ENDANGERED SPECIES MANAGEMENT PLANNING IN NEW ZEALAND

A thesis presented in partial fulfilment of the requirements
for the degree of
Master of Applied Science
in Natural Resource Management
at Massey University, Palmerston North, New Zealand

MASSEY UNIVERSITY

Naomi L E McBride

2011

“This responsibility, caring for the environment, has less to do with the question of right or wrong than with the question of survival. The natural world is our home. It is not necessarily sacred or holy. It is simply where we live. It is therefore in our interest to look after it. This is common sense.”

Dalai Lama Tenzin Gyatso (Ancient Wisdom, Modern World: Ethics for the New Millenium, 2000)

ABSTRACT

The conservation and management of biodiversity has become increasingly sophisticated and this has led to the development of new tools and methods, such as computer programmes to analyse data and modelling approaches to compare different management scenarios and evaluate their potential effectiveness (Kareiva & Levin, 2003). Conservation efforts depend on knowledge, availability of resources, management planning and a willingness of the government and community to commit to long-term recovery actions (National Biodiversity Strategy Review Task Group (NBSRTG), 2009).

Currently, New Zealand legislation that specifically addresses threatened species at a national level in New Zealand, such as the Wildlife Act 1953 and the Conservation Act 1987 are outdated in managing the threats our endangered species face. Adopting more robust legislation, such as that found in Australia (the Environment, Protection and Biodiversity Protection Act 1999), or in the United States of America (the U.S. Endangered Species Act 1973) could help the Department of Conservation reduce the numbers of endemic species being added to the threatened species list and aid in recovery planning for the future.

This research assesses New Zealand's threatened species recovery plans and compares them with national threatened species recovery plans in Australia. New Zealand has recovery plans for only 50 species despite the fact that there are some 2800 species classified as threatened and facing potential extinction (Department of Conservation (DOC), 2010a). Analysing what currently exists in management plans is one way in which to determine what planning has taken place and how an organisation is planning for the future (Sattler & Creighton, 2002b). The lack of review of existing plans is in itself an impediment to improving future plans (Clark, Reading, Clarke, 1994; Clark, Hoekstra, Boersma, Kareiva, 2002).

A review of New Zealand's endangered species recovery plan programme indicates that if threatened species recovery efforts are to be successful in the future, there needs to be a review of existing recovery plans; increased advocacy in the community; and legislation at the national level should be revised and enforced.

ACKNOWLEDGEMENTS

This research has given me the opportunity to meet, work with and learn from an amazing group of people who have all called Massey home at some point.

I would like to thank my supervisors John Holland, Ed Minot and Sue Cassells who gave me the time and space to think.

This thesis would not have been finished without the help and support of the ‘House 39’ and ‘Room 1.42’ gang who willingly gave advice, provided delicious cakes and muffins as well as endless reasons to procrastinate.

Thanks and hugs also go out to my parents and sisters who reminded me to eat, supplied endless cups of tea and bought me a tree to offset all the paper I have had to use.

ACRONYMS

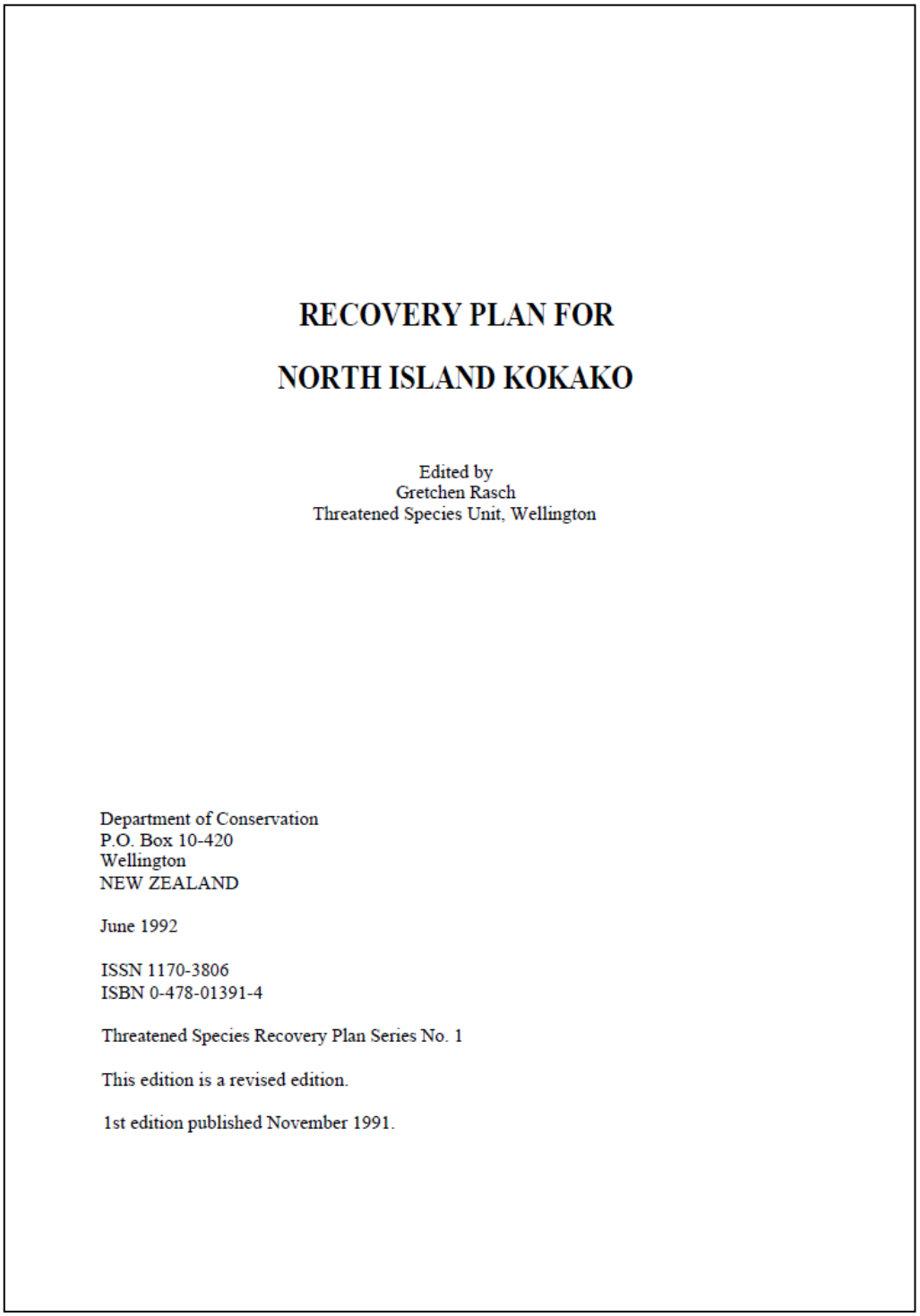
ACNT	Australian Council of National Trusts
ALRC	Australian Law Reform Commission
ANZECC	Australian and New Zealand Environment and Conservation Council
ASEAC	Australian State of the Environment Advisory Committee
ASEC	Australian State of the Environment Committee
CBD	Convention on Biological Diversity
CDEST	Australian government, Commonwealth Department of the Environment, Sport and Territories
DEWHA	Australian government, Department of the Environment, Water, Heritage and the Arts
DLNR	Hawaiian government, Department of Land and Natural Resources
DOC	New Zealand government, Department of Conservation. Also referred to as the Department
DOFAW	United States government, Division of Forestry and Wildlife
DSEWPC	Australian government, Department of Sustainability, Environment, Water, Populations and Communities
EPBC1999	Australian Environment Protection and Biodiversity Conservation Act 1999
ESA1973	United States Endangered Species Act 1973
FWS	United States Fish and Wildlife Service
IPA	Australian Indigenous Protected Areas
IUCN	International Union for the Conservation of Nature
MfE	New Zealand government, Ministry for the Environment
NBSRTG	Australian, National Biodiversity Strategy Review Task Group
NHT	Australian, National Heritage Trust
NSW	New South Wales, Australia
NPW	New South Wales, Australia, National Parks and Wildlife
OECD	Organisation for Economic Cooperation and Development
PPP	Project Prioritisation Protocol
RMA1991	New Zealand Resource Management Act 1991
SCBD	Secretariat of the Convention on Biological Diversity
TSC1995	New South Wales, Australia, Threatened Species Conservation Act 1995
WA1953	New Zealand Wildlife Act 1953

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1. Introduction



RECOVERY PLAN FOR

NORTH ISLAND KOKAKO

Edited by
Gretchen Rasch
Threatened Species Unit, Wellington

Department of Conservation
P.O. Box 10-420
Wellington
NEW ZEALAND

June 1992

ISSN 1170-3806
ISBN 0-478-01391-4

Threatened Species Recovery Plan Series No. 1

This edition is a revised edition.

1st edition published November 1991.

Cover of the first New Zealand threatened species recovery plan published.
Source: North Island Kokako (*Callaeas cinerea wilsoni*) Threatened Species Recovery Plan 1 (Rasch, 1992).

The United Nations designated 2010 as the International Year of Biodiversity in order to mobilise the international community around the wealth and fragility of biological diversity in order to contain an ever-growing range of threats (such as increasing urbanisation, deforestation, agricultural practices and pollution) (Convention on Biological Diversity (CBD), 2010).

New Zealand's indigenous biodiversity comprising of our native endemic species, their genetic diversity, and the habitats and ecosystems that support them is of huge value to our economy. Indigenous biodiversity is important for overseas tourism because it is an element of the government's '100% Pure' marketing campaign. Our iconic endangered species such as the Kiwi (*Apteryx* spp.) are a tourism draw-card and tourism plays a substantial role in New Zealand's economy. Our biodiversity also helps to shape our sense of identity as a nation of 'Kiwi's'. In August 2008, it was estimated that tourism generated NZ$2billion, 18 percent of our export earnings (9.2 percent of our gross domestic product) and one in ten jobs (Department of Conservation (DOC), 2008b). Massey University economists calculated that native biodiversity (our endemic species and the ecosystems they live in, which provide clean air and water, recycle nutrients and decompose wastes) contribute well over twice the value of our gross domestic product (Moran, 2003). In today's terms, that is more than NZ$300 billion to the economy because without the services biodiversity provides, primary industry (such as farming) would be unable to occur (DOC, 2010a).

To date, roughly one third of North America's freshwater fish are rare, threatened or endangered. There is a worldwide decline in amphibian populations, about 42 percent of the world's 270 turtle species are rare or threatened with extinction, almost half of Australia's mammals and 40 percent of mammals in Europe are reported to be threatened with extinction (New, 2000). As countries worldwide become increasingly interested in conserving biodiversity, the profile of nationally threatened species is growing as government agencies compile lists and write plans to determine conservation priorities for threatened and already endangered species. A survey of 180 country signatories of the Convention on Biological Diversity, including New Zealand, discovered that 77 percent of respondents had developed national threatened species lists (Miller, Rodriguez, Aniskowicz-Fowler, Bambaradeniya, Boles, Eaton, Gardenfors, Keller, Molur, Pollock, 2007).

In 2000, the New Zealand Biodiversity Strategy set the ambitious goal of 'halting the decline' of indigenous biodiversity (Ministry for the Environment (MfE), 2000; DOC, 2009b). The first phase in the decline of New Zealand's endemic species was the loss of New Zealand's larger bird species when humans first settled here. By the 1600s, about a third of the original forests had been replaced by grasslands (Young, 2004). From 1850 onwards, European settlements started a new wave of forest destruction and since then a further third of our original forests have been converted to farmland, and there has been extensive modification of wetlands, dunelands, river and lake systems, and coastal areas (Duffey, 2001). As far as we know, in the last 700-800 years, humans and the predator and pest species they have introduced have caused the extinction of 32 percent of indigenous land and freshwater birds; 18 percent of sea birds; three out of seven frogs; at least 12 invertebrates such as snails and insects; one fish, one bat; three reptiles and possibly 11 plants (Young, 2004; MfE, 2007).

Since becoming a signatory of the Convention on Biological Diversity and developing the Biodiversity Strategy, New Zealand has made progress in some areas, including intensive management of mainland islands, eradication of pests on offshore islands, creation of marine reserves and benthic protection areas, and gains on private land (MfE, 2000). But the goal of 'halting the decline' is not yet being met. There have been serious declines in the status of many threatened species and ecosystems; continuing spread of pest fish and aquatic weeds; growing numbers of weed species; and ongoing loss of rare and threatened biodiversity on private lands (MfE, 2000). Whilst significant modification and pollution of harbours and estuaries (which are important breeding grounds for many species, including some harvested fish stocks) is likely to be having a major impact on coastal marine biodiversity (MfE, 2007). Additional pressures on biodiversity include conversion of native habitat to other uses; water pollution, over-abstraction and disruption of natural water flows; terrestrial runoff and sedimentation of coastal waters; impacts of fishing; climate change; and the effect of land use on soils and slope stability (DOC, 2008a; DOC 2008b).

At the moment, it is unclear when the 'optimising threatened species recovery project' which began in 2007-2008 as a result of the Biodiversity Strategy, will be finished. The project's aim is to create a list of nationally important species in New Zealand. It is also unclear if devoting so much time and money in creating the list is an efficient use of scarce resources, when the Department of Conservation's (henceforth referred to as DOC or the Department) 'threat of extinction classification list' written in conjunction with the International Union for

the Conservation of Nature (IUCN) ‘red list’ already highlights which New Zealand species are endangered and threatened with extinction. Whether this new list will be effective in shaping policy within the department is also debateable (confidential discussion with DOC employee, 2009). Especially if the findings conclude that a greater number of species than first thought are in dire need of recovery efforts and immediate action is needed if they are to avoid becoming extinct within the next 50 years.

Around the world, habitat loss is listed as the most significant factor in the decline of flora and fauna (Sutherland, 1998), with 88 percent of the species protected by the United States Endangered Species Act needing some form of habitat protection in order to effectively manage and conserve the species (Wilcove & Chen, 1998; Wilcove, Rothstein, Dubow, Philips, Losos, 1998). At the moment, only 40 percent of New Zealand’s land area is covered with native vegetation, most of which is in hill country and alpine areas. Over the past 200 years, much of New Zealand’s easily accessible and productive land has been cleared or modified for agriculture, viticulture, roads, and human settlement. As a result, many of our lowland and coastal forests, lowland grasslands, wetlands, dune lands, and estuaries have been modified. (MfE, 2000, MfE, 2007). Consequently, the habitat for many threatened species has been forever altered which has enabled more than 2000 plant species, 54 mammal species, and about 2,000 invertebrate species introduced to New Zealand to thrive (Dowding & Murphy, 2001, MfE, 2007; DOC, 2008b). Whilst some of these introduced species, such as sheep and cattle, are cornerstones of New Zealand’s agricultural industry, others pose a threat to our native biodiversity. Introduced predators and competitors, in particular, continue to reduce the populations of some of our most threatened bird species, inadvertently changing our biodiversity (Duffey, 2001). The isolated evolution of our endemic species has meant that many lack strategies to co-exist with, or defend themselves against introduced competitors and predators (Porter, 1988). Without sustained control of such pests and predators, many of New Zealand’s protected ecosystems are at risk of losing key species needed to maintain diversity in our environment (MfE, 2000, MfE, 2007).

DOC is the central government organization charged with promoting the conservation of the natural and historic heritage of New Zealand on behalf, and for the benefit, of present and future New Zealanders (DOC, 2009). Established in 1987, successive New Zealand governments have entered into a number of international treaties concerning the environment and pursue active foreign policy in this regard. Many of these policies and agreements are

managed by DOC on behalf of the government (DOC, 1998b; DOC, 2009) (Appendix 1). DOC also has functions under a number of other Government Acts, such as the National Parks Act 1980, the Reserves Act 1977, the Wildlife Act 1953 (WA1953), the Marine Mammals Protection Act 1978, the Treaty of Waitangi and the Conservation Act 1987 (Appendix 2). Under the Conservation Act 1987, DOC has a number of functions, such as the management for conservation purposes of all land and natural and historic resources held under the Conservation Act; promotion of the benefits of the conservation of natural and historic resources in New Zealand, the sub-Antarctic islands, the Ross Dependency and Antarctica; as well as the provision of advice to the Minister for Conservation (DOC, 2009c). The policy of the Department is to advocate for the conservation of natural and historic resources, provide conservation information and promote the economic, environmental and social benefits of conservation (DOC, 2009d). To do this DOC aims to buffer populations of species against events such as the loss of genetic diversity that can threaten species populations over longer time frames, such as the next 100-300 years (DOC, 2009).

DOC manages almost one-third of the country in the form of 14 national parks, 26 conservation parks, 33 marine reserves, many offshore and sub-Antarctic islands, and numerous other places such as historic sites (DOC, 2008a, DOC, 2009). To do this, DOC has to work with the community and as such roughly 9000 New Zealanders are estimated to contribute to conservation work as volunteers yearly (DOC, 2008b; DOC, 2009). Fieldwork and conservation services are delivered from a network of 44 area offices. The 44 areas are grouped into 11 conservancies, each with a conservancy office to provide support (Figure 1). DOC provides policy advice to the Minister of Conservation and is divided into a number of different departments each with a specific role. The 'Research and Development' department is responsible for developing threatened species recovery plans for endangered species (DOC, 2010a; DOC, 2010e, Appendix 3).

DOC manages these resources in a number of ways. Offshore islands cleared of predators are a key part of the Department's ecosystem-based approach to the management of threatened species. Vital refuges for many threatened native species, there are now an additional six 'island refuges' on the mainland (on North and South Island) (DOC, 2009a). In DOC's Statement of Intent 2010-2013 "conserving nationally threatened species to ensure their persistence" is one of the key focuses for the Department (DOC, 2010a). Nationally threatened species are those that are endemic to New Zealand, including species that have

been self-introduced, but not those introduced by humans. Species are conserved for their contribution to biodiversity and for their role in indigenous ecosystems (DOC, 2008b). A focus on threatened species is necessary because some threatened species require management at sites not targeted for ecosystem management, and techniques are not yet sufficiently developed to ensure effective threatened species conservation as part of ecosystem management (DOC, 2010a).

Figure 1. Map of New Zealand showing DOC conservancies and regional office locations (conservancies are defined by the white lines and named in black, regional offices are labeled with the white text boxes). Source: Conservancy and Area Map (http://www.doc.govt.nz/about-doc/structure/conservancy-and-area-map/).

Governments around the world are being urged to take responsibility for the decline in endemic species at the regional level and to provide legal protection for remaining species and the services they provide (Govey & Owen, 1996; Organisation for Economic Co-operation and Development (OECD), 1999; Myers, Mittermeier, Mittermeier, da Fonseca, Kent, 2000). DOC is currently investigating methods to improve the management and recovery of threatened species (Joseph, Maloney, Possingham, 2009). Therefore, now is an ideal time to closer examine the legislation and recovery planning DOC uses in order to manage and recover populations of threatened and endangered species. Comparisons with another country may highlight weaknesses in the legislation or planning which may be contributing to ineffective management.

Australia is facing similar pressures and threats to its biodiversity as New Zealand. Over the past 200 years, Australia has suffered the largest documented decline in biodiversity of any continent (Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009a). Threats include: habitat loss, degradation and fragmentation; invasive species; unsustainable use and management of natural resources; changes to the aquatic environment and water flows; changing fire regimes and climate change (DEWHA, 2009a).

By 2015, aims of the Australian Biodiversity Conservation Strategy 2010-2020, include: reducing by at least 10 percent the impacts of invasive species on threatened species and ecological communities in terrestrial, aquatic and marine environments; and, establishing a national long-term biodiversity monitoring and reporting system (National Biodiversity Strategy Review Task Group (NBSRTG), 2009). The Department of the Environment, Water, Heritage and the Arts (henceforth referred to as DEWHA), is responsible for biodiversity conservation in Australia in association with other agencies. Working under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC1999) (the Australian government's key piece of environmental legislation) DEWHA is charged with protecting and managing nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the Act as matters of national environmental significance (DEWHA, 2009b; DEWHA, 2009c; DEWHA, 2010a). Since farmers, indigenous communities, and other private land managers manage approximately 77 percent of Australia's land area. Conservation of biodiversity on private land is recognised by the Australian government as an important way to protect Australia's environmental assets. As

such, the Australian government is investing more than AU$2 billion in 2008-2013 to achieve a measurable difference to Australia's environment through its ‘Caring for our Country’ initiative. Caring for our Country supports communities, farmers and other land managers to protect Australia's natural environment and sustainably produce food and fibre (Australian Government Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC), 2010).

Involving the community in the implementation and planning of recovery programmes for threatened species is seen as an important tool in determining the long-term planning for endangered species (Clark, Hoekstra, Boersma, Kareiva, 2002; Moore, 2006). It is also mentioned in most of the recovery plans written for a number of New Zealand’s threatened species. The more people know, understand and experience the full value and benefits of conservation, the more they will support it (DOC, 2010c). DOC has made a commitment to promote the value and benefits of conservation in its everyday work, and promote the economic value and benefits of conservation, such as the way in which conservation of primary farming land can contribute to essential services such as water quality and quantity, soil structures, carbon storage and flood control (DOC, 2010a). A recent review of the Biodiversity Strategy showed that despite gains made, the task ahead remains immense because much of New Zealand’s threatened biodiversity is outside public conservation lands and waters (MfE, 2000). As a result, New Zealanders (tangata whenua, landowners, councils and community groups) will increasingly need to be involved in conservation matters and be encouraged to support the recovery of our threatened flora and fauna.

This thesis reviews DOC’s threatened species recovery plans in order to see what is threatened; how species are being managed both now and in the future; whether legislation is important in the recovery process; and whether or not community involvement is written into New Zealand’s recovery plans as a strategy for the future. Accountability for our decline in threatened species populations lies with DOC. Highlighting ways in which to write more effective management plans and successfully implement threatened species recovery programmes in the future can only but help. Furthermore, it may indicate areas in which DOC needs greater resources or support from the community in order to protect our vulnerable endemic species for future generations.

1.1 Problem Statement

DOC has written management plans for sixty-one of New Zealand's threatened species. These plans outline short-term and long-term recovery goals such as protecting the species, undertaking additional research, establishing and maintaining populations as well as increasing community awareness and participation in species recovery. However, it is unclear if these goals are given equal importance between plans, and whether or not DOC's recovery plans are changing over time to meet the changing needs of the species. Assessing the recovery plans of threatened species in Australia may offer useful insights that lead to more successful management planning for species in New Zealand.

1.2 Research Aim

To review New Zealand's threatened species recovery plan programme.

1.3 Research Objectives

1. To document the content of threatened species recovery plans written in New Zealand and Australia;
2. To compare and contrast management strategies in New Zealand recovery plans with those of Australia;
3. To review case study management plans and develop suggestions for future threatened species recovery planning

1.4 Importance of this Research

The results of this research should aid DOC decision makers when formulating new recovery plans for species which are facing a decline in population numbers. This is because recognising and evaluating what is needed to recover a particular species is a crucial step in the recovery process. Patterns seen in recovery plans for species facing similar threats and management needs could be used to help streamline and improve recovery planning (Foin, Riley, Pawley, Ayres, Carlson, Hodum, Switzer, 1998). This research also highlights the need for a review of how recovery plans are written in New Zealand, particularly when a recovery plan expires and a new one is written for the species.

