerships with leading research institutions, government agencies and the private sector, we greatly increase the value of our research investment. By partnering in external studies and commissioning specific research where necessary, we access the best available minds to help us tackle many of our park management challenges.

There are major issues that need to be addressed to effectively protect threatened species (and biodiversity more broadly) both in and outside protected areas. Legacy issues, inadequate knowledge and resource constraints require a commitment to improving understanding, developing creative approaches, collaboration with neighbours and other partners, and a passion and will to succeed. The overwhelming challenge for us and the nation is to effectively prioritise our conservation actions, acknowledging that resources will never allow us to do everything and we will never have perfect knowledge of the threats we face.

INTRODUCTION

The Director of National Parks

The Director of National Parks is a corporation sole established under Division 5 of Part 19 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is the statutory agency responsible for the Australian Government's protected area estate, both terrestrial and marine declared as Commonwealth reserves under the EPBC Act. The Director is assisted by Parks Australia, a division of the Australian Government Department of Sustainability, Environment, Water, Population and Communities, in carrying out the Director's responsibilities. In this submission, we refer to ourselves as Parks Australia, meaning the Director of National Parks and Parks Australia staff members.

Overview of Activities

Parks Australia provides a national leadership role in the understanding, management and appreciation of the natural and cultural values of Australia's conservation estate, through the management of Commonwealth reserves and through cooperative arrangements with state and territory agencies. A brief overview of the Director's activities follows, with detailed information available in the Director's annual report: http://www.environment.gov.au/parks/publications/annual/11-12/index.html.

Management of Commonwealth terrestrial and marine reserves

There are 66 Commonwealth reserves. Reserves managed directly by Parks Australia staff on behalf of the Director include Booderee, Kakadu and Uluṟu-Kata Tjuṯa national parks, each jointly managed with their Indigenous owners through statutory boards of management; and Christmas Island, Norfolk Island and Pulu Keeling national parks located in Australia's external territories. The Director is also responsible for the Australian National Botanic Gardens (ANBG) a major national scientific, educational and recreational resource located in Canberra.

Under a long-standing agreement between the Director and CSIRO, the ANBG and the CSIRO collaborate as a joint venture through the Centre for Australian National Biodiversity Research. The Centre aims to be a national centre of research excellence in the fields of systematics and conservation biology to support the conservation, sustainable management and sustainable use of Australian ecosystems. Details are at: http://www.anbg.gov.au.

New Commonwealth marine reserves declared in November 2012 added more than 2.3 million square kilometres to the previously existing national system of Commonwealth marine reserves. The Director will take up direct responsibility for the management of marine reserves in February 2013.

Complementary protected area initiatives

Parks Australia and Tourism Australia have formed an innovative partnership to promote Australia's world-class natural and cultural tourism experiences through the National Landscape Program. Currently 15 National Landscapes are recognised including the Australian Alps, the Flinders Ranges and the Kimberley. A major focus of the program is the enhancement of the role of protected areas in the social and economic well-being of regional Australia.

We work closely with the Department of Sustainability, Environment, Water, Population and Communities on programs that complement Commonwealth reserve responsibilities. The prime example is the National Reserve System, Australia's network of protected areas which represents the collective effort of government and non-government organisations, the business sector and Indigenous landholders to formally protect biodiversity in perpetuity. Over almost two decades, 421 new reserves have been added to the National Reserve System covering more than 47 million hectares. This includes 51 Indigenous Protected Areas—areas managed by Indigenous communities to protect their biodiversity for all Australians.

The National Reserve System now covers 15.25 per cent of Australia's landmass. The Commonwealth is responsible for less than three per cent of the land in the National Reserve System but more than 99 per cent of the marine reserve estate.

SCOPE OF THIS SUBMISSION

Notwithstanding the full range of our activities, this submission focuses on the protection of threatened species and ecological communities in the Commonwealth terrestrial reserve estate, comprising six national parks and the Australian National Botanic Gardens. It complements the submission by the Department of Sustainability, Environment, Water, Population and Communities which examines the protection of threatened species and ecological communities from a much wider national perspective.

In particular, with this submission we are not seeking to address the adequacy of threatened species protection across Australia's entire system of protected areas. Such an assessment lies outside the Director's remit, given the diverse range of ownership and management of the nearly 10,000 individual properties that currently comprise the terrestrial component of the National Reserve System.

Nevertheless, we draw the Committee's attention to a detailed study by WWF-Australia and researchers from the University of Queensland. This study indicated that protected areas contribute to the stabilisation or recovery of threatened species, in the face of growing numbers of threatened species resulting from declining habitat (Taylor et al. 2011). Of note is the paper's conclusion that "of all conservation activities, only expansion of strictly protected areas and possibly also legislation to control habitat loss, are associated with stabilisation or recovery of threatened species in Australia." [1]

The Committee should also be aware of the significant investment made by the Australian Government through the National Environmental Research Program (NERP) (http://www.environment.gov.au/biodiversity/science/nerp/index.html). NERP hubs are providing invaluable targeted biodiversity research in our parks and reserves and also improving our decision-making on conserving threatened species and ecological communities.

The remainder of this submission examines threatened species protection in the context of management of the Commonwealth terrestrial protected area estate.

[1] The study utilised a dataset of protected areas maintained by the Director as a contribution to development of the National Reserve System but was not otherwise supported by the Director.

OBJECTIVES OF PROTECTED AREA MANAGEMENT

Protected areas, particularly those designated as national parks, are managed for a range of different objectives—conservation of natural and cultural heritage, recreation consistent with conservation of that heritage and, in the case of jointly-managed national parks, the rights and interests of their Indigenous owners.

While these objectives are in large part complementary, there are also tensions between them. Inevitably, the pressures of responding to incidents, providing safe and attractive recreational opportunities for visitors and meeting the legitimate expectations of traditional owners for economic and social advancement can dominate day-to-day park management. Notwithstanding those potentially competing priorities, biodiversity conservation (including threatened species protection and management) represents a significant commitment of the resources available to the Director.

Those resources are not identified in individual park budgets separately from wider park management activities and so precise estimates are not readily available. We are currently implementing improved activity-based accounting procedures which will provide better estimates of relative expenditure across park management activities in the future.

CURRENT THREATENED SPECIES PROTECTION ACTIVITIES

Each of our six Commonwealth national parks maintains biodiversity monitoring and research programs with a major (but not exclusive) focus on protection of threatened species. Programs concentrate largely on *in situ* conservation although *ex situ* conservation is taking an increasingly important role. The Australian National Botanic Gardens has a major role in the conduct of research into threatened plants and *ex situ* conservation. The Gardens cultivates selected species, maintains seed banks as an insurance against extinction in the wild, and supports species recovery actions such as reintroduction and translocation of threatened species.

The appendix to this submission summarises the principal biodiversity conservation programs undertaken by each reserve. This information is intended as an overview and is not comprehensive—in particular it does not provide details of all programs which control invasive species and which have a flow-on effect for the conservation of threatened species. Further details are available in the Director's annual report, together with supplementary information in the supporting State of the Parks report:
http://www.environment.gov.au/parks/publications/annual/11-12/index.html.

Major threatened species monitoring activities

A number of longstanding monitoring programs on reserves managed by the Director have been important in diagnosing and evaluating biodiversity trends more broadly in Australia:

- The Kakadu National Park Fire Plot Monitoring Program commenced in 1995 with the establishment and baseline sampling of vegetation in 220 plots across three Top End national parks (134 in Kakadu) . The program aims to assess fire regimes, their impacts upon biodiversity and the consequences and efficacy of fire management. It is one of the few long-standing monitoring programs in an Australian protected area and was instrumental in the diagnosis of the decline of small mammals currently occurring

across Australia's northern savannas. While this work provides an essential indicator of regional trends, it does not provide a complete picture of the state of biodiversity conservation for the park and the program is complemented by targeted surveys, research projects and anecdotal sightings of species by park staff.