1.5 Limitations of this Research

An in-depth review of all 428 Australian national recovery plans was beyond the scope of this research. Therefore a representative sample of 12 Australian national threatened species recovery plans was used to compare plan content with that of the 61 recovery plans currently written for New Zealand threatened species. Although only 12 Australian threatened species recovery plans were analysed, the data collected provides state wildlife agencies, researchers and the public with a valuable information resource that can be expanded by simply reviewing additional recovery plans in the future. As a result, a greater number of differences and similarities between individual plans may occur than is mentioned within this thesis. A review of the legislation used in threatened species management in New Zealand was carried out by Seabrook-Davison (2010). As a result, topic overlap and conclusions formed from this research may be similar to those already expressed.

1.6 Thesis Outline

Chapter 2: Literature Review

The literature review provides a brief background about biodiversity in New Zealand and introduces the threats facing biodiversity in New Zealand and Australia, such as habitat loss and introduced predators. It outlines how endangered species are managed in New Zealand and Australia using:

- Recovery planning; and,
- Legislation.

It also highlights the involvement of the community in threatened species recovery and how the respective conservation agencies collaborate with the local community, stakeholders and indigenous people.

Chapter 3: Methodology

Explains the process used to collect the information used to achieve the objectives.

Chapter 4: Results

Presents and analyses the data collected using the methodology outlined in Chapter 3.

Chapter 5: Discussion

Discussion and critique of the findings in relation to published results of relevant studies.

Chapter 6: Conclusion

Summarises the main implications of this research in relation to the aim.

Chapter 7: Recommendations and Further Research

Gives suggestions for successful threatened species recovery planning and proposes areas of further research.

Chapter 2. Literature Review

Source: Stitchbird (Hihi) *Notiomystis cincta* Threatened Species Recovery Plan 20 (Rasch, Boyd, Clegg, 1996).

2.1 Introduction

An environment rich in ecological biodiversity provides clean air and water, recycles nutrients and can regulate local climates (McNeely, Miller, Reid, Mittermeier, Werner, 1990). These ecosystem services are essential to human well-being because they support economic activity, human welfare and are enabling us to adapt to changing climatic conditions (Bell, 1975). Yet there are still many ecosystems and species that are threatened with extinction that are currently not adequately protected or managed (Boardman, 2006). Identifying the threats facing our ecosystems and species is recognised as being time consuming, expensive and requiring commitment over a long period of time, yet understanding these threats is important for those planning management actions at both local and regional levels (Mulder & Coppolillo, 2005; Alexander, 2008).

DOC manages and facilitates the recovery of threatened wildlife in New Zealand. Guided by legislation in the form of the Wildlife Act 1953 (WA1953) and the Conservation Act 1987, each of the 11 regional conservancies administers public conservation land and threatened species within that region. Native and introduced species outside conservation land but within the boundaries of a conservancy are co-managed with other government agencies, landowners, local councils and non-governmental organisations (MfE, 2000; MfE, 2007; DOC, 2010a; DOC, 2010c). DOC also manages species which are not currently protected by the WA1953 (such as invertebrates and plants) on DOC owned land (DOC, 2009d; Seabrook-Davison, 2010).

In New Zealand, loss of habitat, predation by introduced predator species and competition for finite resources with introduced pest species, are recognised as being the primary causes of low population numbers for many of our endangered species (DOC, 2008b). Much of the country's accessible and productive lowland forests, lowland grasslands, wetlands and estuaries have also been cleared or modified for agriculture, horticulture and urban sprawl (MfE, 2000; DOC, 2010a). Protecting and managing our threatened species in the coming years will require greater collaboration between DOC, local councils and the wider community. Many of these threatening processes are also found in other countries such as Australia, where roughly 94 percent of the country's bioregions are threatened, particularly in Victoria, New South Wales, Queensland and in parts of Tasmania (Sattler & Creighton, 2002a). Like New Zealand, a large number of native species in Australia are endemic (Sattler & Creighton, 2002a), which means that the extinction of rare and unique species can only but

harm the ecosystems in which they used to live. This decline in endangered species population numbers and degradation of critical habitats is slowly beginning to be recognised by farmers and others in the community, which is prompting government action in the form of national and state endangered species recovery plans.

Currently in New Zealand there is no legal obligation for the Government to prevent or halt the extinction of species or create legally binding recovery plans for threatened species (Harris, 2004; Seabrook-Davison, 2010). In comparison, since the enactment of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC1999) in Australia, considerable effort has been focused on providing legislative protection and on developing species recovery plans. This has resulted in every endangered and critically endangered species listed under the Act having a national recovery plan outlining the species management over the next five to ten years (Sattler & Creighton, 2002b). By providing a planning document that outlines priorities, objectives, costs and management actions, key interest groups and government agencies in Australia are able to better coordinate their efforts in recovering threatened species populations (Hoekstra, Clack, Fagan, Boersma, 2002; DEWHA, 2009a; DEWHA, 2009d). Understanding the threats facing endangered species in New Zealand, appropriate management actions (in the form of recovery planning and legislation) as well as understanding how the community is being involved in endangered species recovery will outline the direction DOC is taking in New Zealand, and whether or not techniques from other countries may be more successful in the future management of our threatened species. This chapter outlines the threats facing endangered species in New Zealand and Australia; management of endangered species in these two countries, through the use of recovery plans and legislation; and outlines community involvement in endangered species recovery in New Zealand and Australia.

2.2 Biodiversity

The benefits of conserving biological diversity are numerous because biological diversity is the primary source of humanity's needs. An environment rich in diversity offers the broadest array of options for sustainable economic activity, for nurturing human welfare and for adapting to change (Bell, 1975; OECD, 1999). Conservation efforts, however, are under-resourced, uncoordinated and sometimes inappropriate. There are still many ecosystems, species and communities that are important for biological diversity that are not represented in protected areas or adequately conserved (Boardman, 2006). In many cases past economic,

social, political and institutional factors have prevented the appropriate management practices (Bell, 1975). In 2005, the Millennium Ecosystem Assessment completed by more than 1360 scientists working in 95 countries, found that changes in biodiversity due to human activities were occurring more rapidly in the past 50 years than at any other time in human history (Secretariat of the Convention on Biological Diversity (SCBD), 2006). Concern over the rapid loss of biodiversity and the realisation that it plays a fundamental role in supporting human life motivated the creation of the Convention on Biological Diversity, a legally binding global treaty (Le Prestre, 2002). Opened for signature at the Earth Summit, Rio de Janeiro in 1992 and entering into force in 1993,the Convention arose from an international dialogue begun a decade earlier by the World Commission on Environment and Development (known as the Brundtland Commission) (SCBD, 2006). The Convention was the first international treaty to acknowledge the role of biodiversity in sustainable development (Le Prestre, 2002; Mulder & Coppolillo, 2005).

After becoming a signatory to the Convention on Biological Diversity in 1992, the New Zealand Biodiversity Strategy was developed to set the ambitious goal of 'halting the decline' of indigenous biodiversity throughout the country (MfE, 2000). Progress has been made in some areas, such as the intensive management of threatened species on offshore and mainland islands and the creation of marine reserves (MfE, 2000), but this goal is still a work in progress. This is because there have been serious declines in the status of many threatened species and ecosystems; continuing spread of pest fish and aquatic weeds; and growing numbers of weed species (DOC, 2008a; DOC, 2008b).

New Zealand's ecological biodiversity performs a number of important services. Our ecosystems provide clean air and water; help decompose wastes and recycle nutrients; maintain healthy soils; aid pollination; regulate local climates; and reduce flooding (MfE, 2007). These ecosystem services help sustain the country's primary industries production (farming, forestry, viticulture, horticulture) (MfE, 2000; MfE, 2007). In fact, one study has valued the ecosystem services provided by nature each year at NZ$46 billion (Patterson and Cole, 1999). Each of these supporting ecosystem services is essential to human well-being, whether the services are considered at the local, regional or global level (Chapin, Zavaleta, Eviner, Naylor, Vitousek, Hooper, Lavore, Salai, Hobbie, Mack, Diaz, 2000; Mulder & Coppolillo, 2005). Even as we begin to better understand what is at stake, genes, species and habitats are rapidly being lost. The Millennium Ecosystem Assessment concluded that the

direct causes (or drivers) of this loss are either remaining steady, showing no evidence of decline over time, or are increasing in intensity over time (SCBD, 2006).

According to the DOC Statement of Intent (2010-2013) an 'optimising threatened species recovery project' was begun in 2007–2008 to help establish a smarter national direction for threatened species security and recovery. The project aims to create a ranked list of nationally important species during 2010-2011, with the rankings being based upon urgency, feasibility, cost and the relative uniqueness of the species (DOC, 2010a). The list is seen as an invaluable tool in determining the conservation focus of the Department in the coming years and implementation of the species list within DOC is supposed to begin in 2010–2011, whilst a combined priority species and ecosystems list will follow in 2011–2012 (confidential discussion with DOC employee, 2009; DOC, 2010a). Threatened species classification lists provide a method of highlighting those species which are threatened in order to focus attention on conservation measures designed to protect them. As a rule of thumb, more funding is then allotted to species higher up the list (Possingham, Andelman, Burgman, Medellen, Master, Keith, 2002). At the moment, it is unclear exactly when this list will be finished and whether or not it will be effective in shaping policy within the Department (confidential discussion with DOC employee, 2009).

In order to ensure that the long-term security of endangered species is guaranteed, it is important for those planning management actions to understand the threats endangered species face (Alexander, 2008). Identifying the threats causing an individual species to become endangered is a time consuming process which requires extensive research into the biology of the species, as well as long-term monitoring of the species in its natural environment (Biodiversity Decline Working Group, 2005). In both New Zealand and Australia, there are a number of processes which have been identified as threatening the long-term security of many of our endangered species.

2.3 Threats to New Zealand's endangered species

Internationally, New Zealand is regarded as a significant contributor to global biodiversity, with an estimated 80,000 species of native animals, plants, and fungi, of which a large proportion are endemic. Both species of New Zealand bat are endemic, as are all four frogs; all 60 reptiles; more than 90 percent of insects; about 80 percent of vascular plants; and a quarter of all bird species (MfE, 2000; MfE, 2007; DOC, 2009). In contrast, Great Britain,

which separated from continental Europe only 10,000 years ago, has only two endemic species, one plant and one animal (Ray, Redford, Steneck, Berger, 2005). Since the arrival of Maori and Europeans, New Zealand's indigenous biodiversity has suffered one of the highest species extinction rates in the world (Bell, 1975). To date, 2800 native species are listed as threatened ('threatened species' are those most likely to become endangered in the foreseeable future). About 3000 more species are data deficient, which means they could also be threatened but not enough information is known about the species, and its populations, to confirm their status (MfE, 2000; DOC, 2009a).

There are a number of different processes threatening the flora and fauna of New Zealand. Loss of habitat due to destruction or disturbance, predation by introduced predators and competition for resources with introduced pest species, are the primary threats to the long-term survival of many of our endemic species (DOC, 2008b). Particularly for those species which have low population numbers, or have small scattered populations (which affects dispersal ability), and are unable to increase the size of the population without some form of management (Duffey, 2001). Other processes threatening the flora and fauna of New Zealand include, but are not limited to: the effects of inbreeding (such as founder effects and hybridisation); environmental variation and changes in long-term environmental trends (such as increased frequency of flood and drought events); the extinction or reduction in the numbers of mutualistic species (due to competition for resources with introduced species); introduced diseases; and hunting, collecting or other exploitation of both the threatened species (such as whitebaiting), or mutualistic species which the threatened species relies upon (such as harvesting/felling of native hardwood trees and shrubs which support populations of *Dactylanthus taylorii*) (MfE, 2000; MfE, 2007; DOC, 2008b; DOC, 2010a).

Following the initial large-scale deforestation of New Zealand prior to and during the 19th century, only 40 percent of New Zealand's land area is still covered with native vegetation, most of which is now found in hill country and alpine areas (DOC, 2010a). Presently, just over 32 percent of New Zealand's land area is legally protected for conservation purposes, either as public conservation land (8.43 million hectares) or through conservation initiatives on private land (221,473 hectares) (DOC, 2010a). Over the past 200 years, much of New Zealand's most accessible and productive lowland forest has been cleared or modified for a range of different land uses, such as agriculture, horticulture, roading, and human settlement (MfE, 2000). As a result, many of our lowland and coastal forests, lowland

grasslands, wetlands, dune lands, and estuaries have been modified. These habitats and ecosystems are particularly at risk of being modified further if they occur on, or are adjacent to, prime agricultural and horticultural land. This is of concern for those native species which need the habitat in unmodified lowland areas in which to survive (MfE, 2000; MfE 2007; DOC, 2008c).

New Zealand's biodiversity is not only at risk on land. While offshore island reserves continue to protect many of our rarest bird species, freshwater ecosystems, such as streams, lakes, wetlands, and the freshwater species within them, are influenced by human activity that occurs on adjacent land and within estuarine areas (MfE, 2007). Pest species, reduced water quality, and sedimentation are adversely affecting the biodiversity in these ecosystems (MfE, 2000, MfE, 2007). It has been suggested that future conservation priorities continue to focus on improved pest control and biosecurity as well as on increasing legal protection for the land environments and ecosystems that are currently under-represented (Clark, Hoekstra, Boersma, Kareiva, 2002; Kareiva & Levin, 2003).

The isolated evolution of New Zealand's native species means many of them lack strategies to co-exist with or defend themselves against introduced predators and competitors (Porter, 1988). More than 25,000 plant species, 54 mammal species, and about 2,000 invertebrate species have been introduced to New Zealand since it was settled (DOC, 2008b). Of the mammals introduced to New Zealand, a group of 31 species now dominates many of our landscapes (Dowding & Murphy, 2001, MfE, 2007). Whilst some of these introduced species, such as sheep and cattle, are cornerstones of New Zealand's agricultural industry, others pose a threat to our native biodiversity. Introduced predators and competitors, namely Stoats (*Mustela erminea*), Rats (Norwegian Rat or Brown Rat, *Rattus norvegicus*; the Black Rat or Ship Rat, *Rattus rattus*; and the Kiore or Pacific Rat, *Rattus exulans*), Possums (*Trichosurus vulpecula*), Cats (*Felis catus*) and Dogs (*Canis lupus familiaris*) continue to reduce the populations of some of our most threatened bird species, inadvertently changing the structure and composition of our forests. They do so by preying on eggs, chicks and adults, and by competing for food, nesting sites and territories (Duffey, 2001; MfE, 2000, MfE, 2007). Without sustained control of such pests, many of New Zealand's protected ecosystems are at risk of continued biodiversity loss.

Whether plants and animals are native to New Zealand or introduced, most can only survive within a certain climatic zone (Iverson & Prasad, 1998; Ray *et al*., 2005; Hawkes, Broderick,

Godfrey, Godley, 2009). Whilst most species are able to cope with normal climatic variations, climate change is expected to place additional pressure on many species, particularly those already at risk (MfE, 2000). Small populations are particularly vulnerable to collapse because of genetic disorders, demographic events or environmental catastrophes (i.e. flooding events or fire) (Miller, Reading, Conway, Jackson, Hutchins, Snyder, Forrest, Frazier, Derrickson, 1994; De Lange, Norton, Courtney, Heenan, Barkla, Cameron, Hitchmough, Townsend, 2009). A changing climate is expected to disrupt sensitive food-chain relationships in some ecosystems. For example, there is already evidence in the northern hemisphere that as temperatures grow warmer, some bird species are hatching earlier in the year when the flower or fruit on which they depend for nourishment may not yet be ready (Boardman, 2006). Climate-influenced shifts in habitat may also lead to changes in the distribution of species (Iverson & Prasad, 1998; Hawkes *et al*., 2009). It may cause migration patterns to alter and the available habitat for sensitive alpine species may diminish with the gradual recession of glacial or snow systems (Ray *et al*., 2005). As temperatures and climate patterns change, New Zealand may also develop new biosecurity risks, with new tropical pests and diseases potentially becoming established here (MfE, 2000; MfE, 2007).

Loss of biodiversity is a global problem, and many of the threatening processes facing New Zealand's endangered species are found in other countries such as Australia. Also an island nation, there are numerous threats facing Australia's endangered species and it is only through an understanding of these threats, that effective management of the country's endangered species can be carried out.

2.4 Threats to Australia's endangered species

Australia's biodiversity is unique because of the country's size, isolation, naturally fragmented landscapes and long-term climate variability. In total, 2891 ecosystems and ecological communities in 94 percent of the country's bioregions are threatened, with the greatest numbers in the highly cleared regions of the southern highlands in Victoria and New South Wales, the east coast of Queensland, and in parts of Tasmania (Sattler & Creighton, 2002a). Australia has a large number of native species, of which 85 percent of vertebrate species and 80 percent of vascular plant species are endemic to Australia (Sattler & Creighton, 2002a). Twenty two Australian mammals are now extinct (estimated to be a third of the world's recent extinctions) as a direct result of human modification of the landscape

and the introduction of pest, predator and competitor species to the continent (Burgmann & Lindenmayer, 1998; New 2000).

Like New Zealand, many of Australia's threatened species have a low resilience to external pressures, particularly species which live in habitat which has already been extensively modified, such as in the wheat-sheep belt and semi-arid areas (Australian State of the Environment Committee (ASEC), 2006; DEWHA, 2009a). In these areas, many species have suffered a significant decline in numbers and range and even extinction of vulnerable species has occurred (Beeton, Buckley, Jones, Morgan, Reichelt, Trewin, 2006). There are a number of different processes which are threatening the long-term survival of Australia's endangered flora and fauna, they include: the extensive clearing of vegetation for agriculture in Queensland, New South Wales and Tasmania; increase in land use intensity as a result of agricultural intensification; fragmentation of remnant native ecosystems in New South Wales and Western Australia; concentrated urbanisation along coastlines; a continuing loss of native vegetation in Tasmania relative to its area; changing fire regimes in northern Australia; introduced pest, predator and competitor species; increasing salinity of the soil and water table, particularly in parts of southern Australia; and, changes in the climate (i.e. increasing frequency of particularly dry or wet seasons) (Sattler & Creighton, 2002a; Sattler & Creighton, 2002c; Beeton *et al*., 2006; DEWHA, 2009a).

Both the 1996 and 2001 State of the Environment reports identify the clearance of native vegetation as the most significant threat to terrestrial biodiversity (Australian State of the Environment Advisory Committee (ASEAC), 1996; ASEC, 2001). Historically, most of this clearance has been for agricultural production (about 13 percent of endemic vegetation has been cleared since European settlement), with an estimated 17 million hectares of forest having been cleared since 1973 and 1.5 million hectares of deforestation occurring between 2001 and 2004 (Cofinas & Creighton, 2001). With broad scale clearing controls in most states and territories, the threat is from an increase in clearing for urban development on Australia's richly diverse coastlines and mountainous regions (Burgmann & Lindenmayer, 1998; Cofinas & Creighton, 2001; Beeton *et al.*, 2006).

These broad statistics mask some important trends. Some vegetation systems such as hummock grassland are relatively unmodified, whilst one-third of eucalypt woodlands and 80 percent of temperate woodlands have now been cleared (Sattler & Creighton, 2002a; Olsen, Silcocks, Weston, Tzaros, 2006). Apart from limitations in the data due to issues such as the

scale of mapping, there is also the continuing inconsistency of vegetation identification and subsequent classification systems used between states and territories (Sattler & Creighton, 2002b; Beeton *et al*., 2006). Combined with the lack of data surrounding non-vascular plants, this makes it very difficult to consider finer-scale changes in vegetation types across the continent (Cofinas & Creighton, 2001).

Land clearance is also a major cause of declining numbers of fauna populations throughout Australia, and will continue to impact population numbers for decades as a result of habitat fragmentation (Lunney, 1991). For many species, the risk of extinction has yet to become apparent as mobility and adaptability to changing habitats, combined with a lack of biological and census data, means that only some species of birds, reptiles and amphibians have been assessed and are being actively managed (Cogger, Cameron, Sadlier, Eggler, 1993; Australian and New Zealand Environment and Conservation Council (ANZECC), 2001). It is thought that around 82 percent of all avian taxa on mainland Australia and in Tasmania have been affected by land clearance at some stage, and for half it is a continuing threat (Commonwealth Department of the Environment, Sport and Territories (CDEST), 1996; Garnett & Crowley, 2000). Based on analysis of the 1977–81 and 1998–2001 Bird Atlas surveys, 29 species of birds over the past 20 years have shown a significant decrease in numbers in agricultural areas where large scale clearing of the landscape has occurred. Most affected are the grassland, woodland and ground nesting species (Garnett, 1992; Garnett & Crowley, 2000; Sattler & Creighton, 2002a; Sattler & Creighton, 2002c).

Overgrazing in many areas of the pastoral zone is another key issue facing threatened species in Australia. Grazing pressure dramatically reduces the standing biomass of grasses and changes the composition of the grasslands (Cofinas & Creighton, 2001). In systems where the decline has been significant, even low grazing pressure can prevent system recovery. This is particularly the case in parts of Australia where a combination of extreme overstocking and a 50-year rabbit plague has significantly altered the ecosystem for both native fauna and flora (Cofinas & Creighton, 2001; Beeton *et al*., 2006). Intensive grazing and various agricultural improvement strategies have modified vast areas of grasslands and open grassy woodlands, so much so that in temperate ecosystems less than two percent of the original grasslands remain (ANZECC, 2001). These large scale changes to the environment have over time, altered populations of native species because the changed environment favours adaptable introduced species (New, 2000). One objective in the five year Black-throated Finch

(*Poephila cincta cincta*) recovery plan is to study how landscape and management variables (e.g. landscape pattern, vegetation structure, fire, livestock grazing, rainfall and land condition) have influenced the species breeding, so that a more detailed work plan can be developed for the species (Black-throated Finch recovery team, 2007).

Even though it is understood that introduced non-native species compete for similar scarce resources (such as introduced feral animals and weeds competing with native species for water in arid areas) (Sattler & Creighton, 2002a; McLeod, 2004); introduce and transmit new diseases; and prey on vulnerable populations of native animal species (McLeod, 2004), it is estimated that Australia gains around 20 new pests or diseases each year. Some well known examples include Cane Toads (*Bufo marinus*), Rabbits (*Oryctolagus cuniculus*) and Red Fire Ants (*Solenopsis invicta*) (Beeton *et al*., 2006; National Biodiversity Strategy Review Task Group (NBSRTG), 2009). To date, feral Cats and Foxes (*Vulpes vulpes*) have been the cause of local extinctions and significant reductions in range for native bird species, as a result of increased predation in an increasingly modified habitat (Garnett & Crowley, 2000; Olsen *et al.*, 2006). These pest species remain an ongoing problem for environmental agencies. Weeds are an equally significant pressure on ecosystems, with more than 2500 species of introduced plants now established in the wild in Australia (Meredith, 1993; Beeton *et al.*, 2006; Cofinas & Creighton, 2001). The cost of weeds to Australian agriculture now exceeds AU$4 billion a year and almost all the plants involved are foreign (New, 2000; Sattler & Creighton, 2002a). Half a million dollars a year is spent trying to keep just one woody weed species (*Mimosa pigra*) out of the Kakadu National Park (Gong, Sinden, Braysher, Jones, 2009). Many animal species and plants listed under the EPBC1999 are threatened by at least one invasive organism (DEWHA, 2009c; DEWHA, 2009d).