- For the past 21 years, Uluṟu-Kata Tjuṯa National Park has conducted a long-term biennial vertebrate fauna monitoring program across eight habitat types. That monitoring has been supported by targeted monitoring of threatened species including rare plants, the threatened great desert skink (*Liopholis kintorei*) and the brush-tailed mulgara (*Dasycercus blythi*).
- The Christmas Island biennial island-wide survey is a core monitoring and management tool which began in 2001, with the most recent survey conducted in 2011—the island-wide survey approach has more recently been extended to Pulu Keeling National Park.
- At Booderee National Park a comprehensive park-wide biodiversity monitoring program based on 132 permanent monitoring sites has been in place for nearly a decade through a partnership with the Australian National University. This program has provided invaluable information on the effectiveness of park management and in particular the effectiveness of the park's control programs for the introduced red fox (*Vulpes vulpes*) and invasive bitou bush (*Chrysanthemoides monilifera*).
- A new monitoring regime for Norfolk Island National Park is in its early stages of implementation and aims to assess the effectiveness of the park's management programs with a new focus on outcomes rather than outputs.

Utilisation of Science

Science underpins the design, implementation and effectiveness of our biodiversity conservation work. Major conservation programs are developed at the individual park level and often implemented in collaboration with researchers to ensure programs are delivered using the best available information. Formal science-based advisory groups, in place for many years, guide the application of science to our biodiversity conservation work—the Kakadu Research Advisory Committee and Christmas Island's Crazy Ant Scientific Advisory Panel are prominent examples.

Key examples of the application of science to our biodiversity conservation programs include:

- A series of six Kakadu National Park workshops were held between 2007 and 2010 with stakeholders in the Kakadu region. The workshops focused on the agents of landscape change, with the aim of identifying and discussing management issues, emerging threats, knowledge gaps and research priorities on a local, regional and national scale. The workshops have led to an ongoing exchange of personnel and resources across government agencies and non government organisations, working on fire, weeds, feral pest and cultural issues. They were also an important driver for the current NERP research projects in Kakadu. A threatened species workshop is scheduled for 2013.

- Kakadu's Biodiversity Hotspot Survey Program is a major collaborative project with the Northern Territory government. The program involves targeted surveys of threatened species in recognised biodiversity hotspots in the park, largely in the Arnhem Plateau. Species surveyed include a range of threatened and declining small mammals including the northern quoll (*Dasyurus hallacutus*) and the brush-tailed rabbit-rat (*Conilurus penicillatus*). The program began in 2008 and is currently due for completion in 2013.

- Results from the Christmas Island-wide surveys inform the management of invasive yellow crazy ants (*Anoplolepis gracilipes*) by determining the distribution of crazy ant supercolonies. The surveys also provide data on other invasive species and key species such as declining native reptiles and the endangered Abbott's booby (*Papasula abbotti*).
- A captive breeding program for two reptiles endemic to Christmas Island—the blue-tailed skink (*Cryptoblepharus egeriae*) and Lister's gecko (*Lepidodactylus listeri*)—was initiated in 2009 in response to dramatic declines in the populations of the island's native reptiles. The successful program includes the establishment of off-shore insurance populations of both species through a partnership with Taronga Zoo in Sydney.
- A reintroduction program at Uluṟu-Kata Tjuṯa National Park for the threatened mala or rufous hare wallaby (*Lagorchestes hirsutus*) began in 2005 with the construction of a 170 hectare predator-proof enclosure. From a founder population of 25 individuals, annual monitoring has established that the park population has grown to be the largest on mainland Australia; scientific advice is being used to ensure adequate genetic diversity of this population.

The Australian National Botanic Gardens has collaborated with local and regional partners to conserve threatened species by sharing its expertise in growing and studying Australian native plants. For example, the Gardens collaborates in research to support management for the survival and adaptation of Australian alpine plant species in the face of predicted increasing climate change. In the case of *Swainsona recta*, a small purple pea listed as threatened under Commonwealth and state legislation, a collaborative project involving the Gardens, state and territory agencies and the private sector has resulted in seed collection, seed banking and the propagation of plants for translocation to an offset site to help secure the plant's future.

The Gardens champions the conservation of Australian plants and the role of *ex situ* conservation in integrated conservation management. The Gardens provides a national coordinator to support the Australian Seed Bank Partnership. Together with the Atlas of Living Australia, the partnership has delivered a database that makes information on the conservation of native flora seed collections accessible online (http://asbp.ala.org.au). This resource provides information on the status of threatened species held within *ex situ* collections, together with associated known scientific information to support species recovery actions such as translocation and reintroduction.

Parks Australia collaborates extensively with the Australian Government's National Environmental Research Program (NERP) which supports targeted research and partnerships for multidisciplinary applied research in decision science for biodiversity conservation. Parks Australia has undertaken a number of project collaborations through NERP including postdoctoral research, field projects and application of decision-making tools. Six projects are underway in Kakadu National Park through the Northern Australia Hub. Workshops around structured decision making to guide action, underpinned by science from monitoring programs, have been developed through the Environmental Decisions Hub. The Marine Biodiversity Hub played a significant role determining the scientific basis for the selection of marine reserves.

In the case of Booderee National Park, work is underway to develop long-term strategies to monitor the effectiveness of intervention for conserving populations of species such as the endangered eastern bristlebird (*Dasyornis brachypterus*). Future management of the program to conserve the endangered mala at Uluṟu-Kata Tjuṯa National Park has also benefited from the use of decision-making tools developed through NERP-funded research. At Kakadu National

Park, a NERP-funded project is focussing on the potential impact of feral cats on small mammals, with consultations with the park's traditional owners as part of the planning process.

Assessing the effectiveness of management

Parks Australia makes use of its investment in research and monitoring by incorporating research outcomes into our biodiversity conservation programs. In addition, towards the expiry of its statutory management plan, each park undertakes a technical audit to document the plan's implementation. These audits identify how the park is tracking against its aims, and provide an important foundation for the development of the next management plan including research priorities.

A recent research paper (Lindenmayer et al. in press) provides an evaluation of the success of Booderee's biodiversity conservation programs as a result of its long-running partnership with the Australian National University. The paper describes the development of the strong and enduring scientific-resource partnership at the park and how its results are being used to improve management programs on fire management, feral animal control and invasive weed control.

In a further example, the University of Melbourne is currently undertaking an evaluation of Kakadu's 'stone country' fire management program, instituted in 2007 with the objective of reducing damaging hot, late dry season fires in the Arnhem Plateau area of the park. This region is the site of a number of threatened fire-sensitive ecological communities and is characterised by high levels of species endemism, especially among plants. The park's detailed Landsat fire history information stretching back more than 30 years is a key data source for this evaluation.

While the final results of the evaluation are yet to be published, there appears to be strong evidence that the program is proving effective in reducing the incidence of damaging fire. The stone country burning program benefits from the active participation of the Indigenous owners who have appreciated the opportunity to reconnect with country and re-institute traditional burning practices.

CHALLENGES IN THREATENED SPECIES CONSERVATION

While threatened species conservation has its own particular challenges—such as the inherent difficulty in conducting replicable research on species with small populations—the principal challenges largely mirror those that apply to biodiversity conservation more generally. None of these challenges is new or previously unrecognised. Nevertheless a sound understanding of their implications is necessary for any detailed consideration of enhanced approaches to threatened species management.