Declining populations of endangered species and a decrease in habitat quality, is beginning to be recognised by Australian farmers and others in the community, and is increasingly being incorporated into natural resource management policies. This is reflected in the response by local governments in protecting Australia's biodiversity through the EPBC1999 and through the National Heritage Trust (NHT) and other funding bodies (ASEAC, 1996; ASEC, 2001; NBSRTG; 2009). The loss of biodiversity is also having a significant impact on the traditional practices and beliefs of Aboriginal people because traditional customs place great emphasis on 'caring for country' and maintaining its biodiversity (Beeton *et al.*, 2006).

Unfortunately, in the immediate future Australia's biodiversity continues to decline, as processes that undermine biodiversity conservation are still being inefficiently dealt with (NBSRTG, 2009). Although recovery plans have been prepared for the most endangered and the most vulnerable of species, a lack of biological knowledge about individual species is still hindering the effective and successful management of many populations (ANZECC, 2001; Sattler & Creighton, 2002; Alexander, 2008). There is also currently only a small amount of data collected about invertebrates, reflecting not only the scarcity of information but the limited protection afforded in state and territory legislation. For example, the decline in land snails in tropical savannas has not yet been reflected in state or territory listings of threatened species (Sattler & Creighton, 2002a; DEWHA, 2009c). This is why consistent management planning in the long-term for all threatened species (regardless of whether they are flora or fauna) is needed in both New Zealand and Australia, in order to preserve endemic flora and fauna species, and ultimately halt the extinction of vulnerable species.

2.5 Management of endangered species

The complexity and scale of managing biodiversity requires a collaborative approach between government organisations, non-government organisations and the community (Bowles & Whelan, 1994). Yet the governance structures for policy-making, decision-making and implementation of recovery programmes are sometimes disconnected and incoherent (Czech, Krausman, Borkhataria, 1998; Foin *et al.*, 1998) and responsibility for endangered species recovery can be split between several local and central government agencies (Czech *et al*., 1998). Effective implementation of recovery programmes requires sufficient resources (such as time, funding, personnel), comprehensive management plans, interagency cooperation, knowledge of appropriate management techniques, legal protection and procedures for implementing recovery plans, as well as community cooperation in the management of habitats and ecosystems on private land (Gunningham & Young, 1997; Boardman, 2006).

The recovery of threatened species is costly. Annual expenditures on threatened species programmes are estimated to be around US$20 million in New Zealand, US$280 million in the United States and US$6 billion globally (Wilcove & Chen, 1998; Wilcove *et al.*, 1998; DOC, 2001; Dawson & Shogren, 2001). In the face of the current economic crisis, it is no surprise that many believe this is a sufficient amount to spend on preventing species extinctions and biodiversity loss. At the moment, DOC conservancies have to annually

compete for funding, and most recovery programmes are funded separately by each of the 11 conservancies, resulting in multiple approaches to managing the same species (Moran, 2003; confidential discussion with DOC employee, 2009; Seabrook-Davison, 2010). Increased transparency, accountability and efficiency is needed for public investment in biodiversity conservation, including the implementation of recovery plans (Naidoo, Balmford, Ferraro, Polasky, Ricketts, Rouget, 2006; Joseph *et al*., 2009). A review of systems currently available for biodiversity investment prioritisation indicates that there is a wide array of tools, resources, and decision frameworks available to managers and decision makers. One such tool is the Project Prioritisation Protocol (PPP), which provides an operational model for considering the costs and benefits of resource allocation for conservation of threatened species. This tool is being used by DOC to assist in the efficient allocation of resources among management projects for threatened species and ecosystems (Joseph *et al*., 2009). Successful programmes with organisational weaknesses use a larger proportion of resources (i.e. time and money) than necessary and those resources could be applied to other equally threatened species (Joseph, Maloney, O'Conner, Cromarty, Jansen, Stephens, Possingham, 2008). Two species the Kakapo (*Strigops habroptilus*) and Takahe (*Porphyrio hochstetteri*) are allocated a majority of government funding (NZ$1million and NZ$800,000 respectively, Moran, 2003) yet only survive in the wild as a result of intensive management, which looks to be the status quo for the foreseeable future.

Due to their isolation and climatic conditions, island countries such as New Zealand, Australia and Hawaii are recognised globally as having high levels of endemism of both flora and fauna (ANZECC, 2001; Division of Forestry and Wildlife (DOFAW), 2005; DOC, 2010a). As a result, these countries present an opportunity and a challenge for conservation. Whilst the threats to Hawaii's native species persist, in recent years a greater awareness of the need to conserve biodiversity, more assertive political will and wider community involvement in projects have resulted in positive steps towards recovery for some of Hawaii's endangered species (such as the Hawaiian Goose, *Branta sandvicensis* and Green Sea Turtle, *Chelonia mydas agassizi*) (Department of Land and Natural Resources (DLNR), 2001; DOFAW, 2005).

Reviewing the management of endangered species recovery has highlighted a number of different ways in which to secure vulnerable populations from becoming extinct. In both New Zealand and Australia, Government departments such as DOC and DEWHA, together with

regional councils, territorial authorities and local authorities use a variety of different tools to support and increase populations of threatened flora and fauna species. Management tools such as: the identification and biological survey of threatened species; the establishment and management of protected areas (i.e. national parks); increasing population numbers of threatened or endangered species (via techniques like captive breeding), maintaining disease-free populations in zoological facilities, managing pest and predator species; recovery planning for threatened species; legislation to support threatened native species and wilderness areas; and education and support programmes for community conservation groups, have been used for many years to assess and manage known populations of threatened species in both countries (Clark *et al*., 1994; CDEST, 1996; DOC, 1998a; ANZECC, 2001; DOC, 2010a).

Another conservation method which has been used successfully in New Zealand for a number of years is to place populations of endangered bird species on offshore islands. Pest eradication, as opposed to pest control, can be accomplished more effectively in isolated areas that have low risk of reinvasions (DOC, 2008c). Offshore islands that have remained free or have been cleared of introduced predators have been invaluable for the survival of many of New Zealand's most threatened species, such as the Kakapo and Stitchbird/Hihi (*Notiomystis cincta*). In these environments, species may establish new populations in safe havens, free of introduced pests (MfE, 2007). On the mainland, a number of areas have also undergone intensive pest control to hold pest numbers at low thresholds (such as DOC's 'mainland island' projects, Kiwi sanctuaries, and Operation Ark) (MfE, 2007; Clout & Craig, 2008). Surrounded by predator-proof fences and active management of pest species, has enabled Kiwi in particular to return to promising numbers on the mainland (Holzapfel, Robertson, McLennan, Sporle, Hackwell, Impey, 2008). Although mainland islands will be important in the future, because these sanctuaries are typically surrounded by farmland, a lack of wildlife corridors will mean that species will have to be moved by hand to other areas if overcrowding occurs (Bowles & Whelan, 1994; Ray *et al.*, 2005). Similarly, maintaining mainland sanctuaries is very costly as habitat needs to be restored to optimal conditions for various species (Clout, 2001; Clout & Craig, 2008), and predators and pest species will continually endeavour to reach the bounty of endemic fauna and flora inside them.

Under the New Zealand Biodiversity Strategy, the current focus is to secure threatened species from extinction and in particular, reduce the risk of extinction for those species that

are actively managed (MfE, 2000). Species are being preserved for their own sake, for their role in indigenous ecosystems, to meet public expectations and to help to maintain options for current and future New Zealanders (MfE, 2000). As a result, DOC developed field management techniques for a number of threatened species and has been using recovery plans to implement these management strategies for a number of endangered species in New Zealand. In both New Zealand and Australia, recovery plans have been used as guidelines for the conservation of species already threatened or endangered (DEWHA, 2009d; DOC, 2010b), and when combined with appropriate legislation and community awareness and involvement in recovery actions, species such as the Helmeted Honeyeater (*Lichenostomus melanops cassidix*) have been successfully managed and populations of this endangered bird are beginning to increase in number (Menkhorst, 2008).

2.5.1 Recovery planning

A recovery plan for a species or ecological community is defined as "a comprehensive plan that details, schedules and costs all actions, including research, necessary to support the recovery of a species or ecological community" (New, 2000, pg149). It is primarily management focused, and depends on adequate knowledge of the species or community and the reasons for its decline (Alexander, 2008). In many cases, information is likely to be poor and research and surveys are needed to help formulate a recovery plan for the species (Foin *et al.*, 1998). Recovery plans are used to organise, prioritise, and guide the recovery process. They also establish objectives and measurable criteria to determine when a species can be removed from a threatened species list; describe site-specific recovery actions needed to meet the criteria; and identify which parties are responsible for the recovery actions (Boersma, Kareiva, Fagan, Clark, Hoekstra, 2001; Clark *et al*., 2002). As new information becomes available, recovery plans may be revised or updated (Alexander, 2008).

Recovery plans should provide enough information to empower a manager to manage, and must be readable and easy to follow. Although the content and detail may vary from species to species, in brief, a recovery plan should contain an abstract and a simple critical path diagram which outlines, for quick reference, the need for proposed management, its timeframe and costs. There should also be an introduction section which describes the species and its conservation status as well as introducing goals and objectives, the recovery group and its establishment (Hoekstra *et al*., 2002; Alexander, 2008). The species past and present distribution, habitat requirements and known threats should be addressed within the plan and

comment provided on the species recovery potential (Lawler, Campbell, Guerry, Kolozsvary, O'Connor, Seward, 2002). A full range of management options should also be outlined and brief evaluations of each given before management priorities are set. A work plan identifying tasks, their timeframe and approximate costs should also be included, showing opportunities for public involvement (Hoekstra *et al*., 2002; Alexander, 2008; DEWHA, 2009d). The ideal document would allow people at all levels to understand the needs and proposed actions for the species without needing to refer to other documents (Rasch & Saunders, 1990; Hoekstra *et al*., 2002). The framework of a basic management plan, could follow that outlined in Alexander (2008) (see Figure 2 below). This framework proposes a basic structure for management plans which could be easily adapted by a relevant endangered species management agency.

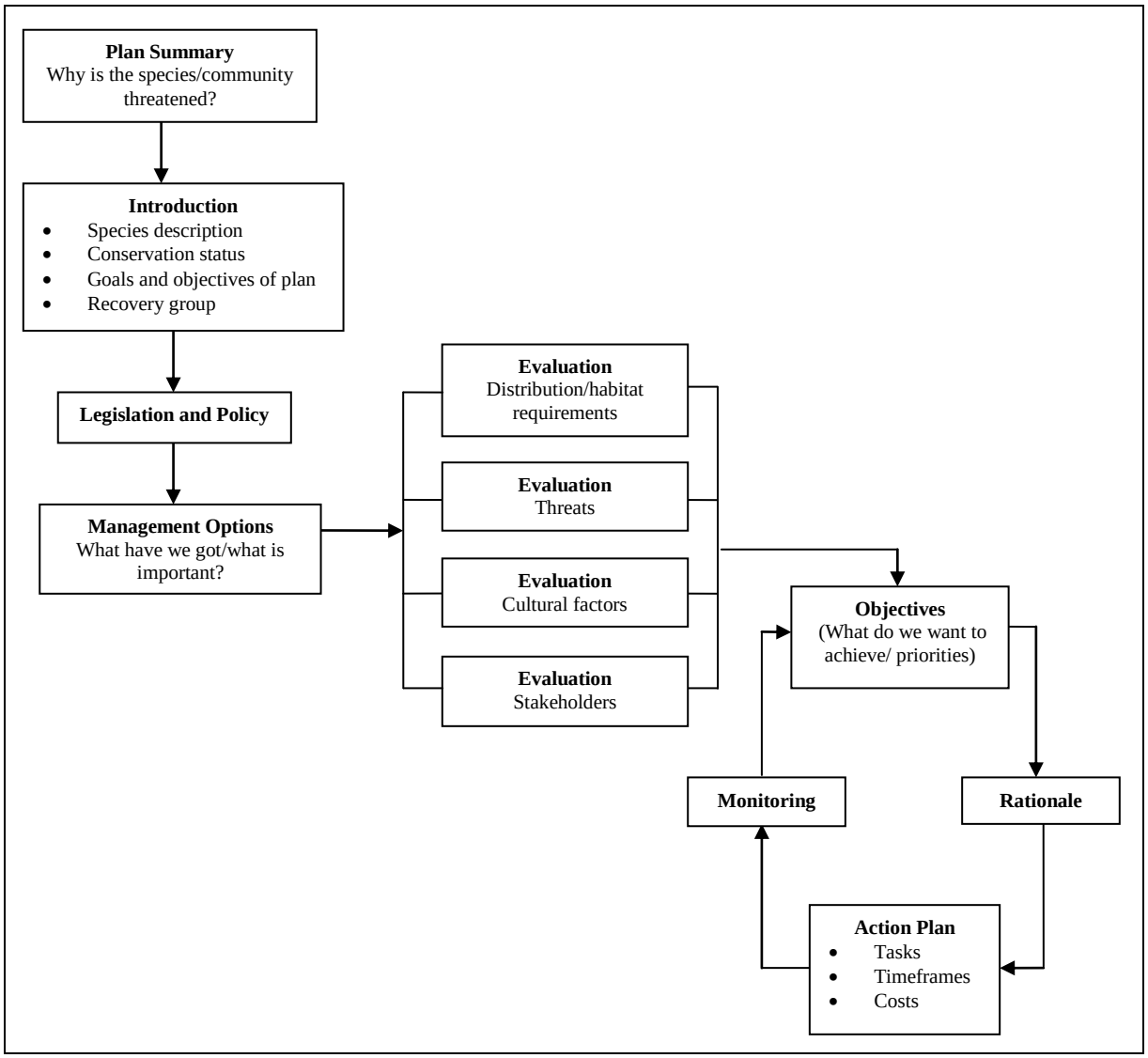


Figure 2. Flow diagram outlining how chapters (in bold type) relate to each other in a basic management plan (Source: Adapted from Alexander, 2008).

Recovery is the process by which listed species and their ecosystems are restored to the point that they no longer meet legislation's (such as the ESA1973 or EPBC1999) definitions of threatened or endangered (in other words, when the threats have been reduced or removed) (Foin *et al.*, 1998; Alexander, 2008). A variety of actions may be necessary to achieve recovery, such as habitat restoration or the reintroduction of the species into unoccupied suitable habitat (Bonnie, 1999). Recovery plans are central to the recovery of listed species, but they are not always regulatory documents. This is because in some countries, like New Zealand, although the recovery plans are written by a government agency (DOC) they are not yet enforced by legislation at the national level. This means that no agency or entity is required by law to implement the recovery strategy or specific actions recommended in a recovery plan (Lundquist, Diehl, Harvey, Botsford, 2002). This is also the case in the United States where under the ESA1973, the Fish and Wildlife Service (FWS) is required under section 4(f)(1) of the ESA1973 to prepare recovery plans for newly listed species but is not required to make sure the recovery plan is implemented (Clark *et al.*, 2002).

Only under certain circumstances, such as if a recovery plan will not promote species conservation, is a species exempt from having a recovery plan written in the United States. In the case of the Ivory-Billed Woodpecker (*Campephilus principalis*) the FWS determined that developing a recovery plan for a species whose very existence was uncertain (before 2004, the last documented sighting of this Woodpecker was in 1942) would not benefit the species, therefore, it was exempt from recovery planning. It was only after more credible sightings in 2004, that the FWS reconsidered this exemption and finally a recovery plan for the species was published in July 2010 (Martin, 2008; United States Fish and Wildlife Service (FWS), 2010). Over the past 20 years, the FWS has written 2758 draft and final recovery plans, 77 of which were published in the United States in 2010 (a majority of which are for Hawaiian species) (FWS, 2010). In the United States, Australia and New Zealand, recovery plans tend to serve as a road map for a species recovery. Laying out where we need to go, how best to get there, how long we think it will take, how much we think it will cost, and when or if recovery management is to be put into practice.

2.5.1.1 New Zealand's recovery plans

To date, DOC has published 61 publically accessible, species recovery plans (some are revisions of earlier plans which have since expired) which include iconic species such as the Kiwi, Kakapo and Takahe as well as lesser known species of native fish and giant land snails.

Individually tailored species management plans are continuing to be written, however, DOC is beginning to move towards an ecosystem-based approach to conservation. Incorporating biodiversity protection in management plans and agreements and understanding the interactions and relationships between species within an ecosystem is seen as a more effective use of resources (Cullen, Moran, Hughey, 2005; DOC, 2008b). As the ecological health of the target area improves, so do the prospects for its community of native species (DOC, 2009a).

Recovery plans are statements about DOC's intentions for the conservation of a particular species of plant or animal, group of species or plant or animal community over a period of time. The plans serve to highlight goals and objectives of recovery management, guide DOC in the allocation of resources and are used to raise public awareness of the recovery process (O'Connor, Maloney, Pierce, 2007; DOC, 2010b). Each plan has a term of five to ten years. All of the plans are now publically accessible via DOC's webpage. The purpose of New Zealand recovery plans is to be proactive and operational in nature by focusing on specific key issues, providing direction, and identifying recovery actions for managers and technical workers (O'Connor *et al.*, 2007). The recovery plans outline objectives which when combined with effective management and implementation should secure and recover threatened species from extinction. The recovery plans should also stimulate the development of best-practice techniques and manuals, which can be transferable across similar species recovery programmes (O'Connor *et al.*, 2007; Wickes, Crouchley, Maxwell, 2009).

Under the WA1953 there is no legal obligation for central government to prevent the extinction of species (Seabrook-Davison, 2010). There is a reference in the Act about the power of the Minister of Conservation to prepare 'generic wildlife plans' but no directive to produce legally binding recovery plans for threatened species (Harris, 2004). Rather, Section 41(e) of the WA1953 states the Minister may from time to time: "prepare and issue plans and publications for the advancement, conservation, management and control of wildlife and the eradication of harmful species of wildlife" (Parliamentary Counsel Office, 2010, pg64). The process for preparing conservation strategies and plans is set out in Sections 17F and 17G of the Conservation Act. The process may include the preparation of information leaflets and resource discussion documents; the circulation of draft material; and the facilitation of hui, public meetings and workshops (Appendix 5) (DOC, 2010b). Individually tailored species management plans are continuing to be written, however, DOC is moving towards an

ecosystem-based approach to conservation which will be reflected in upcoming plans (DOC, 2008b; DOC, 2009a).

2.5.1.2 Australia's recovery plans

In Australia, the Government Minister for the Department of the Environment, Water, Heritage and the Arts (DEWHA) is responsible for making, adopting and implementing recovery plans for all threatened fauna, flora (other than conservation dependent species) and threatened ecological communities listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC1999) (DEWHA, 2009a). At the moment, there are 428 national recovery plans in publication and a further 253 flora and 100 fauna plans are being prepared (DEWHA, 2009c; DEWHA, 2010c). Each plan has a term of five to ten years. Published plans are publically accessible via the Australian government's DEWHA webpage; a number of plans open for public comment are also available here. These plans remain in force unless the species is removed from the threatened species list. Recovery plans are binding on the Australian government, once a recovery plan is in place Australian government agencies must act in accordance with that plan (DEWHA, 2010a).

Recovery plans in Australia set out the research and management actions necessary to stop the decline of threatened species and support the recovery of listed threatened species or threatened ecological communities (DEWHA, 2009d). The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community (Alexander, 2008; DEWHA, 2009a). An effective recovery plan should state what must be done to protect and restore populations of threatened species and their habitat, as well as how to manage and reduce threatening processes. Recovery plans achieve this aim by providing a planned and logical framework for key interest groups and responsible government agencies to coordinate their work to improve the plight of threatened species and ecological communities (Hoekstra *et al*., 2002; DEWHA, 2009a; DEWHA, 2009d).

Before making a recovery plan for a listed threatened species or listed threatened ecological community, the Minister for DEWHA must consult with the appropriate Minister of each state and territory in which the species or ecological community occurs; consider advice from the Threatened Species Scientific Committee; and invite public comment on the proposed plan (the steps used in adopting a recovery plan in Australia can be found in Appendix 6) (DEWHA, 2009a; DEWHA, 2009f). Within 90 days of a species or community being listed

under the EPBC1999 a decision must be made as to whether or not a recovery plan is needed. If a recovery plan is required, it must be in force within three years (DEWHA, 2009b, DEWHA, 2009f; Commonwealth of Australia Law (ComLaw), 2010). Since the enactment of the EPBC1999, considerable effort has been focused on providing legislative protection and on developing species recovery plans. As a result, by 2005 every endangered and critically endangered species listed under the Act had a national recovery plan, and State and Territory governments have been encouraged to develop regional recovery plans (Sattler & Creighton, 2002b).

Recovery plans guide strategic thinking, help establish priorities and cost actions, justify budgets and ultimately plan endangered species management over a five to ten year period (Hoekstra *et al*., 2002; Alexander, 2008; DEWHA, 2009d). Yet there is little point in planning recovery programmes and securing funding if the implementation is not monitored or managed well (Male, 1994). In countries like New Zealand, where there is currently no legal obligation for central government to prevent the extinction of species and no directive to produce legally binding recovery plans for threatened species (Harris, 2004), legislation is seen as a key management tool for the future protection and management of threatened species (Goble, George, Mazaika, Scott, Karl, 1999).

2.5.2 Legislation

Another management tool used to protect and govern species management is the use of legislation, both at national and state levels, to protect threatened or endangered native species and the wilderness areas in which they live (Swanson, 1994). Under the Endangered Species Act of 1973 (ESA1973) the United States Fish and Wildlife Service (FWS) has responsibility for implementing listings, consultations, enforcement of prohibitions and recovery planning. Recovering threatened and endangered species, occurs once the species has been added to the federal lists of endangered species. After listing, recovery plans are developed (one for the species and one for the critical habitat in which the species lives) as well as threat abatement plans (FWS, 2009). Planning and implementing an ecosystem approach to conservation is a priority for the FWS, not only for threatened and endangered species but for all wildlife (Clark *et al.*, 2002).

The ultimate goal of such conservation efforts is the recovery of these species so that they no longer need the Act's protection. An advantage of the ESA1973 is that it has had almost 40

years to be incorporated into legal and administrative functions of the federal government (Ferraro, McIntosh, Ospina, 2007). In time, it is hoped that the recovery of endangered and threatened species throughout the world will become more important to the general public, as they will ultimately be the driving force behind changes to national or state legislation and laws (Clark *et al*., 2002; Manfredo, 2008; Martin, 2008).

2.5.2.1 Endangered species legislation in New Zealand

In New Zealand, DOC has responsibility for the management of New Zealand's endemic species. Guided by the Conservation Act 1987, National Parks Act 1980, Reserves Act 1977, WA1953, the Resource Management Act 1991(RMA1991), plus an additional 35 other Acts (Appendix 2), DOC administers with regional and local councils native flora and fauna. Under the RMA1991, regional councils and local authorities are responsible for maintaining native biological diversity and controlling the effects of land use on native biological diversity (Section 30(1) and Section 31(b) iii). Only Section 6(c) of the RMA1991 refers to the protection of areas of significant native vegetation and significant habitats of native fauna (Harris, 2004).