Dealing with Legacy Issues

As identified in the 2011 State of the Environment Report, many of the most pressing threatening processes that operate today are the result of deliberate or unintentional land-use and societal decisions made long ago; historical land clearing and introduced invasive species are prime examples. Such factors generally precede the establishment of any particular protected area and in many cases (such as weeds) operate across park boundaries and cannot be adequately addressed in isolation from surrounding land uses. It is important to ensure that the

variety of complementary actions developed to address these issues are sustained across different tenures—parks, private lands and land managed by other agencies for different objectives.

Establishing Priorities

It is inevitable that priorities need to be set in threatened species conservation. The resources required to implement all current and proposed recovery plans and to reverse the multiple threatening processes are beyond what are realistically likely to be available to government and non-government agencies alike. In many cases, there may not be clear management actions yet identified to address threats or remedy legacy issues.

Processes for priority setting are not yet well established, neither within parks managed by the Director nor for threatened species conservation more generally. A range of factors needs to be taken into account in priority setting (including social and economic considerations). Despite the recent development of priority-setting tools for conservation, they are not yet widely deployed in Australia.

For example, it would be an advance to adopt a more objective basis for establishing priorities, one which gave greater emphasis to relative conservation status, taxonomic distinctiveness and the importance of ecosystem function in identifying target species. However, consensus on an appropriate regime would be difficult to achieve. The issue of prioritisation and conservation triage are currently the subject of active scientific consideration (Bottrill et al. 2008; Joseph et al. 2011).

In the case of parks managed by the Director, the conservation program at Uluru-Kata Tjuta National Park for the endangered mala is an example where conservation priorities and social considerations align well. The mala, long extinct from the area now occupied by the park, has great cultural significance for the Anangu traditional owners who have been instrumental in establishing and maintaining a successful breeding population within the park's predator-proof enclosure. The large captive population in the park provides a potential source for reintroductions of this iconic species elsewhere.

Risk of Perverse Outcomes

Natural systems are complex and characterised by interrelated processes that may be poorly studied or understood. There is a risk of perverse outcomes arising from biodiversity interventions, meaning that actions to protect a given species may unknowingly come at the expense of others or at the expense of overall ecosystem function.

Booderee National Park has led the way in regional efforts to control foxes. It is a well-regarded and successful program which has seen the recovery in populations of threatened or significant species known to be at risk from fox predation. Yet unanticipated declines in the park's populations of arboreal marsupials since fox bating may have been an unexpected consequence of this program, possibly in part through increases in populations of two species of large forest-dwelling owls, themselves the subject of conservation concern (Likens and Lindenmayer 2012).

The potential for perverse outcomes demonstrates the need to actively support research and monitoring programs that improve understanding of multi-species interactions and to integrate the results into park management.

Adequacy of Knowledge

Responding to biodiversity threats may require acting without waiting for more complete knowledge. Inadequate information however can compromise the effectiveness and success of management actions. As noted above, Parks Australia uses collaborative partnerships with a wide range of government institutions and universities to progressively improve the knowledge base that underpins park management.

Resource Limitations

Resources will always be constrained. A key task is to make best use of the resources available. The development by NERP researchers of new tools to improve targeting and priority setting is providing more creative solutions to resource constraints. These tools are also helping to guide decision-making in the face of scientific uncertainty.

The protection, conservation and recovery of ecosystems and native species will increasingly rely on cooperation between stakeholders, both within and outside protected area systems.

CONCLUSIONS

Through our extensive monitoring, research partnerships and adaptive management, Parks Australia is working hard to conserve biodiversity and threatened species.

Establishing protected areas is a key component of strategies to protect threatened species but, in isolation, is insufficient. Protected area networks need to be well managed, informed by science and supported by complementary conservation actions across the surrounding landscape.

A diversity of approaches—both ecosystem-wide and species-specific in nature—is required to halt and reverse current declines in biodiversity.