Amendments to the RMA1991 in 2003, clarified that regional councils and territorial authorities are responsible for managing native biodiversity with DOC. Local authorities must consider the consequences of all effects humans make on the native biodiversity within their regions, as well as prepare for contingency planning if an action (i.e. new road or bridge) will harm a particular species or habitat (Harris, 2004). When the ESA1973 was written, protection of threatened species and their habitat was given equal consideration and is written into legislation at the national level (Clark, Reading, Clarke, 1994). In Australia, the EPBC1999 gives protection to threatened species and large areas designated as ecological communities. It also advocates producing threat abatement plans for processes which directly affect wildlife (DEWHA, 2009b).

Until the 1950s, most environmental legislation in New Zealand focused on the use of land, water and wildlife for the development of the country and hunting of game rather than conservation of endemic species. Such as the Animal Protection Act 1867, which was modelled on English hunting laws and focused on the statutory protection of introduced species (Galbreath, 1993). When it was written, the focus of the WA1953 was to control pest species and allow public access to both introduced and native game species. It provides for

the protection of indigenous wildlife, but does not mention the conservation of threatened species or give mandates for their recovery (wildlife under the WA1953 includes introduced species which are beneficial to humans but which compete with or prey upon threatened native species e.g. game birds and stock) (Parliamentary Counsel Office, 2010). However, as primary industries (agriculture, forestry, fisheries and mining) have been encouraged to drive the economy, forestry and mining acts have taken precedence in determining the current landscape (Young, 2004). Even recent amendments to the WA1953 in 2000 and 2003, only focus on concessions for tourist operators and penalties for killing or harming protected species (Parliamentary Counsel Office, 2010). There is an act specifically for plants, but the Native Plants Protection Act 1934 only provides limited protection for native plant species and needs to be updated to meet today's conservation issues (Harris, 2004).

2.5.2.2 Endangered species legislation in Australia

In contrast with New Zealand, endangered and threatened species issues were brought to national and public prominence in Australia in July 1989 when a ten year 'Endangered Species Programme' was initiated as part of a much broader package of programmes. The Endangered Species Programme was designed to address a wide range of environmental problems from greenhouse effects to biodiversity and loss of cultural heritage. Most of this work has been carried out by the Australian State and Territory government conservation agencies, often with assistance from the National government (Australian Government, 2010). These conservation agencies have the constitutional authority and responsibility for land and wildlife management. When the Australian Constitution was framed in the late 1800s, the environment was not perceived as an issue and it is only since 1999 when the EPBC1999 was developed that effective environmental legislation has been present at a national level (Male, 1994; Australian Government, 2010).

The EPBC1999 is the Australian government's key piece of environmental legislation. Commenced on July 16, 2000, the EPBC1999 enables the DEWHA to join with each of the eight states and other territories in providing a national legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places throughout Australia (DEWHA, 2009b). The EPBC1999 provides a framework for the protection of Australia's native species and ecological communities by identifying and listing species and ecological communities that are threatened; developing recovery plans for listed species, ecological communities and critical habitat; recognising

threatening processes and reducing the impacts of these processes through threat abatement plans (DEWHA, 2009c; DEWHA, 2010a).

In New South Wales (NSW), the Threatened Species Conservation Act 1995 (TSC1995) provides the framework to conserve and recover threatened species, populations and ecological communities through the preparation and implementation of recovery plans. Under this legislation, the Director-General of National Parks and Wildlife (NPW) has a responsibility to prepare recovery plans for all species, populations and ecological communities listed as endangered or vulnerable under the EPBC1999 and TSC1995 schedules (NSW National Parks and Wildlife Service, 2001). Both Acts specify matters to be addressed by recovery plans and the administrative process for preparing recovery plans. In the case of the Blue Mountains Water Skink (*Eulamprus leuraensis*), the species is considered endangered nationally under the EPBC1999, and is listed as endangered in NSW under Schedule 1, Part 1 of the TSC1995. As a result, a recovery plan has been prepared for the species that satisfies both the requirements of the TSC1995 and the EPBC1999 and therefore will be the only recovery plan for the species (NSW National Parks and Wildlife Service, 2001).

Developing threatened species recovery plans means that the prioritisation of recovery efforts can be targeted more strategically on those taxa where the risk of extinction is imminent and prospects of successful recovery are good (DEWHA 2009d; DEWHA, 2009g). Detractors of the EPBC1999 comment on the ambiguity of the act in providing legal precedents for the conservation of threatened species, whilst at the same time providing the consent process for the exploitation of natural resources (Godden & Peel, 2007). This is because economic concerns can often override environmental ones especially since large scale land developments, such as forestry, are exempt from the environmental impact assessment process under the EPBC1999 (ANZECC, 2001; Godden & Peel, 2007; Seabrook-Davison, 2010). In a recent review of the EPBC1999, the NSW Scientific Committee stressed the importance of this distinction, suggesting that linking the listing process with prioritisation of recovery planning and management activities generates a public perception that socio-economic considerations influence the listing process, leaving it open to potential abuse (DEWHA, 2009g). The review recommends that Section186 (2) (b) of the Act be amended to require the Environment Minister (when deciding whether to list a threatened species or ecological community) take the principles of ecologically sustainable development into

account only in exceptional situations, where any social or economic costs associated with listing are vast and the environmental benefits are known to be slight (DEWHA, 2009g).

It is also important to note that assessing greenhouse gas emissions and the impacts of climate change are missing from the EPBC1999 (and are not yet found in New Zealand legislation either) (Harris, 2004; Crossen, 2007; DEWHA, 2009c). Experts agree that the environmental effects of these two processes are having a detrimental effect on the survival of threatened and endangered species in Australia, particularly in the Murray-Darling watershed and Great Barrier Reef (Lane, Wills, Vanclay, Lucas, 2008).

A strength of the ESA1973 and the EPBC1999 is that species that have been assessed and found to be threatened with extinction are listed on a central government register with a legal mandate for the production of a recovery plan. A weakness of both acts is that species can stay on these lists with no effective recovery action for many years (Goble *et al.*, 1999). Although not always implemented, both acts have provisions for the protection and conservation of habitat which is critical for the survival of a federally listed threatened species (Ray & Ginsberg, 1999). However, no matter what level of legislation a country has, if the general public are unwilling to abide by the legislation and subsequent laws, environmental protection of threatened species and ecosystems will never become a priority (Clark *et al*., 1994; Clout, 2001).

2.5.3 Community involvement in endangered species recovery

Involving the community in caring for their natural heritage through education and advice, volunteer programmes and events such as ‘Conservation Week’ and ‘Biodiversity Month’ are vitally important, because without support, government environment agencies invariably face opposition when creating new national parks or reserves, and when seeking additional funding (DOC, 2009a; ASEC, 2006). Since a large proportion of New Zealand’s threatened biodiversity can be found living on private land, education and support programmes in communities with threatened biodiversity are a way in which to increase collaboration with the public, non-government organisations, businesses and other government agencies in order to protect and restore populations of threatened species (CDEST, 1996; DOC, 1998a; ANZECC, 2001; Kuehn, Feldman, Harpke, Hirneisen, Musche, Leopold, Settele, 2008; DOC, 2009a).

2.5.3.1 Community conservation in New Zealand

New Zealanders take pride in calling themselves 'Kiwis' after one of the country's most well-known threatened native birds. Involving the community in caring for their natural heritage through education, sponsorship, awards, volunteer programmes, partnerships and events such as 'Conservation Week' are important, because a large proportion of the country's biodiversity can be found on privately owned land and native species living on this land are still being added to the threatened species list (Hitchmough, Bull, Cromarty, 2007; DOC, 2009a; DOC, 2010a).

In DOC's Statement of Intent 2010-2013, the impact of DOC's efforts to increase public awareness of conservation measures (this was measured through the use of surveys in 2007-09), show that around 80 percent of people surveyed considered conservation important to New Zealand as a country, and roughly 70 percent feel conservation is important to them personally (Figure 3). The most highly valued outcomes in both surveys were 'preserving natural land and water habitats', 'protecting national parks and nature reserves', and 'protecting native plants and animals' (DOC, 2010a).

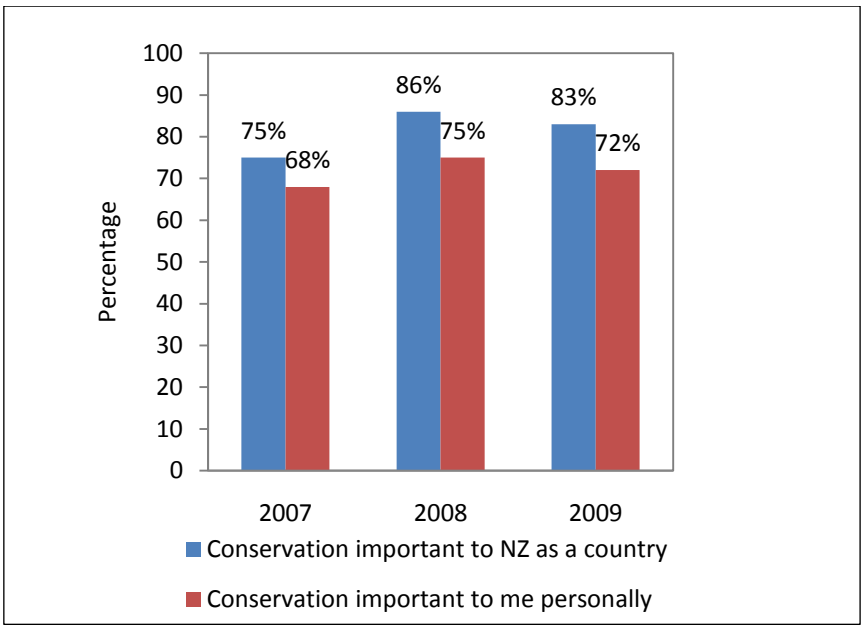


Figure 3. Percentage of people surveyed who believe conservation is important or very important in New Zealand. Source: Statement of Intent 2010-2013 (DOC, 2010a, pg32).

A survey carried out in 2007 found that although public awareness of the need for conservation is high, recall of threatened species in New Zealand is limited to those species with an active recovery plan, such as the Kiwi and Kakapo (Seabrook-Davison, 2010). Even

though Kokako (*Callaeas cinerea wilsoni*) have been actively managed by DOC since 1991, only four percent of survey respondents (out of the 131 people who returned the surveys) correctly identified Kokako as a species threatened with extinction in New Zealand. Granted the recall of threatened species depends on many factors, such as media awareness, desire to understand social issues and personal ability to recall information (Moran, 2003; Seabrook-Davison, 2010). It is now widely recognised that without community involvement and cooperation, conservation management plans will be ineffective (Morad & Jay, 2000; Novacek, 2008). Increased awareness regarding the conservation of threatened species in an urban setting may also help to bring about changes in social behaviour (Ashworth & Tuckey, 2001; Moore, Townsend, Oldroyd, 2006).

"The Department will be outward looking and responsive, recognising and valuing different perspectives, and working well with others" (DOC, 2009e, pg11). DOC works with a number of different stakeholders both nationally and locally to meet the aims of their strategies and obligations under various acts of legislation (Appendix 4) (DOC, 2009e). DOC works with local government to promote the protection of natural and historic heritage, through planning and decision-making under the RMA1991. Some examples of local and regional council collaboration with DOC include: protection programmes (including predator control) for threatened shorebirds in many coastal regional parks (such as Whakanewha, Wenderholm, and Mahurangi); the 'Ark in the Park' initiative, a joint program with the Royal Forest and Bird Protection Society to restore birds to the Waitakere Ranges; conservation of Kokako in the Hunua Ranges Regional Park; and establishing mainland island sanctuaries such as the one at Tawharanui in 2004 (DOC, 2008a; DOC, 2008c; DOC, 2009d).

DOC engages with tangata whenua, private land owners, and land care community groups through the delivery of the Nga Whenua Rahui Fund, Biodiversity Condition Fund and the Advice and Nature Heritage Fund (DOC, 2009d). It has also formed partnerships with more than 480 community groups to carry out conservation work on public land, and has numerous voluntary conservation agreements in place as a result of the Queen Elizabeth II Trust (DOC, 2009d). All types of people volunteer for conservation work from school children to retirees. Volunteers tend to have a wide variety of backgrounds such as retired business leaders, school teachers, artists, scientists and parents (Manfredo, 2008). The work volunteers do is varied and can include planting trees, counting birds, restoring natural habitats, transferring bird and plant species, looking after huts in national parks, controlling weeds and pests, fund-

raising, and assisting with the rescue of stranded whales. Most volunteers receive training and learn techniques alongside DOC staff on the job (DOC, 2009). A 2007 survey of 201 groups found that more than 6000 volunteers were involved, contributing 175,000 hours of voluntary work valued at more than NZ$2.1 million (DOC, 2008a). DOC also works with the Ministry of Education and other education providers to help inform young New Zealanders about their natural and historic heritage (DOC, 1998; MfE, 1998; MfE, 2000; DOC, 2008c; DOC, 2010a).

The business sector is also increasingly supporting conservation programmes through sponsorship. An example is the Bank of New Zealand Save the Kiwi Trust, established in 2002, which has provided monetary sponsorship for DOC's Kiwi protection, rehabilitation and egg/chick rearing initiatives. The trust also has a website which is linked up with its bank website which promotes Kiwi conservation and collates resources, information and contact details for people interested in the species (Bank of New Zealand Save the Kiwi Trust (BNZ), 2010). As a result of this and other successful business partnerships, DOC is developing future opportunities for businesses, such as the investment in forest carbon sink projects on conservation land (DOC, 2008a; DOC, 2008b).

2.5.3.2 Collaboration with indigenous people

DOC's work creates opportunities for Maori, as tangata whenua of New Zealand, to exercise kaitiakitanga (the process and practices of protecting and looking after the environment, guardianship) with respect to natural and cultural heritage, and to maintain and revitalise cultural practices (Centre for Research, Evaluation and Social Assessment (CRESA), 1998; Morad & Jay, 2000).Native species are culturally important to Maori. Maori have traditionally used a variety of native berries, roots, and fruits for food, dyes and stains, as well as medicine. The flowering and fruiting of some native species guided traditional planting and harvesting times and rahui (periods when harvesting is restricted to allow a resource to regenerate) (MfE, 2007). The purpose of DOC's collaboration with Maori is to achieve positive conservation outcomes by brokering and maintaining successful relationships through effective communication, because the Department has an increasing number of formal agreements and protocols with iwi arising from Treaty settlements (departmental relationships with iwi are managed with specialist help and advice from the Kahui Kura Taiao, a group of staff with specialist knowledge of Maoritanga and tikanga) (Taiepa, Lyver, Horsley, Davis, Bragg, Moller, 1997; DOC, 2008b; DOC, 2010a).

The Department's collaboration with Maori in conservation issues is based on the following guidelines:

- Protecting Maori cultural values on land managed by the Department and protecting conservation values on land owned by Maori;
- Empowering Maori communities to fulfil their customary duty as kaitiaki of taonga and encouraging their participation in conservation delivery;
- Engendering tangata whenua and Maori support for conservation and DOC; and,
- Giving effect to the principles of the Treaty of Waitangi (DOC, 2008a, pg69).

In 1991, the Nga Whenua Rahui Fund was established to provide funding for the protection of indigenous ecosystems on Maori land. The Nga Whenua Rahui Committee advises the Minister of Conservation on funding applications from iwi; the placing of kawenata or covenants (Maori landowners can protect indigenous ecosystems under the fund as long as public access is maintained); and the setting aside of areas for Maori reservations (DOC, 2008b).

2.5.3.3 Community conservation in Australia

In Australia, the protection of biodiversity by individuals and community groups is encouraged by both Commonwealth and state governments. The Commonwealth government and individual state governments are working together to develop a national approach to biodiversity management (ANZECC, 2001). This is seen in the listing and protection of threatened species and ecological communities as well as the agreement between Victoria, New South Wales, Western Australia and the Australian Capital Territory to formulate national objectives and targets for biodiversity conservation (DEWHA, 2006).

From 2000 to 2004, Australia's terrestrial protected areas increased by approximately 19 million hectares and now extend across almost 81 million hectares (or 10.5 percent) of Australia (Cork, Sattler, Creighton, Alexandra, 2006). Despite this coverage, the protected area system is only partly representative of the biodiversity of nearly half of Australia's bioregions. Large areas of land with high conservation potential are found on private property (New, 2000). For example, 50 percent of Victoria's threatened vegetation types are found almost entirely on private land (Winter, 2005). As a result, community cooperation and collaboration through schemes such as Bush Tender Victoria, Property Vegetation Planning in New South Wales, and the Nature Reserve System in Queensland, are being trialled as mechanisms for engaging private landholders in biodiversity conservation (New, 2000;

ASEC, 2006). In New South Wales, the community-based New South Wales Murray Wetlands Working Group has been managing the wetlands on behalf of the New South Wales government. The programme has so far extended a natural flood event through the Barmah–Millewa Forest and ensured successful breeding of more than 30,000 waterbirds (Winter, 2005; Lane *et al.*, 2007).

An innovative programme of the Australian government to improve the conservation of biodiversity hotspots came about as a result of the work carried out by the Threatened Species Scientific Committee in 2003 (DEWHA, 2006). Biodiversity hotspots are areas that are both rich in plant and animal species, particularly many endemic species, and under immediate threat from impacts such as land clearing, development pressures, salinity, weeds and feral animals. Since 2003, the Australian government has allocated about AU$36 million to improve the conservation of these biodiversity hotspots on private and leasehold land (Beeton *et al.*, 2006).

Increasingly, non-government organisations such as the Australian Bush Heritage Fund, the Australian Landscape Trust, the Australian Wildlife Conservancy, Earth Sanctuaries and Birds Australia are purchasing and managing lands for conservation (Beeton *et al*., 2006). In the last ten years, these organisations have acquired more than one million hectares as a result of increased public awareness about the environment and increased funding (Table 1). As attention shifted from the management of the reserve estate to areas in the private sector, the involvement of groups of people and individuals became necessary (Ewing, 1999). Around Australia, hundreds of community groups and organisations are working to increase community understanding of biodiversity and involvement in its conservation (Appendix 7). In New South Wales alone, some 600 wildlife refuges have now been declared, and over 80 voluntary conservation agreements have been made for individual private properties (CDEST, 1996; Williams, Read, Norton, Dovers, Burgman, Proctor, Anderson, 2001).

Table 1. Area of land managed by some Australian conservation organisations, in May 2006.

Organisation	Area of land (hectares)	Number of reserves	Status
Australian Bush Heritage Fund	372,156	19	Own and manage
Australian Wildlife Conservancy	917,000	14 locations	Own and manage
Australian Landscape Trust	340,000	-	Research, restore and manage
Trust for Nature	35,000 hectares of natural bush	56 bush properties of natural bush	Own and manage

Source: Australia State of the Environment report 2006 (Beeton *et al.*, 2006, pg96).

The role of the philanthropic sector and conservation organisations in environmental stewardship has changed over the last five to ten years. The increasing value many Australians place on biodiversity is reflected in the large increase in community action and investment in recent years (Ewing, 1999). Annually, about AU$5.7 billion from individuals and AU$3.3 billion from businesses is donated in all areas of the Australian community, including the environment, arts and culture, health, indigenous people, medical research, community development, social justice and education (Beeton *et al.*, 2006). Along with philanthropy, volunteering in the community and in conservation initiatives is also on the rise, with the National Trust of Australia alone managing a volunteer workforce of 7000 people (Australian Council of National Trusts (ACNT), 2008).

2.5.3.4 Collaboration with indigenous people

In recent years, the percentage of indigenous-owned and managed land has been slowly increasing. In addition, there is a growing recognition and appreciation of Indigenous knowledge of the land, the sea, and their biodiversity (Yibarbuk, Whitehead, Russel-Smith, Jackson, Godjuwa, Fisher, Cooke, Choquenot, Bowman, 2001). Under the Indigenous Protected Areas (IPAs) programme, Aboriginal landowners manage their lands for the protection of natural and cultural features. The programme funds management plans and practical work to protect natural and cultural features and to contribute to conserving biological diversity (New, 2000). Thirteen IPAs were declared between 1998 and 2001 and have been added to the National Reserve System (ASEC, 2006).

> A genuine attempt should be made, where there are conflicting interests, to establish, in consultation with those Aboriginal people, the extent to which a particular species is threatened with extinction, and the likely impact of the numbers taken by Aborigines upon a species. (Australian Law Reform Commission (ALRC), 2010, chapter 36, pg561)

Some Aboriginal communities still depend directly on the natural environment for live game, firewood, edible plants, medicine, materials (for building, weapons and transport), and cultural and spiritual items. For example, indigenous people catch 2,000 to 4,000 Green Turtles (*Chelonia mydas*) each year (permits regulate this hunting). Only when it is established that traditional hunting and fishing may endanger the species, whether generally or in the relevant area, should hunting and fishing be limited (ALRC, 2010). This is because cooperation with local communities can be beneficial for both the community and native wildlife involved (CDEST, 1996; Brown & Creaser, 2006).