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APPENDIX

MAJOR BIODIVERSITY CONSERVATION UNDERTAKEN IN NATIONAL PARKS MANAGED BY PARKS AUSTRALIA

This appendix is intended as a compilation of major biodiversity conservation activities undertaken in the six national parks managed by Parks Australia and does not provide any information on the results or outcomes of those activities

Booderee National Park

- Poison baiting program for the introduced red fox (*Vulpes vulpes*) commenced in 1999 and intensified in 2002.
- Control of invasive bitou bush (*Chrysanthemoides monilifera*) involving aerial spraying, ground spraying and burning techniques began in the 1990s and intensified in 2004.
- Long-term monitoring of park populations of the endangered eastern bristlebird (*Dasyornis brachypterus*), little penguin (*Eudyptula minor*) and shorebirds.
- Monitoring the effectiveness of fox baiting and of impact of macropod herbivory on vegetation cover following fire.
- Australian Research Council partnership study with the Australian National University, commenced in 2002 is examining impacts of weeds and fire on native species. Major surveys of 132 long-term sites are ongoing with high quality longitudinal data being assembled and analysed on mammal, reptile, frog and bird responses to vegetation type and fire regime.

Christmas Island National Park

- Christmas Island Mine-site to Forest Rehabilitation Program initiated in 1989 (revamped in 2000) to restore areas of rainforest previously cleared for phosphate mining; the program has a focus on rehabilitation of nesting habitat for the endangered Abbott's booby (*Papasula abbotti*).
- On-going control program for invasive yellow crazy ants (*Anoplolepis gracilipes*) involving aerial spraying of supercolonies and follow-up targeted control. A three-year research program conducted by La Trobe University began in 2010, to identify biological control techniques as a long-term alternative to current pesticide-based control.
- Biennial Island Wide Survey undertaken since 2001, initially primarily to guide management of crazy ant control programs by mapping supercolonies and identifying areas for future control work; and by monitoring changes in red crab (*Gecarcoidea natalis*) burrow counts and burrow distribution and density. The survey also provides distributional data on other native and exotic species.

- On-island and off-island captive breeding programs for two native reptiles—the blue-tailed skink (*Cryptoblepharus egeriae*) and Lister's gecko (*Lepidodactylus listeri*)—was established in 2009 in response to on-going drastic declines in native reptile populations.
- Island-wide rat and cat management program established in 2010, in collaboration with the island's principal land management agencies.

Kakadu National Park

- Long-term monitoring of 152 fire plots, as part of the evaluation of the park's fire management program, began in 1995 and is used to measure the outcomes of fire management practices and identify potential impacts of management activities on the ecosystem. The program covers three of the Top End's major national parks—Kakadu, Nitmiluk and Litchfield national parks.
- The Stone Country Burning Program was initiated in 2007 with the aim of reducing the incidence of late dry season intense fires in the park's stone country in the Arnhem Plateau. The program involves traditional owners in bushwalking/burning activities and aims to establish an appropriate fire regime to protect sensitive biodiversity values as well as to facilitate cultural activities on country.
- Ongoing monitoring and control of introduced plants including *Mimosa pigra*, mission grass (*Pennisetum polystachion*), olive hymenachne (*Hymenachne amplexicaulis*), salvinia (*Salvinia molesta*) at Yellow Water and gamba grass (*Andropogon gayanus*).
- The Biodiversity Hotspot Survey began in 2008 as a major collaborative project with the Northern Territory government and involves targeted surveys of threatened species in recognised biodiversity hotspots in the park, largely in the Arnhem Plateau, targeting several declining small to medium-sized mammals including the threatened northern quoll (*Dasyurus hallacutus*) and the brush-tailed rabbit-rat (*Conilurus penicillatus*).
- A collaborative project with the University of Sydney and the Territory Wildlife Park to train northern quolls to avoid cane toads (*Rhinella marina*) as prey and to investigate whether this behaviour is passed on to their offspring began in the park in 2009.
- Six projects funded through the Australian Government's National Environmental Research Program (NERP), focusing on the potential impact of climate change on wetland and coastal environments; a further NERP-funded project focussing on the potential impact of feral cats on small mammals is being planned.
- Monitoring program for two inshore dolphin species, Australian snubfin (*Orcaella heinsohni*) and Indo-Pacific (*Sousa chinensis*), and their habitat requirements was completed in 2011.
- Studies of estuarine crocodile (*Crocodylus porosus*) populations underway since 1979.
- Annual surveys of nesting sites of the threatened flatback turtle (*Natator depressus*) in coastal areas of the park have been undertaken since 1995.

Norfolk National Park

- Monitoring of black rat (*Rattus rattus*) numbers to evaluate effectiveness of on-going introduced rodent management program; supported by cat trapping program.
- Long-term weed management program, undertaken in accordance with the park's weed control strategy.
- Monitoring and recording nest sites of the threatened Norfolk Island green parrot (*Cyanoramphus cookii*) and morepork (*Ninox novaeseelandiae undulata*) which commenced in the 1980s.
- Monitoring of seabird abundance on the Phillip Island section of the park, a major nesting site for seabirds including species no longer found on the main island.
- A new monitoring regime for the park is in its early stages of implementation and aims to assess the effectiveness of natural resource management programs via outcomes rather than outputs. Previous monitoring was largely activity-based, eg number of pests removed or area of vegetation treated—the new monitoring program will focus on outcome approaches, eg tracking trends in population numbers of forest birds over time and assessing the extent of increase in the area and density of native habitat.

Pulu Keeling National Park

- Monitoring of the park's population of the red-footed booby (*Sula sula*) began in 1985.
- Systematic monitoring of marine turtles has been maintained over the last ten years.
- Monitoring of the endemic and threatened Cocos buff-banded rail (*Gallirallus philippensis andrewsi*) which is now restricted to the park began in 1999; establishment of a second population via translocation to an island in the park's neighbouring southern atoll is being planned.
- A biennial Island Wide Survey was established for the park in 2008 to provide baseline biodiversity information and incorporates existing species-specific monitoring programs.

Uluṟu-Kata Tjuṯa National Park

- Biennial fauna monitoring across eight habitat types (includes ten mammals, 65 reptiles and 93 bird species) undertaken since 1990.
- Targeted annual monitoring for the threatened *tjakuṟa* or great desert skink (*Liopholis kintorei*) and *murtja* or brush-tailed mulgara (*Dasycercus blythi*) undertaken since 1999.
- A range of other significant species are monitored including invertebrates in the pools on Uluṟu, seven target species of rare flora in the mesic habitats of Uluṟu and Kata Tjuṯa and the threatened *itjaritjari* or southern marsupial mole (*Notoryctes typhlops*) in various spinifex habitats.
- A reintroduction program for the threatened mala or rufous hare wallaby (*Lagorchestes hirsutus*) began in 2005 with the construction of a 170 hectare predator-proof enclosure

with the involvement of the park's traditional owners, to whom the mala has great cultural significance.

- Monitoring to quantify the health of the waterholes at the base of Uluṟu and gain an improved understanding of the cause of previous frog mortality at Muṯitjulu waterhole.
- Targeted monitoring to address recognised knowledge gaps, including the first ever survey of the park's ant fauna in 2012 in partnership with the CSIRO; surveys of the termite fauna (key ecosystem drivers in arid areas) and microbats are planned for 2013.
- Remote camera and track-based monitoring programs for feral predators and targeted trapping programs, in line with the park's vertebrate pest strategy.
- Monitoring of active burrows of rabbits (*Oryctolagus cuniculus*) undertaken since 1989, with control programs currently focused on release of calicivirus around resilient burrows and intensive treatment and re-treatment of burrows in the mala enclosure with phostoxin.
- On-going control strategy for invasive buffel grass (*Cenchrus ciliaris*) in place throughout the park (previously included a ten-year program of removal in high visitation areas which began in 2002, undertaken in cooperation with conservation volunteers).