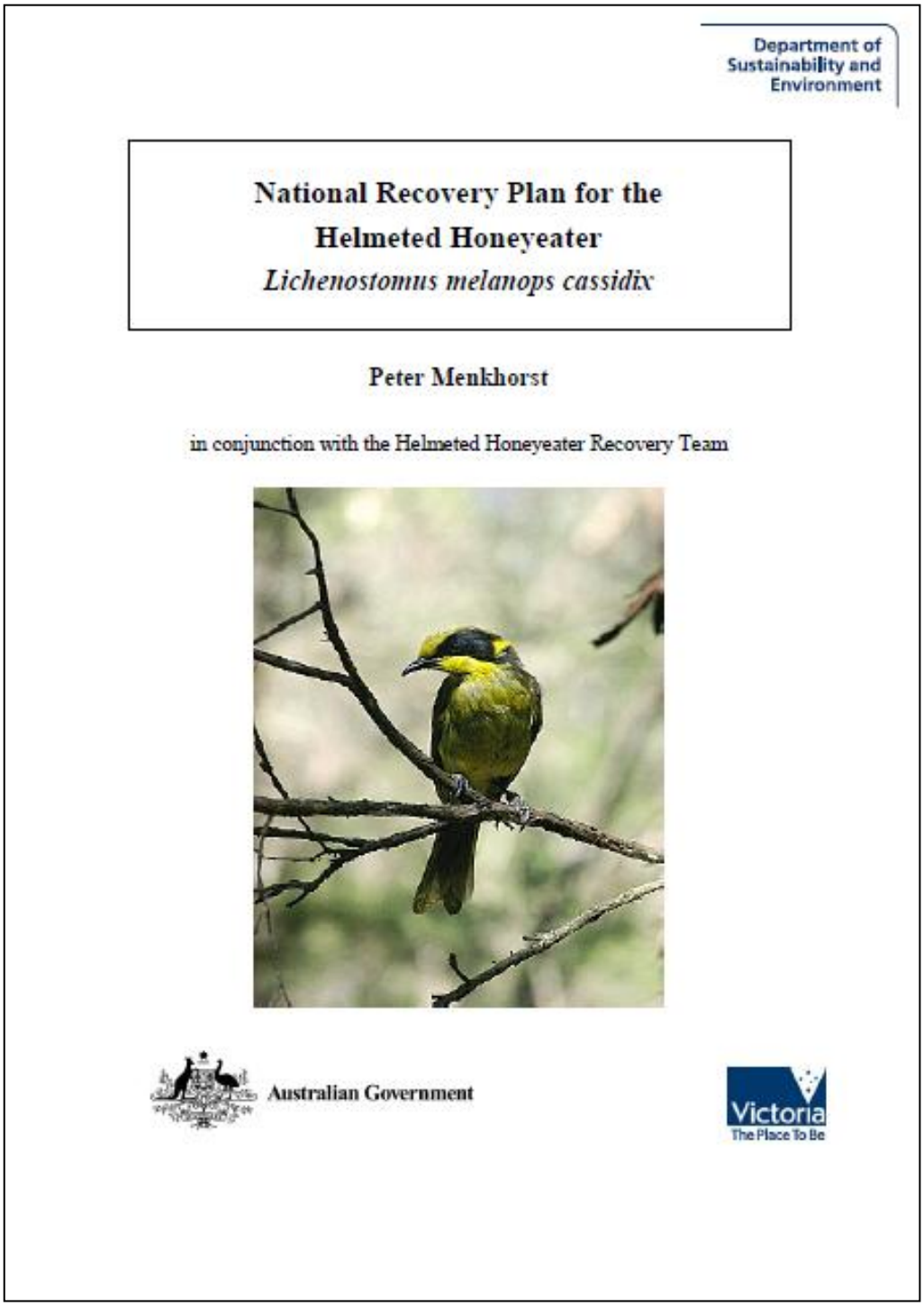
For Aboriginal people, the environmental, economic, social and cultural aspects of natural resource management are not separate, but inextricably and seamlessly linked (Beeton *et.al*, 2006; ALRC, 2010). Traditional cultural practices of Aboriginal people support the maintenance of ecological systems and are also a vehicle for passing on culture to younger generations (New, 2000; Yibarbuk *et al.*, 2001; Brown & Creaser, 2006). For example, the Northern Territories Conservation Commission sought the co-operation of the Warlpiri Aborigines in the management of *Spinifex* as a food source for the Rufous Hare Wallaby (*Lagorchestes hirsutus*) through the regular use of fire (Brown & Creaser, 2006). As this and similar experiences indicate, consultation and local involvement in management programmes is necessary, not only because the local people are affected by the decisions and entitled to some say in them, but also because management of resources is likely to be more effective with local support (CDEST, 1996; New, 2000; Brown & Creaser, 2006).

2.6 Conclusion

Due to the complexity and scale of managing endangered biodiversity, a collaborative approach between government organisations, non-government organisations and the community will be required in order for recovery programmes to be successful in the future (Bowles & Whelan, 1994). Implementing recovery programmes will require: sufficient resources (time, funding and personnel); comprehensive management plans; interagency

cooperation; knowledge of appropriate management techniques; legal protection and procedures for implementing recovery plans; as well as community cooperation in the management of habitats and ecosystems on private land (Gunningham & Young, 1997; Boardman, 2006). In both New Zealand and Australia, government departments such as DOC and DEFRA have been using recovery plans to guide the conservation of a number of threatened species and ecosystems (DEWHA, 2009d; DOC, 2010b). When combined with appropriate legislation and community awareness and involvement, species such as the Helmeted Honeyeater and Kiwi have been successfully managed and populations of these endangered bird species are beginning to increase (Robertson, 2003; Menkhorst, 2008). Understanding the interactions and relationships between species as well as incorporating biodiversity protection in management plans is seen as a more effective use of resources (Cullen *et al*., 2005; DOC, 2008b). By analysing planning documents for threatened and endangered species we can understand how species have been managed in the past and whether or not management practices are adapting and changing to meet new threats and challenges identified as being a problem in the future.

Chapter 3. Methodology


Department of Sustainability and Environment

National Recovery Plan for the Helmeted Honeyeater

Lichenostomus melanops cassidix

Peter Menkhorst

in conjunction with the Helmeted Honeyeater Recovery Team

Australian Government

Victoria The Place To Be

Source: National Recovery Plan for the Helmeted Honeyeater (*Lichenostomus melanops*) (Menkhorst, 2008).

A review of management planning literature for the successful recovery of endangered species has revealed a number of different ways in which to approach the process. Legislation at a national level as a method of ensuring that those responsible for the protection of endangered species are accountable for their actions has been used for a number of years in the United States and Australia. Another management technique used in New Zealand and Australia has been to create national recovery plans for threatened species.

A recovery plan outlines all existing knowledge about a species (such as biology, distribution and threats to long-term survival), as well as management goals and objectives for future management of the species (Boersma *et al*., 2001; Alexander, 2008). This chapter outlines how four matrices were developed in order to analyse the planning structure and conservation content of recovery plans written in New Zealand with those written in Australia. In New Zealand, 61 recovery plans have been written for 50 different threatened species (n=61; eleven plans are second or third editions). A list of all species in New Zealand with a recovery plan can be found in Table 2. This list was used to create a summary of all 61 recovery plans including: the year they were approved; author; species status (according to DOC's threatened species classification); current distribution; key DOC conservancies; and those responsible for carrying out management actions, this can be found in Appendix 8.

Table 2. The 50 threatened species in New Zealand with a recovery plan that have been analysed in this thesis.

1. *North Island Kokako	21. Kakapo	41. Chatham Island and Pacific Mollymawks (Northern Royal Albatross)
2. *Kiwi	22. Blue Duck	42. Chatham and Pitt Island Shags
3. Whitaker's and Robust Skinks	23.*New Zealand Fairy Tern	43. New Zealand Shore Plover
4. Black Stilt	24. Striped Skink	44. Forbe's Parakeet and Chatham Island Red-crowned Parakeet
5. Chevron Stilt	25. Threatened Weta	45. Chatham Island Fantail, Tomtit and Warbler
6. Mohua (Yellowhead)	26. Coastal Cresses	46. North Island *Oligosoma* Skink spp.
7. Subantarctic Teal	27. *Cyclodina* Skinks	47. Mudfish (*Neochanna* spp.)
8. *Kowhai ngutukaka*	28. *Pittosporum patulum*	48. Grassy Plants of fertile sites
9. *Tuatara	29. Weka	49. New Zealand non-migratory Galaxiid Fish
10.*New Zealand Dotterel	30. *Muehlenbeckia astonii*	50. New Zealand Large Galaxiid
11. South Island Saddleback	31. Inland *Lepidium*	
12. *Takahe	32. *Hebe cupressoides*	
13. *Giant Land Snail	33. Pygmy Button Daisy	
14. Otago and Grand Skinks	34. Hoiho (Yellow-eyed Penguin)	
15. Native Bats (Pekapeka)	35. Chatham Island Taiko	
16. **Dactylanthus taylorii*	36. Chatham Petrel	
17. New Zealand (Hooker's) Sealion	37. Chatham Island Oystercatcher	
18. Native Frogs	38. Parea (Chatham Island Pigeon)	
19. *Pateke (Brown Teal)	39. Black Robin	
20. *Hihi (Stitchbird)	40. Chatham Island Tui	

The ten species denoted with an asterix * have had more than one recovery plan written.

In order to compare and analyse the contents of the 61 New Zealand recovery plans a contents page template was developed that shows the structure and chapter titles of recovery plans written in New Zealand, for example ecology/biology, causes of decline and past conservation management (see Table 3).

Table 3. Contents page template showing the structure and chapter titles of recovery plans written in New Zealand.

1. Introduction
   - Past and present distribution
   - Status
   - Estimated population size
2. Ecology/Biology
3. Causes of decline/threats to long term survival
4. Past conservation management
5. Recovery potential
6. Options for recovery
7. Strategic directives/Cultural importance/ Public awareness
8. Goals
   - Long term
   - Short term
9. Recovery strategies
10. Accountability/plan authorship
11. Review date
12. Acknowledgements
13. References
14. Appendices

This template formed the structure of the matrix in Appendix 9. In order to create Appendix 9, each plan (n=61) was thoroughly analysed. Across the top of the matrix (on the X axis) are the plans numbered 1-61, as well as the year in which they were approved (1991-2008). The plans have been colour coded according to whether the plan represents a mammal (dark red); bird (orange); reptile (pale yellow); amphibian (light green); fish (light blue); mollusc or insect (pink); or plant (purple) (see Table 4 or Appendix 9). Chapter titles (1-14 outlined in the contents page template, Table 3) appear in bold in the left hand column of the matrix (the Y axis) and form distinct sections in the matrix with subheadings below them (the subheadings are re-occurring section titles, objectives and actions which appear in this particular chapter in more than one of the plans). Every time a subheading was written in a plan its corresponding box was shaded in grey. These subheadings were then able to be ranked according to how frequently they were mentioned in the plans using the '# of plans' and '% of plans' columns. These two columns have also been given a performance rating and

coloured either green, yellow or red. If a subheading appeared in 30 or more plans it was deemed strong (green); between 10-30 plans it was deemed poor (yellow); and 10 or less plans it was deemed a weak performing element in the plans (red). For example, in the Ecology/Biology chapter, the subheading 'Habitat selection and use' appears in 58 plans so it has been coloured green (see Table 4 or Appendix 9). The matrix in Appendix 9 also includes red boxes circling parts of the table. These indicate gaps in knowledge that are commented on in the 'Discussion' chapter.

Table 4. Part of the Matrix which summarises some of the key attributes in New Zealand's recovery plans (the complete matrix can be found as Appendix 9).

	Performance rating: Strong; Poor performance; Weak performance																														
	Written in		Mammal					Bird					Reptile		Amphibian				Fish			Insect							Plant		
	Year approved		1991	1991	1992	1993	1993	1993	1993	1993	1993	1993	1994	1994	1995	1995	1995	1995	1995	1996	1996	1996	1996	1997	1997	1998	1998	1999	1999
Chapter headings (in bold) and their contents	# of plans	% of plans	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Introduction																													
Past Distribution	61	100.0																											
Present Distribution	59	96.7																											
Wild population	61	100.0																											
Captive population	16	26.2																											
Distribution map																													
Past Distribution	25	41.0																											
Present Distribution	42	68.9																											
Status	61	100.0																											
Estimated population size	37	60.7																											
Ecology/Biology																													
Habitat selection and use	58	95.1																											
Breeding behaviour/success (e.g rituals/pollination/dispersal)	55	90.2																											
Diet/Feeding	41	67.2																											
Behaviour	29	47.5																											
Vulnerability to predation	12	19.7																											
Population dynamics/statistics	10	16.4																											
Competition	8	13.1																											

This matrix enabled comparisons to be made between the content found in plans for different species (i.e. bird versus plant) and over time. After this matrix was developed it was decided that three New Zealand species (representing a bird, a reptile and a plant species) would be chosen for an in-depth analysis of the content and management strategy outlined in their management plans. The New Zealand species were chosen because they represent species which have had a second management plan written and all three species are actively managed on offshore islands, in mainland sanctuaries, and in captive breeding facilities. The three New Zealand species are the Stitchbird/Hihi (*Notiomystis cincta*), Tuatara (*Sphenodon punctatus punctatus*, *S. punctatus* and *S. guntheri*), and a plant *Dactylanthus taylorii*. Discussion of the contents of each chapter in the matrix and the content of the three species plans can be found in the 'Results' chapter.

Since the first recovery plan was approved for use in 1991, management strategies have adapted to address the changing causes of decline and threats to long-term survival (i.e. habitat loss or predation). Under the chapter title 'Recovery Strategies' in the matrix, there

are 36 different subheadings which represent objectives and actions in the work plans of all 61 recovery plans (Appendix 9, section titled 'Recovery Strategies' on the Y axis). Comparison of these objectives and actions highlighted the emphasis many of the plans make on long-term monitoring and the translocation of threatened species to offshore or mainland island sanctuaries. The most frequently mentioned objective or action in the plans stressed the need for advocacy in the community in order to secure the successful long-term management of these species. All community-focused objectives and actions in the New Zealand recovery plans are listed in detail in Appendix 10. A second matrix was developed to analyse all community-focused objectives and actions listed in Appendix 10. All objectives and actions were collated into one of six different categories: Providing Information; Education; use of Volunteers; Social Responsibility; Species Ambassadors; and Legal Avenues. This matrix can be found in Appendix 11, and detailed analysis of each of the six categories is outlined in the 'Results' chapter.

In order to comment on the management strategies and conservation measures found in the New Zealand recovery plans, it was decided that analysis of plans in another country would be needed. Recovery plans written in another country may highlight new strategies and actions which could be adopted and used by DOC in their recovery efforts. Australian plans were chosen because Australian threatened species face similar threats to New Zealand species (such as habitat loss and predation), and past and present conservation management strategies are also similar (such as translocations and advocacy in the community). National threatened species recovery plans have only been written in Australia since 2000. This is because the plans are written in accordance with the Commonwealth Environment Protection and Biodiversity Act which was adopted in 1999. An initial step in the review of the plans was to select a representative sample of recovery plans. Upon analysing the New Zealand recovery plans it was noted that the plans fall under three stratification variables: taxon (most of the New Zealand recovery plans are written for birds, reptiles and plants); year published (1991-2008); and conservancy (the country has been divided up into 11 conservancies and the 61 recovery plans represent species found in all 11 conservancies). It was decided that a sample of 12 recovery plans out of the possible 428 Australian national recovery plans would be chosen and analysed in detail. The 12 Australian recovery plans represent plans which fall under the same stratification variables found in the New Zealand plans: three different taxa (birds, reptiles and plants); plans written in a variety of years (2000-2008); and all were published to address threatened species recovery in a variety of different states (New South

Wales, Queensland, South Australia, Western Australia, Victoria and Northern Territories). A list of the 12 species which had their plans analysed can be found in Table 5.

Table 5. Sample of 12 case study plans chosen from Australia's recovery plans (428).

1 Blue Mountains Water Skink	7 Hairy-stemmed Zig-Zag Wattle
2 Black-throated Finch	8 Helmeted Honeyeater
3 Angle-stemmed Myrtle	9 Aniseed Boronia
4 Pygmy Bluetongue Lizard	10 Striped Legless Lizard
5 Glossy Black Cockatoo	11 Minnie Daisy and Desert Flannel-flower
6 Muir's Corella	12 Slater's Skink

A third matrix comprising the 12 Australian case study plans was created to analyse the content of their recovery plans. The matrix was created in the same way as the New Zealand matrix in Appendix 9 using the contents page template (see Table 6) to structure the chapter titles of the Australian recovery plans.

Table 6. Contents page template showing the structure and chapter titles of recovery plans written in Australia.

1. Introduction
2. Species information
   - Status
   - Habitat
   - Description
   - Distribution (past and present)
   - Life history/ecology
   - Taxonomy
3. General requirements
   - Biodiversity benefits
   - Objectives under the EPBC Act 1999
   - Legislative context (State acts)
   - International obligations
   - Social and economic benefits
   - Affected interests
   - Role and interests of indigenous people
4. Threatening processes (causes of decline)
5. Past conservation management
6. Recovery strategies
7. Performance criteria
8. Implementation schedule
9. Recovery costs/budget
10. Accountability/plan authorship
11. Review date
12. Contact details
13. References
14. Appendices

Many of the chapter headings are similar to those in the New Zealand matrix, with the exception of the 'Species information' and 'General requirements' chapters which contain sections and ideas found as independent chapters in the New Zealand plans. There is also a new chapter titled 'Performance criteria' which measures how successful a particular action is in the work plan. The matrix in Appendix 12 provides a summary of the content of each chapter in all 12 Australian recovery plans. Across the top of the matrix (on the X axis) are the plans numbered 1-12, as well as the year in which they were approved (1999-2008). The plans have been colour coded according to whether the plan represents a bird (orange); reptile (pale yellow); or plant (purple) (see Table 7 or Appendix 12). Chapter titles (1-14 outlined in the contents page template, Table 6) appear in bold in the left hand column of the matrix (the Y axis) and form distinct sections in the matrix with subheadings below them (the subheadings are re-occurring section titles, objectives and actions which appear in this particular chapter in more than one of the plans). Every time a subheading was written in a plan its corresponding box was shaded in grey. For example, plan number 1represents a reptile, was published in NSW, approved in 2001 and has both long term and short term goals.

Table 7. Part of the Matrix which summarises some of the key attributes in 12 of Australia's recovery plans (the complete matrix can be found as Appendix 12).

		Written in plan		Bird		Reptile		Plant					
	State plan published in	NSW	NSW/QLD	QLD	SA	SA	WA	WA	VIC	VIC	VIC	NT	NT
	Year approved	2001	2004	2001	2000	2005	2008	2003	2008	2008	1999	2008	2004
Chapter headings (in bold) and their contents	# of plans	1	2	3	4	5	6	7	8	9	10	11	12
Executive summary	11	91.7											
Introduction	12	100.0											
Species Information													
Conservation status	12	100.0											
Habitat	12	100.0											
Description	12	100.0											
Distribution	12	100.0											
Distribution map	9	75.0											
Life history	9	75.0											
Taxonomy	6	50.0											
Captive breeding	1	8.3											
Goals													
Long term (5+ years)	8	66.7											
Short term (5 years of plan)	12	100.0											
General Requirements													
Biodiversity benefits	12	100.0											
Objectives under the EPBC Act1999	12	100.0											
Legislative context (State acts)	12	100.0											
International obligations	9	75.0											
Social and economic benefits	9	75.0											
Affected interests	8	66.7											
Role of indigenous people	8	66.7											
Environmental assessment	2	16.7											

This matrix enabled comparisons to be made between the content found in plans for different species (i.e. bird versus reptile). After this matrix was developed it was decided that three Australian species (representing a bird, a reptile and a plant species) would be chosen for an in-depth analysis of the content of their management plans in order to further compare Australian plans with the New Zealand plans. The Australian species were chosen because they represent species which face similar threats to the New Zealand species, such as loss of suitable habitat, predation and competition. In order to compare the New Zealand species

with Australian species it was decided that plans written in Victoria (by the Victorian Government Department of Sustainability and Environment (DSE) Melbourne) would be used in order to see if plans written in this state are consistent. This is because analysis of the matrix in Appendix 12 shows that plans published in different states contain different content and management strategies. The three Australian species are the Helmeted Honeyeater (*Lichenostomus melanops cassidix*), the Striped Legless Lizard (*Delma impar*) and a plant Aniseed Boronia (*Boronia galbraithiae*). Discussion of the contents of the three species plans can be found in the 'Results' chapter.

All 12 of the Australian case study recovery plans advocate public awareness and community ownership in threatened species recovery. A fourth matrix was created to undertake analysis on all objectives and actions in the work plans of the 12 recovery plans which support community involvement in the recovery process. All objectives and actions were organised into the same six categories used to analyse the New Zealand plans (Providing Information; Education; use of Volunteers; Social Responsibility; Species Ambassadors; and Legal Avenues). This matrix can be found in Appendix 13, and analysis of each of the six categories as they appear in the Australian plans can be found in the 'Results' chapter.

After creating the matrices, the flow diagram outlining how chapters relate to each other in a basic management plan (Figure 2, 'Literature Review', pg28; adapted from Alexander, 2008, pg17) was modified to further examine the characteristics of the New Zealand plans. Alexander's diagram was redrawn in order to reflect my interpretation of how a management plan should work (the redrawn diagram also serves as a template for the discussion and conclusion chapters). Each box in the flow diagram corresponds with a chapter title in bold in the left hand column of the matrix (Appendix 9). Figure 4 (see below) highlights how chapters in the New Zealand recovery plans should interrelate, and how changing or removing a chapter (for example the 'Recovery Potential' chapter) can influence the structure of a recovery plan. A coloured flow diagram (see Figure 6, pg124) was created to provide a clear summary of how each chapter in the matrix in Appendix 9 has been ranked for performance. The boxes have been colour coded either green, yellow or red. If the section in the matrix (Appendix 9) or a majority of the subheadings were coloured green, it was deemed a strong performing chapter and the box in the flow diagram was coloured green, then either yellow for a poor performing chapter or red for a weak performing chapter.

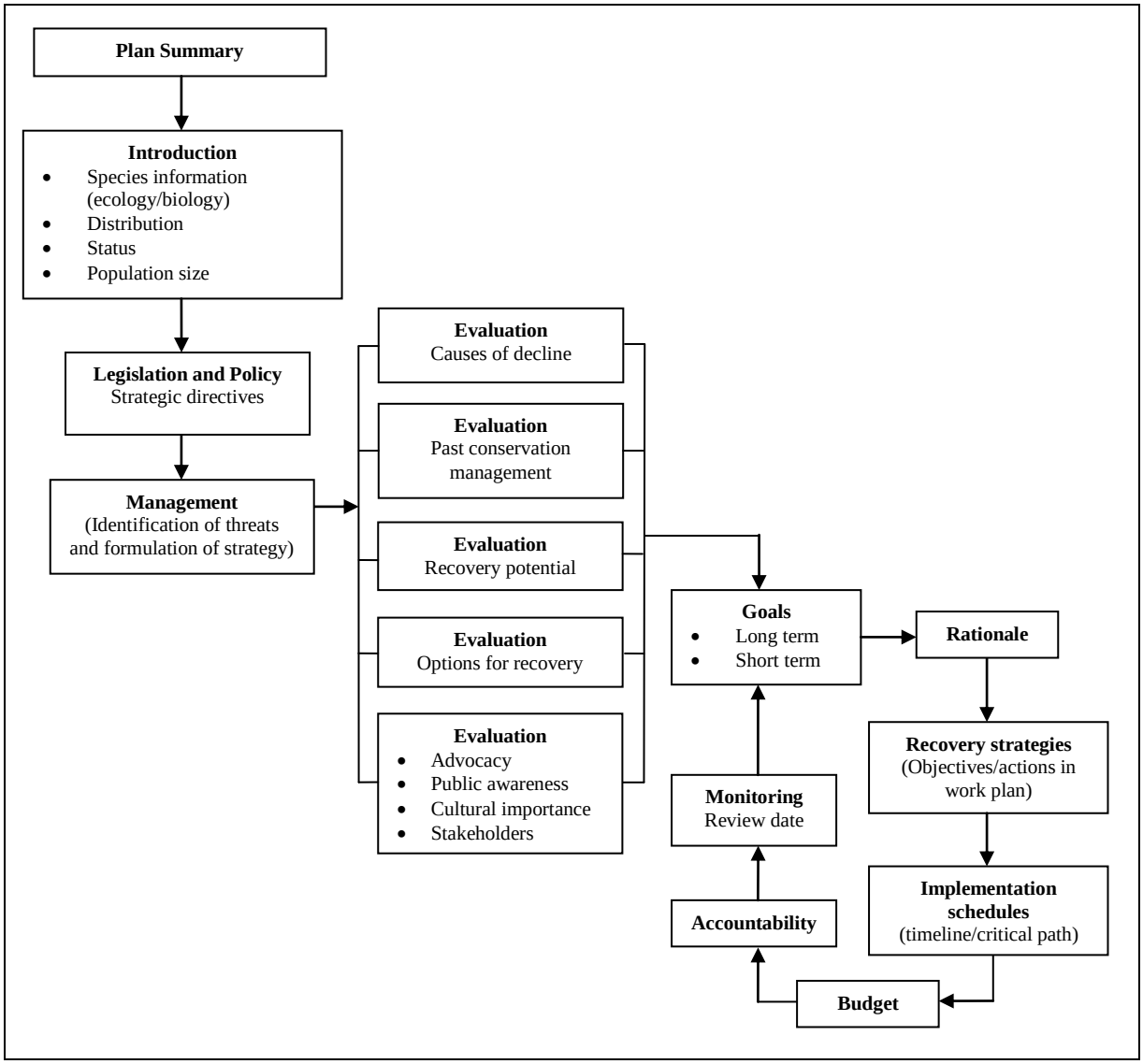
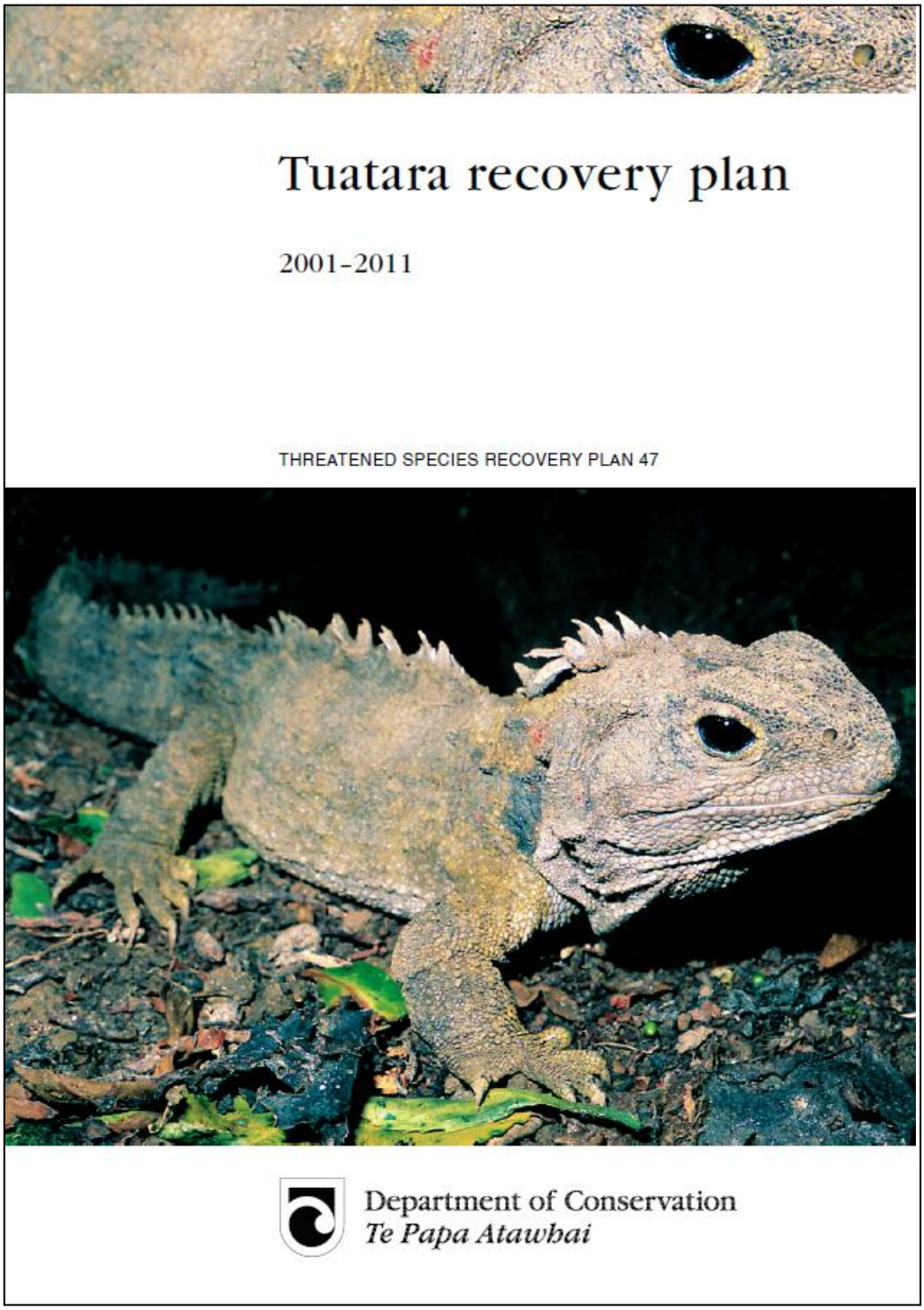


Figure 4. Flow diagram outlining how chapters relate to each other in New Zealand recovery plans (based on flow diagram in Literature Review pg28, which has been adapted from Alexander, 2008, pg17).

The four matrices, the in-depth analysis of six different threatened species and the modified flow diagrams provide a valuable record of the content of individual recovery plans, and offers a snapshot of threatened species recovery planning today. The results of this study will highlight similarities and differences between threatened species recovery planning in New Zealand and Australia, which can be used by planners in both countries to develop more consistent management plans in the future.

Chapter 4. Results



Source: Tuatara Threatened Species Recovery Plan 47 (Gaze, 2001).

4.1 Introduction

Under the New Zealand Biodiversity Strategy, the focus is to secure threatened species from extinction and reduce the risk of extinction for those species already actively managed (MfE, 2000). Recovery plans are central to the recovery of listed threatened species but they are not always regulatory documents. In the case of New Zealand, although a government agency (DOC) publishes the plans they are not yet enforced by legislation at the national level. At the present time, no agency or entity is required by law to either write recovery plans, or implement recovery strategies and actions outlined in the plans (Harris, 2004; Parliamentary Counsel Office, 2010). Creating national strategies to conserve threatened species in this country has been left up to DOC and at the present time, there have been few reviews of the content and structure of our endangered species recovery planning documents.

This chapter reviews the content of 61 species recovery plans that that have been written by DOC to address the recovery of 50 of New Zealand's threatened and endangered species. It also contains analysis of 12 Australian national recovery plans in order to compare and contrast content and management strategies in New Zealand plans with those written in Australia. In-depth review of an additional three New Zealand and three Australian recovery plans has also been carried out, to see whether plans written in both countries contain concise and effective recovery planning strategies and actions that can be easily implemented.

Each chapter in New Zealand's threatened species recovery plans has been analysed and is commented on following the structure of the contents page template outlined in Table 4. This is followed by a review of the content of three New Zealand species plans, that of the Stitchbird or Hihi (*Notiomystis cincta*), Tuatara (*Sphenodon punctatus punctatus*, *S. punctatus* and *S. guntheri*), and an endemic plant *Dactylanthus taylorii*. Then comes analysis of the 12 Australian plans following the structure of the simplified contents page outlined in Table 28. Before a review of three Australian national recovery plans which were published in Victoria for the Helmeted Honeyeater (*Lichenostomus melanops cassidix*), the Striped Legless Lizard (*Delma impar*) and Aniseed Boronia (*Boronia galbraithiae*).

4.2 New Zealand threatened species recovery plans

One of the aims of the New Zealand Biodiversity Strategy is that as a country we must "maintain and restore viable populations of all indigenous species and subspecies across their range and maintain their genetic diversity" (MfE, 2000, pg4). Since 1991, DOC has published 61 species recovery plans for 50 different threatened and endangered species (Table 2), many of which are available to the public via DOC's website. The process for preparing conservation strategies and plans is set out in Sections 17F and 17G of the Conservation Act 1987 (this process can be found in Appendix 5) (DOC, 2010b). However, although this outlines how a plan will be approved for use, there is no legal obligation on DOC to create recovery plans for all nationally threatened indigenous species and subspecies. Furthermore, it is only since 2003 that seven plans (no. 50, 52, 57, 58, 59, 60, 61) have outlined whether or not the management of the species is working to achieve the aim of the Biodiversity Strategy, in a chapter entitled 'Strategic Directives'. For example, the Kiwi plan (no.50) (hereafter any mention of Kiwi refers to all *Apteryx* spp. because all subspecies of Kiwi are managed using similar strategies and actions in each of the three recovery plans) supports the National Priority Outcome 1.2 in the Department's Statement of Intent 2002-2005: "no avoidable human-induced extinctions of indigenous terrestrial, freshwater and marine species have occurred and, where practicable, representative populations of all indigenous species have long-term security in predominantly natural habitats within their natural range" (Robertson, 2003,pg8).

These 61 recovery plans act as statements of DOC's intentions for the conservation of a particular species of plant or animal over a defined period of time. The recovery plans focus on recovery management goals and objectives and guide DOC in its allocation of resources. Each plan has been tailored to the particular species it focuses on and includes information such as the biology, the distribution of the species throughout the country, as well as information pertaining to past and current management. The content of each chapter in the recovery plan (i.e. Ecology/Biology) has been analysed and any idea, strategy or action which appears in the chapter has been counted and entered into a table (i.e. Table 9). An overview of all 61 recovery plans and the content within each chapter can be found as a matrix in Appendix 9. For the most part, each of the recovery plans follow the simplified format of a management plan outlined by Alexander (2008) in Figure 2 ('Literature Review' pg28). After reviewing all 61 recovery plans, a template was created which outlines the structure of

New Zealand's recovery plans and details the titles of the different chapters (as seen in Table 3, pg47).

Each plan remains operative until a new plan has been prepared and approved (this varies between five and ten years), or until the plan becomes redundant because recovery of the species is achieved (or the species becomes extinct) and management enters a 'maintenance phase', which as of yet this has not happened (DOC, 2010b). At the moment, only ten species have had a revised or second plan written for them (Kiwi have had three plans written). Of these ten species, only five (Table 8, species denoted with an asterix *) have a chapter or Appendix discussing the achievements and progress of management objectives outlined in the previous plan, such as any progress made in carrying out the actions and tasks outlined in the work plan.

All 61 plans comment on the status of the species (i.e. vulnerable, threatened, endangered), but only 37 plans give an estimated known population size. Although 59 plans mention where the species resided in the past, only 42 plans illustrate the present known distribution of the species with a distribution map. For example, the Chatham Island Taiko (*Pterodroma magentae*) recovery plan (no.36) outlines the historic and present distribution of the species on Chatham Island, and where the island is located in relation to New Zealand.

Table 8. New Zealand threatened species with more than one recovery plan.

Species	**Date of first plan**	**Date of second plan**	**Date of third plan**
*North Island Kokako	1991	1999	
*Kiwi	1991	2003	2010
Tuatara	1993	2001	
*New Zealand Dotterel	1993	2006	
Takahe	1994	2010	
Giant Land Snail (*Powelliphanta spp*.)	1995	2003	
Dactylanthus taylorii	1995	2005	
Brown Teal	1996	2006	
*Stitchbird	1996	2004	
*Fairy Tern	1997	2006	

(The five species denoted with an asterix * discuss the achievements and progress of previous management objectives in their second plans). Source: Threatened Species Recovery Plan Archive (DOC, 2010d).

All bar one of the plans (no.18) comment on the ecology and biology of the species. This chapter is dependent upon field research into how the species has adapted to live in its habitat. Habitat selection and use, as well as behaviour and diet had been the primary focus of research when these recovery plans were written (Table 9).

Table 9. Key topics and ideas that appear within the Ecology/Biology chapter of New Zealand's recovery plans.

Ecology/Biology	**Number of plans (N=61)**
Habitat selection and use	58
Breeding behaviour/success (e.g. rituals/pollination/dispersal)	55
Diet/Feeding	41
Behaviour	29
Vulnerability to predation	12
Population dynamics/statistics	10
Competition	8

(Number of plans refers to the number of plans that have this topic written in the ecology/biology chapter, further detail on specific plans can be found in the matrix located in Appendix 9).

4.2.1 The identification of threats and formulation of strategy

There are many different causes of decline and threats facing New Zealand's endangered species. Predation of eggs, chicks and adults by Stoats, Cats, Dogs and Possums is seen as a contributor to declining population numbers in 56 of the plans. This is closely followed by habitat loss due to degradation, fragmentation or modification of the landscape (51 plans) (Table 10).

Competition also plays a role in threatening endemic species (25 plans), either as a direct result of introduced species competing for the same limited resource, or due to habitat limitations which force individuals/pairs to inhabit smaller territories, and subsequently result in the population relying on a smaller pool of resources (Gaze, 2001). Hunting/collecting (16 plans), disease (15 plans), natural events (14 plans) and breeding site disturbance (13 plans) are other examples of less common threatening processes. Whilst the loss of associated species (2 plans) and recruitment failure (1 plan) are threats which appear in only a couple of the plans (Table 10). It is also of note that these two concepts are mentioned in the introduction chapter of these plans, rather than in the dedicated cause of decline chapter.

Table 10. Key factors that have been identified as 'causes of decline or threats to the long term survival' of New Zealand's threatened species.

Causes of Decline or Threats to Long Term Survival	**Number of plans (N=61)**
Predation	56
Habitat loss due to degradation/fragmentation/modification	51
Competition	25
Hunting/collecting (legal & illegal)	16
Disease	15
Natural events (e.g. storms, drought)	14
Human/animal disturbance at breeding sites	13
Low productivity/long incubation or nesting period	7
Genetic variation/drift/hybridisation	6
Agricultural/pest eradication toxins (e.g. herbicides, 1080, cyanide)	6
Fishing industry bycatch	3
Loss associated animal spp.	2
Recruitment failure of single sex populations	1

(Number of plans refers to the number of plans that have these factors written in the cause of decline or threats to long term survival chapter, further detail on specific plans can be found in the matrix located in Appendix 9).

The role past management actions have played in the current status of a species is also mentioned in the plans, either as a dedicated chapter or as an aside in the introduction (Table 11). Previous conservation management strategies have focused primarily on predator control (24 plans) and habitat management (24 plans) because these threats have been identified as the leading causes of population decline for many of our threatened species (Table 10).

Habitat management only appears in plans written since 1993. The restoration, protection and enhancement of critical habitat are actions which can benefit a number of different species in one area and when combined with predator control (i.e. trapping and laying poisoned bait), have been used successfully for many years to help recover a number of different species, such as Kiwi and Takahe. Population monitoring (23 plans) and research (22 plans) are also strategies used in the past primarily because many of these threatened species had little or no research carried out on them before the first plan was written. In order for successful conservation of the species in the future, it was identified that more research would have to be undertaken to ensure that management strategies would work. Other past conservation management tools have included breeding populations in captivity (21 plans) ready for translocation (20 plans) to areas which have had predator and pest management (24 and 15

plans) (Table 11). Only one plan, no. 42, which concerns seabirds mentions management through the use of fisheries regulation to protect the species.

Table 11. Key strategies that have been used in the past to manage populations of New Zealand's threatened species.

Past Conservation Management	**Number of plans (N=61)**
Management of predators	24
Habitat management (restoration, protection, enhancement)	24
Monitoring of populations	23
Research	22
Captive population breeding	21
Translocation of populations	20
Surveys/census (e.g. banding)	18
Management of pests	15
Releases of captive-reared individuals	14
Advocacy/promote public interest	11
Egg manipulation/incubation/cross-fostering	8
Quarantine measures	3
Culling of hybrids	1
Fishery regulation	1

(Number of plans refers to the number of plans that have this strategy written in the past conservation management chapter, further detail on specific plans can be found in the matrix located in Appendix 9).

Until 2001, most plans contained a chapter which addressed the 'recovery potential' of the species (Table 12).

Table 12. Types of management strategy or action needed to enable species to recover.

Recovery Potential (Ability of species to recover)	**Number of plans (N=61)**
With habitat free from disturbance and predators/pests	16
With breeding in captivity	11
With translocations	7
Survival within present range	5
Only with conservation	4
With development of *in situ* management	4
With community support	2
With management to prevent extinction due to genetic events	1
Second generation research	1
With egg manipulation/multiple clutching	1

(Number of plans refers to the number of plans that have this action written in the recovery potential chapter, further detail on specific plans can be found in the matrix located in Appendix 9).

The ‘Recovery Potential’ chapter explains the ability of the species to recover in the wild to levels which would reduce the threatened status of the species, if appropriate management options are chosen and carried out. Sixteen plans mention that with habitat free from disturbance and predators/pests, these species should be able to recover to population numbers which would remove the species from the threatened species list (Table 12). For example, in the Otago (*Leiolopisma otagense*) and Grand Skink (*Leiolopisma grande*) recovery plan (no.14), long term survival of the species is possible due to the wide geographic range inhabited by the two species (which buffers the populations from localised extinctions) and the ability of these populations to survive would be enhanced with *in situ* protection of breeding habitat. Since 2001, this chapter has been omitted, even though it appears again in plan no. 52. However, the ability of the species to recover, if appropriate management actions are carried out, is briefly mentioned in the introduction chapter in plans since 2001.

Another chapter in 54 of New Zealand’s recovery plans looks at the ‘options for recovery’ of the species. This chapter implies that the actions in the work plans of these recovery plans are necessary in order to maintain population numbers, and prevent the species from becoming extinct. Most plans (40 plans) agree that ‘doing nothing’ to aid the conservation of the species will result in the species becoming extinct in a matter of years. Maintaining populations through management *in situ* (36 plans); maintaining island populations (33 plans); and translocating individuals to suitable habitat (such as predator free islands or to areas of former range) (27 plans) are management actions which are recommended for use in order to secure populations of a number of threatened species (Table 13).

In the case of the Hihi (no.54), the preferred option for recovery is to secure Hihi populations at all existing sites as well as establishing populations elsewhere. This option aims to consolidate past recovery actions and make progress with Hihi recovery towards achieving the long-term goal. Other options such as doing nothing or simply securing Hihi at existing sites would not lead to improved security for the species and were rejected on this basis (Taylor, Castro, Griffiths, 2005).

Table 13. Management options considered for maintaining population numbers and preventing the species from becoming extinct.

Options for Recovery	**Number of plans (N=61)**
Do nothing	40
Maintain populations through management *in situ*	36
Maintain/protect/increase island populations	33
Translocation to suitable locations (e.g. islands, former range)	27
Maintain/protect/increase mainland populations	21
Establish/maintain captive population	19
Control pests/predators	15
Intensively manage as many populations as possible	13
Survey/monitor populations	13
Maintain solely as captive population (cultivation)	7
Research	7
Undertake national priority work	5
Advocacy in community (farmers, landowners)	2
Determine conservation status	1
Protect minimum numbers of each taxon	1

(Number of plans refers to the number of plans that have these management actions written in the options for recovery chapter, further detail on specific plans can be found in the matrix located in Appendix 9).

The objectives and actions in the work plans of all 61 recovery plans can be grouped into 36 different recovery strategies (Chapter titled Recovery Strategies, Appendix 9). Of these strategies, the ten most common are detailed in Table 14. The most frequently mentioned objective or action in the plans is that of advocacy in the community (53 plans). Advocacy in the plans is often written as 'raising public awareness of the need for conservation, and increasing community involvement in the species recovery'. For example, raising awareness about the plight of the New Zealand Fairy Tern (*Sterna nereis davisae*) (no.57) and encouraging local community involvement in their conservation is seen as an important strategy for the long term survival of the species. To do this, actions include: involving iwi through consultation; using the media to increase emphasis on New Zealand Fairy Tern management, as an important part of wider coastal management and shorebird protection; as well as improving signage that advocates protection and provides information about the Fairy Tern at breeding sites (Hansen, 2006). These actions would simultaneously inform and involve the community plus raise awareness of the species which may create funding and sponsorship opportunities for the species recovery in the future.

Table 14. The ten most common recovery strategies written in the work plans of New Zealand threatened species recovery plans.

Management objective or action in the work plan	**Number of plans (N=61)**
Advocacy in the community (consult with iwi, community members)	53
Long term monitoring of populations (distribution/abundance/status)	37
Establish additional wild populations on offshore islands (translocation)	33
Maintain habitat of mainland populations (monitor/protect)	33
Maintain habitat of island populations (monitor/protect)	33
Maintain captive breeding population	32
Establish/maintain predator control	24
Monitor poorly known populations (surveys/census)	22
Maintain all populations	20
Breeding habitat protection and restoration	18

(Number of plans refers to the number of plans that have these management objectives or actions written in the recovery strategy chapter, further detail on specific plans can be found in the matrix located in Appendix 9).

Other key management strategies over the years have been to monitor populations (37 plans) and maintain captive breeding populations (32 plans) (Table 14). Thirty-three of the plans contain objectives in their work plan which seek to secure the survival of the species in the long term by translocating individuals or populations to offshore islands (either from wild populations on other islands, from the mainland, or from captive bred populations), and to maintain the habitat on these offshore islands (33 plans). One of the reasons behind this strategy is to ensure that there are self-sustaining 'insurance populations' if populations on the mainland suffered a catastrophic event (Wickes *et al.*, 2009). Only one plan (no.61, Takahe) mentions the need to establish a new island sanctuary for the species. Although maintaining the habitat of mainland populations appears in 33 plans, establishing new self-sustaining populations on the mainland was not considered an option, or was viewed as unsustainable until 2001, when it was first written into the Pygmy Button Daisy (*Leptinella nana*) recovery plan (no.34). Only three plans (no.34, 50, 60) aim to establish a self-sustaining population on the mainland. Establishing additional wild populations on the mainland by translocation (15 plans), has been a key management tool for species such as the Kokako (*Callaeas cinerea wilsoni*) (no.30). This is because it enables the threatened species to live and breed in an environment intensively managed to control predator and pest species numbers, which enables the threatened species population numbers an opportunity to increase to sustainable levels (Cree & Butler, 1993). Due to the limited size of offshore islands and the lack of key habitats (i.e. mountain river or scrub ecosystems) on many offshore islands,

mainland islands are considered an important tool in the future management of species such as the Brown Teal (*Anas chlorotis*) (no.19) and *Muehlenbeckia astonii* (no.31). Only 12 plans contain objectives or actions in the work plan which expand upon the need for statutory protection such as legislation, regulations, rules, incentives or policies to address activities which are threatening these species. Eighteen plans talk about the need for breeding habitat protection and restoration. A further 19 plans mention or imply the need for legislation to protect threatened species habitat on private land (e.g. plans 22, 29 and 55) (Appendix 9).

Only 26 out of the 61 recovery plans analysed contain a timeline or critical path diagram either within the work plan chapter of the recovery plan, or as a separate appendix. A timeline or critical path is an important tool to outline when management objectives will be carried out (in which month or year), when actions or tasks are expected to be undertaken and of what priority they are (essential, high, medium). There are many variations of timetables in the different plans but those in later plans, such as the one in the New Zealand Dotterel (*Charadrius obscurus*) plan (no.58) give a rough idea of which management actions are to be carried in which year of the ten year plan (Table 15).

Table 15. Condensed timeline of proposed recovery actions outlined in the New Zealand Dotterel (*Charadrius obscurus*) recovery plan (no.58).

Objective	**Action**	**Priority**	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1.1	1.1 Maintain predator control	E	■	■	■	■	■	■	■	■	■	■
	1.2 Keep Stewart Island mustelid free	E	■	■	■	■	■	■	■	■	■	■
1.2	1.3 Identify North Island west coast management units	E	■	■								
	1.4 Establish management at North Island west coast sites	E			■	■	■	■	■	■	■	■
1.3	1.5 Maintain management at current North Island sites	E	■	■	■	■	■	■	■	■	■	■
	1.6 Establish management at new sites	H	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
2.1	2.1 Census southern subspecies annually	E	■	■	■	■	■	■	■	■	■	■
	2.2 Census northern subspecies every 7 years	E	■							■		
2.2	2.3 Monitor numbers in Wanganui annually	M	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒

Priorities: E=Essential (black), H=High (dark grey), M=Medium (pale grey). Shaded years are those in which the particular action should be undertaken. Source: New Zealand Dotterel (*Charadrius obscurus*) recovery plan, 58, 2004-14 (Dowding & Davis, 2007, pg26).

Only 15 plans written between 1991 and 1996 contain budget or funding estimates of the costs associated with the management strategies outlined in the plan. A further two plans contain increasing funding support for the programme as an objective in the work plan (no.59 and 61). In the Black Stilt (*Himantopus novaezealandiae*) recovery plan (no.4), the number of staff and vehicles needed to oversee the recovery project in a year is outlined. Along with the estimated annual costs associated with the project such as wages, operating costs and costs associated with breeding the species in captivity. Whilst in the Native Frog (*Leiopelma* spp.) recovery plan (no.18), an estimate of the funds required to carry out the projects outlined in the recovery plan are estimated for a five year period (Table 16).

Table 16. Estimates of funding needed to carry out projects outlined in the Native Frog recovery plan (no.18) (NZ$).

Conservancy	Monitoring	Establish new popns	Attend recovery group	Survey	Total funds over five years	Funds required per year
Northland	$7,500	-	$2,500	$3,000	$10,500	$1,500
Auckland	$7,500	-	$2,000	-	$7,000	$1,400
Waikato	$12,500	-	$2,000	$5,000	$17,000	$3,400
East Coast	$7,500	-	$2,000	$3,000	$12,000	$2,400

Source: Native Frog (*Leiopelma* spp.) recovery plan, 18 (Newman, 1996, pg31).

Fifty-three plans mention who is accountable for carrying out a particular objective or action in the work plan (Table 17). Such as a relevant conservancy, biodiversity programme managers, recovery group or technical support officers. Twenty-three of these plans also list people involved in the plan or recovery of the species, either in the acknowledgements chapter or as a separate appendix. Many of the recovery plans are written in collaboration with recovery group members and those who have an expert knowledge of the species. Within the appendices, 14 plans mention by name experts involved in that particular species conservation and five plans give contact details for these experts (Table 17).

Table 17. Accountability of species management and plan authorship chapter contents.

	Number of plans (N=61)
Accountability (Area managers, programme manager, recovery group, conservancies, NGOs)	53
List of key people involved in the plan/recovery group	23
Appendices	
List of experts involved with species conservation	14
Contact details for experts	5

Accountability, list of key people involved in the plan/recovery group and appendices are all stand alone chapters in the matrix in Appendix 9 (Number of plans refers to the number of plans that have this chapter written in the recovery plan, further detail on specific plans can be found in the matrix located in Appendix 9).

4.2.2 Community involvement in New Zealand's endangered species recovery

Cultural importance (8 plans) and public awareness (9 plans) are sections which first appeared in 2003 in the Kiwi plan (no.50). All plans numbered 56 – 61 contain this section within the introduction chapter of the plan. In the Kiwi plan (no.50), the cultural importance section mentions how the Kiwi is important to Maori because the species has always been taonga (treasure) to tangata whenua. The section also mentions the Ngai Tahu relationship with South Island Kiwi, which has been formalised in the Ngai Tahu Claims Settlement Act 1998 (Robertson, 2003). In the public awareness section of this plan (no.50) it is noted that there is a high level of awareness and community concern about Kiwi. The Bank of New Zealand is the key sponsor of Kiwi recovery through the Bank of New Zealand Kiwi Recovery Trust. In addition, there are many private conservation groups throughout New Zealand who are involved in working with Kiwi and in several areas, Kiwi advocates are working actively to publicise threats to Kiwi and increase community engagement (Robertson, 2003).

Most of the plans acknowledge that promoting public awareness and involvement in the recovery of threatened species is an important strategy for the long term. After analysing the work plans of all 61 New Zealand recovery plans, there were numerous different objectives and actions outlined in the work plans which aim at increasing public awareness and involvement in a particular species recovery, these have been outlined in detail in Appendix 10.

In the case of the Kiwi, involving the community in Kiwi recovery programmes has changed over the years from advocacy and education via Kiwi displays in zoological gardens, to ensuring iwi are involved in Kiwi management, and educating the public about best practise measures such as leashing dogs in known Kiwi habitats (Table 18).

Table 18. Community focused objectives written in the Kiwi (*Apteryx* spp.) recovery plans (no.2,50,60).

Species	Plan number	Year approved	Community focused objective	Action written in the work plan
Kiwi (*Apteryx* spp.)	2	1991	10. Promote public interest and involvement in kiwi conservation	Evaluate proposals to transfer kiwi to open sanctuary islands where they can act as a resource for advocacy and education (e.g. Tiritiri Matangi); encourage display of NI brown kiwi at suitable zoological gardens here and overseas; produce a leaflet for landowners with kiwi on their land, those taking dogs into native forest, those involved in trapping and poisoning of possums; encourage the involvement of volunteers in kiwi surveys
	50	2003	1. To encourage and support public and community protection of kiwi and their habitat throughout the term of this plan	Inform iwi/public about kiwi conservation; maintain open communication with all interested parties; empower people to develop own conservation projects
	60	2008	Topic 18. Advocacy	To increase awareness and support for kiwi protection through advocacy at all levels
			Topic 19. Tangata whenua	To ensure iwi are involved at all levels of kiwi management and research in an interactive way
			Topic 20. Community led initiatives	To ensure community involvement in kiwi protection is optimised and follows best practice

Source: Kiwi (*Apteryx* spp.) recovery plans, 2, 50, 60 (Butler & McLennan, 1991; Robertson, 2003; Holzapfel *et al*., 2008)

In total, 53 of the plans mention or imply the need to promote public awareness, interest or involvement in the recovery process of that particular threatened species. Many of these plans contain more than one idea or action in their work plans, all of which have been organised into one of six different categories: Providing Information; Education; use of Volunteers; Social Responsibility; Species Ambassadors; and Legal Avenues and collated into the Table found in Appendix 11.

Objectives and actions in the work plans, which relate to providing information to the community about threatened species recovery, have been grouped into nine different strategies (Table 19). In 47 plans, informing the community will be carried out through the use of education leaflets/pamphlets or fact sheets about the threatened species. These are to be made readily available to the community at places such as local DOC offices and local libraries. Media releases (38 plans) and publishing articles in scientific journals and magazines (23 plans) are also mentioned and would provide the public with knowledge about a species if they happen to read or see the particular item.

Table 19. Types of information provided to the community to inform them of a threatened species recovery programme.

	Objective or action in the work plan	Number of plans (N=61)
Provide Information	Education leaflet/pamphlet/fact sheet about species	47
	Media releases (e.g. television coverage, newspaper articles, videos)	38
	Publish articles in natural history/scientific journals and magazines	23
	Provide local community with educational material	16
	Interpretive signs at breeding sites	8
	Pamphlets/signs warning of dog responsibility	4
	Provide conservation/species information to local boat operators	3
	Possum control pamphlet	1
	Develop and promote a webpage	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 11).

Notably, plans 36-46 (mainly species which live in the Chatham Islands) tend to only imply that public awareness is important to the local community, and should be facilitated through interpretive signs at breeding sites (8 plans) and educational material such as leaflets (Appendix 11). Only one plan (no.56, *Dactylanthus taylorii*), published in 2005, mentions developing a webpage which promotes the species conservation message.

There are also a number of different ways in which the education of the community about a species recovery efforts can be applied (Table 20). Education about conservation issues through public talks (16 plans) and visits by DOC staff to schools, as well as school visits to breeding sites and habitats (15 plans), are important education measures which have the potential for long term promotion of conservation issues. Advocating appropriate land use (11 plans) particularly for species such as the New Zealand non-migratory Galaxiid Fish (no. 53), is important because land users such as those in the dairy industry are playing a role in the health of streams and rivers in which these species live.

Education is also needed to inform the public of the need to try and avoid disturbing threatened species in the wild (10 plans) (Table 20), such as by staying on marked tracks in DOC forest reserves and not taking dogs into areas of forest which are known to contain breeding Kiwi. The general public also needs to be informed of the proper etiquette when visiting threatened species populations on island sanctuaries (particularly for the Chatham Island species, plans no.37-46) and being aware of the threats introduced pests and predators have on threatened species which are managed on offshore islands (3 plans).

Table 20. Community education initiatives written in the work plans of New Zealand threatened species recovery plans.

	Objective or action in the work plan	Number of plans (N=61)
Education	Public talks/lectures	16
	School education/participation with site visits	15
	Appropriate land use	11
	Encourage minimal disturbance to wild populations	10
	Pest spp. awareness/prevention/eradication (e.g. wallabies)	8
	Island quarantine procedures/awareness	8
	Predator free island education	3
	Emphasise relationship with umbrella spp./ecological restoration	3
	Hunter/duck-shooter species awareness	3
	Promote protection from persecution/accidental bycatch/illegal harvest	3
	Summer awareness programme	2
	Educate to minimise road deaths	1
	Educate landowners to protect colonies from stock	1
	Subantarctic island education	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 11).

The use of volunteers in monitoring (15 plans), surveying (13 plans) and protection of breeding sites (5 plans) is managed by respective DOC conservancies and in many plans is only implied and not written in as an objective or action in the work plan (Table 21). Only plans 57 (New Zealand Fairy Tern) and 60 (Kiwi) mention the need to provide volunteers with some form of logistical support, and only one plan 39 (Chatham Island Pigeon) mentions providing the community with a survey in which to record sightings (Table 21, Appendix 11).

Table 21. Use of volunteers as a way in which to involve the community in species recovery.

	Objective or action in the work plan	Number of plans (N=61)
Volunteers	Volunteer participation in monitoring	15
	Volunteer participation in surveying	13
	Use volunteers to locate spp.	7
	Use volunteers to protect breeding sites	5
	Volunteer participation in tracking tagged animals	3
	Provide logistic support to volunteers	2
	Provide community with a survey to record sightings	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 11).

Fifty-three of the New Zealand plans comment on community ownership and guardianship of threatened species as either an objective or action in the work plan (Table 22). Social responsibility in the Brown Teal (*Anas chlorotis*) recovery plan (no.59) is said to be due to a number of private initiatives already underway in the community (e.g. landcare group activities and a captive breeding program) and at least two national non-governmental organisations (The Pateke 'Ducks Unlimited' and Brown Teal Conservation Trusts) who are helping DOC to protect and manage the species. Only plans written after 1999 promote iwi ownership and participation as actions in the work plan. Seventeen plans highlight the cultural significance of the species to Maori and iwi and how their involvement is important. In the case of the Kiwi, the bird is considered a taonga (treasure) to Maori who have strong cultural, spiritual and historic associations with the species. For example, Kiwi feathers have long been used in ceremonial cloaks (Robertson, 2003). As a result, tangata whenua are a key stakeholder in Kiwi recovery planning and implementation (Holzapfel *et al.*, 2008). Only eight plans written since 2003 (no.50, 52, 56-61), have a section dedicated to explaining the cultural importance of Maori involvement in that particular threatened species (Appendix 11).

Table 22. Promoting social responsibility of species recovery in the community.

	Objective or action in the work plan	**Number of plans (N=61)**
Social Responsibility	Community ownership/guardianship	53
	Promote iwi interest/partnership	17
	Seek financial assistance fundraising/sponsorship/grants	9
	Nominate landowners for environmental awards	3

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 11).

The recovery plans of many species also highlight the need for species ambassadors and plan to maintain a captive population for breeding and research (32 plans, Appendix 11), yet this action only appears in three work plans (Table 23). Just as important is the need for community involvement in releases of captive bred animals, as well as encouraging the public to visit habitat such as mainland island reserves (14 plans). This is because introducing the general public to the concept of conservation of the environment benefits other species which live in similar habitats to iconic species such as the Kiwi (Butler & McLennan, 1991). At the moment only Kiwi have provisions in their work plans for publically accessible captive populations in zoological facilities overseas (no. 2 and 50). However, both Black Stilt

(no.4) and Takahe (no.61) recovery plans mention the need for a viewing hide at a breeding site, which would enable the general public to see the species without interfering in any way with the behaviour of the birds.

Table 23. Use of species ambassadors to increase community awareness of threatened species.

	Objective or action in the work plan	**Number of plans (N=61)**
Species Ambassadors	Release site visits/known breeding or habitat visits	14
	Visits to schools with species ambassadors	6
	Mainland island/offshore island visits	4
	Publically accessible captive population in a zoological facility in NZ	3
	Publically accessible captive population in a zoological facility overseas	2
	Viewing hide/display at captive management site	2

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 11).

Legal avenues are another way in which the community needs to be involved in the recovery of certain threatened species. Legal protection of habitat on private property appears in 19 plans (it is written as an action in 12 plans, but only implied not written as an action in a further 7 plans) (Table 24, Appendix 11). Legal protection would depend on the cooperation of the landowner to comply with any regulations or rules without supervision.

Table 24. Legal avenues which would rely on community ownership of a species recovery.

	Objective or action in the work plan	**Number of plans (N=61)**
Legal Avenues	Protection on private land	19
	Protect habitat through statutory/non-statutory advocacy	4

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 11).

Necessary legal protection and other legal matters are outlined in great detail in the *Dactylanthus taylorii* recovery plan (Table 25). They are also mentioned in the New Zealand Large Galaxiid recovery plan (no.55). Where management actions include: liaising with landowners of sites with Large Galaxiids present; seeking protection of wetlands on private land; and advocating through statutory planning the protection of important habitat (such as migratory pathways) in order to prevent the spread and/or establishment of introduced fish into critical Large Galaxiid habitat (Hallas, 2005). Protecting habitat through statutory/non-statutory advocacy appears in only four plans (Table 24).

Table 25. Legal protection outlined in the *Dactylanthus taylorii* recovery plan (no.56).

Themes	Topics	Objectives	Action	Priority
Theme 1: Management	Topic 3: Legal protection and other legal matters	Objective 1: All *Dactylanthus* populations of national importance are legally protected	Action 1.1 Advocate for and assist in the legal protection of *Dactylanthus* and its habitat, at least for the populations of national importance, for the duration of the recovery plan	Low
		Objective 2: Adequate legislation is in place to protect threatened plants on private land	Action 2.1 Advocate for adequate legislation to protect threatened plants throughout New Zealand, for the duration of the plan	Low
		Objective 3: Penalties are adequate, and the Department has compliance and law enforcement capability, to deter the destruction of *Dactylanthus* on all land	Action 3.1 Continue to advocate for the reassessment of the penalty structure and the Department's compliance and law enforcement capability with regard to the protection of *Dactylanthus*	Low

Source: *Dactylanthus taylorii* recovery plan, 56, 2004-14 (La Cock *et al*., 2005, pg14).

4.3 New Zealand case study management plans

Three species were chosen for an in-depth analysis of their management plans, a bird, a reptile and a plant. Their plans were chosen because they represent species which have had a second management plan written (nine species have had a second plan written, Kiwi have had three plans written). All three species are actively managed on offshore islands, in mainland sanctuaries, and in captive breeding facilities. The three species are Stitchbird or Hihi (*Notiomystis cincta*) (no.20, 1996 & no.54, 2004); Tuatara (*Sphenodon punctatus punctatus*, *S. punctatus* and *S. guntheri*) (no.9, 1993 & no.47, 2001); and an endemic parasitic flowering plant *Dactylanthus taylorii* (no.16, 1995 & no.56, 2005).

4.3.1 Stitchbird or Hihi (Notiomystis cincta)

Under the Department of Conservation's Threat Classification System (2005), Hihi are listed as Nationally Endangered. This is because the species has a high risk of extinction due to its vulnerability to disease and the risk of predator invasions to the one natural self-sustaining population (Little Barrier Island). Although a number of birds have been translocated to Tiritiri Matangi, Mokoia and Kapiti Islands and a breeding population is maintained at the Pukaka Mount Bruce National Wildlife Centre, the poor success of past translocations and breeding in captivity has resulted in small population numbers. The long term goal for the

species is “to improve the conservation status of Hihi by increasing the number of self-sustaining Hihi populations to at least five” (Taylor *et al.*, 2005).

The initial recovery plan (no.20, 1996-2001) focused on research, development of management techniques and translocation to improve the status of the Hihi. The recovery of the species up to this point had been translocations of individuals and pairs to other islands as well as captive breeding. Both of which had limited success due to poor survival rates and the unsuitability of transfer islands. In order to continue the security of the largest population (Hauturu/Little Barrier Island) the following objectives were written in the plan:

1. Ensure the protection of the Little Barrier Island population;
2. Protect, monitor and enhance populations on existing transfer sites;
3. Establish at least one more self-sustaining population and gain more information on transfer success by transferring birds to appropriate sites;
4. Raise public awareness of the Stitchbird recovery program; and,
5. Maintain a small number of pairs in captivity for research and advocacy purposes (Rasch, Boyd, Clegg, 1996, pg13).

To meet these objectives, the work plan focuses on long term monitoring and protection of *in situ* populations, development of a captive breeding program, establishing additional populations by translocation and educating the public about Hihi conservation. It also outlines a list of research needs such as the development of monitoring techniques and the need for investigation into breeding, feeding and disease susceptibility. The plan also includes a timetable (implementation schedule) detailing when the execution of each objective is to be carried out over the next five years (Table 26).

Table 26. Implementation schedule for Objective 2 in the first Hihi (*Notiomystis cincta*) recovery plan (no.20).

Objective	**Year 1 (1995)**	**Year 2 (1996)**	**Year 3 (1997)**	**Year 4 (1998)**	**Year 5 (1999)**
2. Protect, monitor and/or enhance populations on existing transfer sites	Develop standard, national Stitchbird monitoring system	Monitor Little Barrier I	→	→	→
	Monitor Hen & Cuvier I for Bellbirds/Stitchbirds and phenology as opportunity arises		Monitor Hen & Cuvier I		
	Monitor/evaluate Kapiti I September			If <50 birds and a higher number of juveniles then another transfer	
	Establish/implement rodent contingency for islands with Stitchbirds	→	→	→	→
	Mokoia Is • Monitor Stitchbirds during mouse eradication • Discuss/incorporate recovery goals into Mokoia Is management plan • Provide nest boxes • Support research → • Evaluate initial transfer success	Evaluate need for supplementary nectar, additional management	Monitor and evaluate need for additional management		
	Transfer Stitchbirds to Tiritiri Matangi Island	Monitor Stitchbird numbers			

Arrows indicate additional years action will be carried out in. Source: Stitchbird (Hihi) (*Notiomystis cincta*) recovery plan, 20 (Rasch *et al*., 1996, pg20)

In 2005, a revised Hihi recovery plan (no.54, 2004-2009) was published. Since the first plan was written, background information about the species (such as the distribution, causes of decline and ecology) is more detailed due to an increase in research on the species (this has also resulted in the distribution map being updated). There is also a list of key research and management results achieved during the course of the first Hihi recovery plan in the appendix.

Actions such as the translocation of birds to other islands (e.g. 181 birds to Kapiti Island) and enhancing populations on existing transfer sites were largely unsuccessful until further research and monitoring at the transfer sites revealed that the provision of additional food,

nest boxes and controlling mite populations in nest boxes would help to improve recruitment levels, enabling the populations on Kapiti and Tiritiri Matangi Islands to remain fairly stable. The objectives of this revised plan are similar to those of the first plan:

1. Secure Hihi populations at all existing sites;
2. Raise awareness and support for Hihi recovery;
3. Establish a research programme on Hauturu;
4. Identify sites favourable to the establishment of self-sustaining Hihi populations and introduce Hihi to the most favourable of these;
5. Establish further managed populations; and,
6. Maintain a captive population of Hihi (Taylor *et al*., 2005, pg16).

Each objective now has list of 'performance measures' and an explanation why this objective is important. There are more actions per objective, and each includes who is responsible for carrying out that particular action. For example, the performance measures of *Objective 2: Raise awareness and support for Hihi recovery include:*

- Completing an advocacy plan;
- Securing sufficient funding to enable Objective 3 to be implemented;
- Publishing a minimum number of media releases; and,
- Creating opportunities for public involvement (Taylor *et al*., 2005, pg18).

This revised plan has no timeline or implementation schedule for the work plan, although many of the actions state that by the end of year one or year two this action should be carried out. Still more research needs to be carried out on the species and at the end of the plan there is a chapter outlining a list of key research priorities and research questions which need to be addressed in the next five years.

4.3.2 Tuatara (Sphenodon punctatus punctatus, S. punctatus and S. guntheri)

Under the Department of Conservation's Threat Classification System (2005), Brother Island Tuatara (*S. guntheri*) is listed as Nationally Endangered whilst Northern (*S. punctatus punctatus*) and Cook Strait Tuatara (*S. punctatus*) are listed as Sparse. Current taxonomy recognises two species of Tuatara (the Northern and Brothers Island), because the Cook Strait Tuatara is thought to be an as yet unnamed subspecies of the Northern Tuatara. Tuatara were once widely distributed over the North and South islands, however they now only survive in the wild on 35 offshore islands and in captive breeding facilities (e.g. Auckland Zoo, Victoria

University) (a distribution map showing the present distribution of the species appears in the second plan). It is estimated that Northern Tuatara total 10,000 individuals, Cook Strait Tuatara number 45,000 and Brother Island Tuatara about 400 adults. Until recently, populations of Tuatara have been steadily declining due to predation by rats (Norway Rat *Rattus norvegicus*; Ships Rat *Rattus rattus* and particularly by the Pacific Rat *Rattus exulans*) on small Tuatara and eggs, and competition between Tuatara and rats for food resources, but eradication of these species on some of the islands are enabling populations to slowly increase. The long term goal (50 years) for the species is that "the genetic diversity of Tuatara will be maintained by returning all existing populations to their natural levels and establishing new wild populations of Tuatara throughout their pre-human range as components of healthy ecosystems" (Gaze, 2001, pg13).

The initial recovery plan (no.9, 1992-1997) covers all three types of Tuatara, because previous management and legislation were only focused on the Northern subspecies due to a lack of understanding about the genetic differences between the three. The plan covers the past and present distribution of Tuatara in detail (with distribution maps). It also details the causes of decline and threats to the long term survival of the different species, such as the small size of the islands and the presence of rats and rabbits (*Oryctolagus cuniculus*) on islands inhabited by the Northern species. Biology and ecology information for each of the subspecies is included as an appendix. The ability of the species to recover is thought to be feasible if the management actions outlined in this plan are carried out.

There is a detailed work plan which outlines seven aims. Each aim has a number of objectives with associated actions that are specific to each subspecies. There is also mention of key personnel and conservancies involved in the implementation of the objective.
The objectives of the initial recovery plan include:

1. Procedures for increasing the security of all populations;
2. Increased security of the North Brother Island population;
3. Establish two new wild populations plus one captive population of the Brothers Tuatara;
4. Captive breeding of Northern Tuatara from Stanley Island, Red Mercury Island and Cuvier Island;
5. Survey to establish the status of Northern Tuatara on Little Barrier Island;

6. Manage Little Barrier Tuatara on the island, either through island transfer or captive breeding;
7. Identification of new islands for Little Barrier Tuatara;
8. Restoration of Stanley, Red Mercury and Cuvier islands for Northern Tuatara;
9. Monitor evidence for recruitment of Northern Tuatara on Hen and Chickens islands and begin kiore eradication as soon as possible;
10. Eradication of kiore from Middle Chain Island in the Alderman Group;
11. Survey other populations of Northern Tuatara of uncertain status;
12. Restoration of Northern Tuatara on an island on which controlled public access is permitted;
13. Restoration of Cook Strait Tuatara on an island on which controlled public access is permitted;
14. Undertake research required for Tuatara conservation;
15. Co-ordination of captive breeding of Tuatara;
16. Maintain national database with records of all wild Tuatara permanently marked;
17. Formulation of recovery group; and,
18. Advocacy (Cree & Butler, 1993, pg13-29).

A budget has been included in the initial plan which details the approximate costs of the projects outlined in this recovery plan over the next five years, for all the conservancies concerned (Table 27).

Table 27. Approximate costs of some of the DOC conservancy projects outlined in the Tuatara (*Sphenodon* spp.) recovery plan (no.9) over a five year period (1992-97).

DOC Conservancy	**Associated Costs (NZ$)**
Northland	$15,000 over five years for annual surveys and upgrading signs on all Tuatara islands
	$50,000-$100,000 kiore eradication from the three Chicken Islands
Auckland	$12,000 for two further surveys of Little Barrier Island
	$30,000 for surveying food supplies and habitat on an island for release of Little Barrier Tuatara

Source: Tuatara (*Sphenodon* spp.) recovery plan, 1992-97 (Cree & Butler, 1993, pg30).

At the beginning of the work plan there is a critical path diagram detailing when each of the objectives should be achieved between 1992 and 1997. At the end of the work plan, there is a

second critical path diagram that indicates when each objective will be carried from 1992 until 2040 (Table 28).

Table 28. Critical path diagram detailing when each objective in the first Tuatara recovery plan (no.9) will be carried out over a 48-year time span.

Action	**1992**	**2000**	**2010**	**2020**	**2030**	**2040**
All populations: Increase security and monitor annually						
Northern Tuatara: Survey & captive breeding or island transfer of Little Barrier Tuatara						
Captive breeding of Stanley, Red Mercury and Cuvier populations						
Restoration of Stanley, Red Mercury and Cuvier Islands						
Restoration of Hen and Chicken Islands						
Eradication of kiore on Middle Chain Island						
Survey populations of uncertain status						
Re-establishment of one new wild population						
Brothers Tuatara: Increase security of North Brother Island						
Establish two new wild populations and one captive population						
Cook Strait Tuatara: Re-establishment of one new wild population						
Advocacy & Research						

Height of horizontal bars indicates amount of effort. Source: Tuatara (*Sphenodon* spp.) recovery plan, 9. 1992-97 (Cree & Butler, 1993, pgIX).

In 2001, a revised Tuatara recovery plan (no.47, 2001-2011) was published. This plan has evolved significantly from the first as more research on the species has been carried out. This revised plan includes updated distribution, population trends, causes of decline and greater detail about the species ecology and biology. The eradication of rats from several islands and the translocations of Tuatara to other islands have enabled new wild populations to establish. DOC has also successfully incubated eggs and raised juveniles in captivity, as a direct result of in-depth research and enhanced animal husbandry techniques developed since the first plan.

Future conservation work will focus on eradication of rats from Little Barrier (Hauturu), Mauitaha and Hen Islands and in maintaining the pest free status of other islands, in addition to further translocations in order to meet the long term objective of establishing wild populations of Tuatara throughout their pre-human range (Gaze, 2001). The updated objectives of the second Tuatara recovery plan include:

1. The genetic diversity of all existing Tuatara stock is preserved;
2. Tuatara are reinstated as components of healthy ecosystems throughout their pre-human range; and,
3. Public awareness of Tuatara and related conservation issues will be promoted through accessibility to captive animals and certain wild populations of Tuatara (Gaze, 2001, pg15).

To meet these objectives, a number of detailed actions have been written in the work plan. Such as: *Action 1.2. The department will seek the support of iwi to eradicate Pacific Rats from islands where they are present with Tuatara*, this action supports Objective 1 (Table 29).

Table 29. Work plan for Objective 1, Action 1.2 in the revised Tuatara recovery plan (no.47).

Conservancy	**Priority**	**Task**	**Performance Measure**	**Timing**
Auckland	High	Obtain agreement from iwi and secure funding for rat eradication from at least Little Barrier and Hen Islands	Eradication of rats recruitment of wild juveniles to these populations	Operations completed by winter 2002
Northland	Moderate			

Source: Tuatara recovery plan, 47, 2001-2011 (Gaze, 2001, pg16).

The potential to use Tuatara in education to enhance public awareness of conservation issues and for research are promoted within the plan, and are seen as essential for the long term survival of the species. It is also mentioned that increased involvement of iwi will be needed to ensure the plan succeeds. There is also a list of research topics that have been identified as needing further study, in order to better the conservation management of the species in the next couple of years.

4.3.3 Dactylanthus taylorii

Dactylanthus taylorii, otherwise known as pua o te reinga, wae-wae-atua, the ‘wood rose’ or flower of Hades, is a parasitic flowering plant which grows on the roots of about 30 species of native hardwood trees and shrubs. Under the Department of Conservation’s Threat Classification System (2005), *Dactylanthus* is classified as being in Serious Decline.

This is because although it has a moderate to large population (>5000 individuals) it is predicted that up to 30 percent of the total population may be lost in the next ten years due to recruitment failure if conservation measures are not carried out. *Dactylanthus* is currently distributed in only four percent of its former range, with its range decreasing 32 percent since the 1970s. The long term goals for the species are "*Dactylanthus* is not threatened; there are at least 15 populations throughout its known range of distribution and environments; and, the abundance in each population is stable or increasing and includes 100 females" (La Cock, Holzapfel, King, Singers, 2005, pg11).

The initial recovery plan (no.16, 1994-2005) goes into detail about the species cultural significance to Maori, the distribution of the species in the past and present (*Dactylanthus* is only found on the North Island) as well as the ecology of the species (habitat, flowering biology, pollination, seed dispersal, germination and cultivation). There is also a chapter detailing the reasons why the species is in decline and why its survival is threatened (due to habitat destruction, collectors and browsing pest species such as the possum and rats) if conservation measures and active management are not carried out. The objectives of the ten year work plan include:

1. As a minimum, protect representative plants from possums, rats and other recognised threats at all known sites on land administered by the Department of Conservation;
2. Promote public interest and involvement in the recovery of *Dactylanthus taylorii*, encourage its protection on private land;
3. Advocate for the listing of *Dactylanthus taylorii* in CITES to prohibit the export of wood roses;
4. Obtain better information on the distribution, condition and trends of *Dactylanthus taylorii*; and,
5. Carry out or promote research on the propagation, genetics, ecology and protection of *Dactylanthus taylorii* (Ecroyd, 1995, pg12).

Each objective in the work plan has a detailed explanation of why it is important, as well as a plan of action and an expected outcome. Key personnel associated with each action in the work plan are given. There is also a timeline detailing when each objective will be carried out over the ten years, along with an estimate of the number of man hours and the costs which will be incurred each financial year associated with carrying out these objectives. A list of key contacts is also included in the appendices.

In 2004, a revised recovery plan (no.56, 2004-2014) was written for *Dactylanthus taylorii*. This revised plan is more detailed due to research carried out since the first plan was written. The cultural importance of the species to Maori, and the need for increased public awareness (such as the newly formed 'Friends of *Dactylanthus*' group), have been given separate chapters. Past and current management of the species is commented on with recognition that future long-term management options for the species are dependent upon the need for several large populations of *Dactylanthus* throughout its distributional range. There are no distribution maps but a list of sites of national importance is included as an appendix.

To aid the implementation of the work plan it has been divided into three themes (management, working with the community and research). Each theme has then been subdivided into a number of topics, each with their own objectives. In total, there are now 16 topics and 26 objectives to replace the five objectives written in the initial recovery plan (e.g. Table 30). This revised recovery plan has no timeline and no indication of a budget and costs associated with implementing the program.

Table 30. Example of management actions for Theme 2 outlined in the work plan of the revised *Dactylanthus taylorii* recovery plan (no.56).

Theme	**Topic**	**Objective**	**Action**	**Priority**	**Accountability**
Theme 2: Working with the community	Topic 2: The Community	Objective 1: Opportunities to involve the public and local authorities in management of *Dactylanthus* are recognised and realised	*Action 1.1* Continue and increase the number of *Dactylanthus* management projects that involve the public (volunteers, interest groups, individuals, local authorities). Examples include Oropi volunteer workdays (Bay of Plenty), survey through volunteers at Mount Pirongia (Waikato), school group visits at Te Araroa (East Coast), and caging in the Tongariro-Taupo Conservancy with the Tongariro Natural History Society	High	Recovery group and conservancies
			Action 1.2 Seek financial assistance from local and national sources (e.g. grants, sponsorship) for *Dactylanthus* recovery outside the Department.	Medium	Recovery group and conservancies

Source: *Dactylanthus taylorii* recovery plan, 56, 2004-14 (La Cock *et al*., 2005, pg19).

4.4 Australian threatened species recovery plans

National threatened species recovery plans in Australia are written in accordance with the Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC1999), with the assistance of funding provided by the Australian Government. The management actions within the plan are then carried out by the respective state in which the threatened species lives (DEWHA, 2009d). Since the plans are prepared under the EPBC1999, national recovery plans have only been written since 2000, many of which are available to the public via the Department of the Environment, Water, Heritage and the Arts website. Some draft recovery plans are also available online for public consultation before they are given by the Threatened Species Scientific Committee to the Australian Commonwealth Government Minister for the Environment, for consideration. The process for preparing and adopting recovery plans in Australia can be found in Appendix 6. A recovery plan only has force under the EPBC1999 if it has been formally made or adopted by the Minister (DEWHA, 2009f).

The preparation and implementation of recovery plans is identified by both the National Strategy for the Conservation of Australia's Biological Diversity and independent state Biodiversity Strategies as a key tool in the conservation of threatened flora, fauna and invertebrates (ANZECC, 2001). The object of a recovery plan is to document the management actions required to promote the recovery of a threatened species, population or ecological community and to ensure its ongoing viability in nature (DEWHA, 2009f). In Australia although there are 428 national recovery plans (and 14 draft recovery plans open for public comment), individual states have management plans for threatened species within their regions. The purpose of the national plans is to make management of certain species mandatory under law, and to increase cooperation between states for threatened species which live in more than one area (DEWHA, 2009f).

Twelve out of the 428 national recovery plans were analysed in detail to ascertain the structure and content of recovery plans written in Australia. The 12 plans represent bird, reptile and plant species which can be found in a number of different states (New South Wales, Queensland, South Australia, Western Australia, Victoria and the Northern Territory). Each chapter in the recovery plans (e.g. Species information or General requirements) has been analysed and is commented upon within this section of the results chapter. An overview of all 12 recovery plans and the content within each chapter can be found as a table in Appendix 12 (plans have

been numbered 1-12 but this does not represent the order in which they were written). In general, each of the Australian national recovery plans studied has a similar structure to that outlined in Table 6 (pg 50); however, there is variation in the content and titles of chapters in plans written in different states. In order to compare recovery strategies in Australian plans with that of New Zealand plans it was decided that plans from only one state (in this case Victoria) would be chosen. This is because all of the Victorian plans studied (in particular the three case study species the Helmeted Honeyeater, *Lichenostomus melanops cassidix*; the Striped Legless Lizard, *Delma impar*; and Aniseed Boronia, *Boronia galbraithiae*) appear to follow a uniform structure which suggests that there must be a template for writing recovery plans in Victoria.

Within the 'Species Information' or background chapter all 12 plans comment on the conservation status (i.e. threatened or endangered), the habitat in which the species lives as well as the present known distribution of the species. Nine plans illustrate this distribution with a distribution map. In the case of the Angle-stemmed Myrtle (*Austromyrtus gonoclada*) (no.3) because so few individuals remain, all areas in which the species occur (including sites where the species has recently been established are considered critically important to the species survival so their distribution is kept a secret (McNeill, 2001). Nine of the plans also have a separate life history or ecology section which details behaviour and other aspects of the species which enables it to adapt to its environment.

Some of the recovery plans list the subsections outlined in Table 31 within a chapter entitled 'General Requirements', other plans comment on these sections within the introduction. Of note, all plans mention whether the species has been listed under the EPBC Act1999 and any legislation at a State level which applies to the species recovery status. Most of the plans also identify whether or not actions outlined in the plan are consistent with Australia's international obligations under the Convention of Biodiversity (9 plans).

The social and economic benefits associated with the implementation of the actions in the recovery plan appears in nine of the plans (Table 31). In most cases it is anticipated that there will be no significant social or economic costs associated with the implementation of the recovery plan. In the Black-throated Finch (*Poephila cincta cincta*)(no.2) plan, executing the actions in the work plan will improve land management of a range of regional ecosystems.

Any management on private land will be in consultation with the landholders, and required changes to land use or restriction of activities may be offset by the support and incentives provided by voluntary conservation agreements (Black-throated Finch Recovery Team, 2007).

Table 31. Subsections that can be found either within the 'general requirements' chapter or within the 'introduction'.

General Requirements	**Number of plans (N=12)**
Biodiversity benefits	12
Objectives under the EPBC Act1999	12
Legislative context (State acts)	12
International obligations	9
Social and economic benefits	9
Affected interests	8
Role of indigenous people	8

(Number of plans refers to the number of plans that have this subsection written in the general requirement or introduction chapters, further detail on specific plans can be found in the matrix located in Appendix 12).

Eight plans mention other affected interests such as other state agencies and departments, community groups, environmental groups, non-government organisations and businesses which are involved as stakeholders in the species recovery program. The role Aboriginal people will play in the implementation of the recovery plans is also taken into consideration (8 plans) (Table 31). When the Glossy Black Cockatoo (*Calyptorhynchus lathami halmaturinus*) recovery plan (no.5) was written, a draft copy was referred to the Aboriginal Partnerships Section of the South Australian Department for Environment and Heritage, who undertook consultation with the relevant indigenous communities (Mooney & Pedler, 2005).

4.4.1 The identification of threats and formulation of strategy

The primary cause of decline and threat to the long term survival of Australia's threatened species is habitat degradation and habitat loss as a result of human actions (10 plans) and environmental events (i.e. drought or flooding events) (8 plans) (Table 32). The decline of the Pygmy Bluetongue Lizard (*Tiliqua adelaidensis*) (no.4) has been directly correlated with the ploughing of the native grassy understorey, which has altered soil compaction and friability, destroyed lizards directly (by destroying burrows) and converted stable perennial grassland into crops or improved pasture dominated by introduced annuals (Milne , Hutchinson, Clarke, 2000).

Table 32. Key factors that have been identified as 'threatening processes' or 'causes of decline' of Australia's threatened species.

Threatening Processes (causes of decline)	**Number of plans (N=12)**
Habitat degradation	10
Changes in fire regimes	9
Habitat loss	8
Grazing by domestic stock (of species or species relied upon)	8
Predation (cats, rabbits, kangaroos)	7
Introduced weeds	6
Human recreation (trapping, hunting, firewood collection)	5
Small population size (recruitment of next generation)	5
Competition	3
Inbreeding depression	3
Pollution/fertilizers/pesticides	3
Hybridisation	2
Road maintenance threatening populations (grading, chemical spraying)	2

(Number of plans refers to the number of plans that have these factors written in the threatening processes chapter, further detail on specific plans can be found in the matrix located in Appendix 12).

Also of concern to Australian species are changes in the fire regimes (9 plans), particularly when there are additional pressures already placed on the habitat, such as the presence of introduced weed species (6 plans). Both Minnie Daisy (*Minuria tridens*) (no.11) and populations of Slater's Skink (*Egernia slateri*) (no.12) are affected by the degradation of alluvial habitat as a result of invasion by the introduced pest species Buffel Grass (*Cenchrus ciliaris*), which is often managed by fire. Inappropriate fire regimes and an increasing threat of wildfires, therefore represent a potential threat to both species as Buffel Grass becomes established in their habitat (Pavey, 2004; Nano & Pavey, 2008).

Many of the threatened species with national recovery plans are already intensively managed in their respective states. Previous management of the species has usually included surveys of populations and habitat in which the species lives (9 plans), combined with monitoring of population trends (8 plans), and protecting/managing the habitat in which the species lives (7 plans) (Table 33).

Table 33. Key strategies that have been used in the past to manage populations of Australia's threatened species.

Past Conservation Management	**Number of plans (N=12)**
Surveys of habitat/population	9
Monitoring of populations	8
Research	7
Habitat protection and management	7
Formation of a recovery team	6
Identification of habitat	6
Captive breeding	6
Community awareness and involvement	5
Translocation	4
Population protection	4
Management of pest species	2
Management in national parks	1
Management of predators	1

(Number of plans refers to the number of plans that have this subsection written in the general requirement or introduction chapters, further detail on specific plans can be found in the matrix located in Appendix 12).

Some of the recovery plans analysed mention that the formation of a recovery team or group is paramount to ensure the management of the species both within the state and across state boundaries (6 plans). At the moment, unless the species is actively managed by a recovery group with a national or state recovery plan, there are too many species and not enough people to research and intensively manage all of the threatened species in the country. Pest species management (2 plans) and predator management (1 plan) have also been carried out to improve population numbers of vulnerable species such as the Angle-stemmed myrtle (no.3) and Helmeted Honeyeater (no.8) (Table 33).

The objectives and actions in the work plans of the 12 national recovery plans can be grouped into 29 different recovery strategies (Chapter titled Recovery Strategies, Appendix 12). Of these strategies, the ten most common are detailed in Table 34. All 12 of the plans mention advocacy in the community in their work plans. Increasing public awareness and involvement will raise awareness of the conservation status of the threatened species and involve the broader community and key groups (such as landholders, land managers, local and State government agencies, public authorities and researchers) in the recovery program of the species. For example, recovery of the Minnie Daisy will depend on incorporating traditional ecological knowledge and management practices as well as informing and involving the

community and stakeholders in the recovery process. This is because the species occurs in a range of land tenures (National parks, pastoral lease land, Aboriginal Land Trusts and in the greater Alice Springs municipality) (Nano & Pavey, 2008).

Table 34. The ten most common recovery strategies written in the work plans of Australian threatened species recovery plans.

Management objective or action in the work plan	**Number of plans (N=12)**
Advocacy in the community (encourage/involve/raise community awareness)	12
Survey (distribution, find new populations)	10
Undertake research/encourage scientific studies	10
Monitor representative populations	9
Establish reserves/managed areas/secure habitat	9
Monitor threats	8
Assess potential habitat	8
Maintain captive populations (seed banks, genetic diversity)	8
Identify threats to habitat	7
Manage threats (pest species such as bees or humans)	7

(Number of plans refers to the number of plans that have these management objectives or actions written in the recovery strategy chapter, further detail on specific plans can be found in the matrix located in Appendix 12).

Surveying the species to find populations or determine habitat preferences (10 plans) as well as undertaking research and encouraging scientific studies on the species (10 plans) are also frequently mentioned objectives in the work plans (Table 34). This is because most of these plans are the first editions for the species. In the case of the Black-throated Finch recovery plan (no.2), an objective in the five year recovery plan is to conduct surveys to investigate the species breeding in relation to landscape and management variables (e.g. landscape pattern, vegetation structure, fire, livestock grazing, rainfall and land condition). At the moment, not enough is known about the species, so the recovery plan outlines carrying out surveys and banding birds in its objectives, in order to enable the recovery team to develop a more concise work plan for the species in the future (Black-throated Finch recovery team, 2007). This approach is similar to that of other species (e.g. Blue Mountain Water Skink and Slater's Skink) in which the initial recovery plan outlines the need for further study into the ecology and biology of the species over a five-ten year period before a comprehensive work plan can be formulated to aid recovery. Many of the recovery plans also include performance criteria. These criteria are used as a way in which to measure the success of an objective after appropriate actions have been carried out (Table 35).

Table 35. Criteria which can be used to assess the performance of threatened species management actions during the lifespan of the recovery plan.

Performance Criteria	**Number of plans (N=12)**
Monitor populations	10
Actively involve community in recovery program	8
Increase number of individuals	7
Inform community about conservation of species	7
Identify threats to species	3
More informed recovery/management programmes	3
Assess success of research/management programmes	3
Reassess State status	3
Study completed within lifespan of plan	3
Targeted survey of species	2
Prepare State management plans	2
Identify threats to habitat	2
Reassess national status	2

(Number of plans refers to the number of plans that have these management actions written in the performance criteria chapter, further detail on specific plans can be found in the matrix located in Appendix 12).

Performance criteria can include actions such as the monitoring of threatened species populations (10 plans); involving the community in the recovery program (8 plans); or completing the study within the lifespan of the recovery plan (3 plans) (Table 35). Performance measures usually appear in the work plan or implementation schedule of the recovery plan, such those found in the Minnie Daisy recovery plan Table 36.

Table 36. Relationship between specific objectives, performance criteria and actions in the work plan of the Minnie Daisy (*Minuria tridens*) threatened species recovery plan.

Specific objectives		**Performance criteria**		**Actions**
Quantify distribution, abundance and population dynamics using long-term monitoring surveys.	⇔	The distribution limits and dynamics of populations are understood.	⇔	1.Carry out targeted surveys for additional populations within the MacDonnell Ranges (all species) and in the Petermann Ranges (*A. Schwarzii*) and Western Australia (*Minuria tridens*). 2.Mapping of subpopulations (all species)
Maintain or enhance habitat quality and extent.	⇔	Habitat quality and extent is maintained or enhanced	⇔	3.Negotiate conservation agreements to secure significant populations on pastoral leasehold and Aboriginal land trust properties. 4.Carry out population and habitat monitoring at selected sites. 5.Implement management strategies for key threatening processes as required.

Source: National Recovery Plan for *Olearia macdonnellensis, Minuria tridens* (Minnie Daisy) and *Actinotus schwarzii* (Desert Flannel Flower) (Nano & Pavey, 2008, pg14).

Responsibility or accountability for carrying out the actions in the work plans can be found in the implementation schedules of the Australian recovery plans. Six out of the 12 recovery plans analysed contain a timeline or implementation schedule which details when each objective or management action will be carried out during the lifespan of the plan. However, all of the recovery plans analysed contain budget information for the timeframe of the plan (Appendix 12). Often the implementation schedule combines the year the recovery action will be carried out with a summary of the costs involved with carrying out each action, and the budget allotted to the species recovery, such as in the Angle-stemmed Myrtle recovery plan (Table 37).

Table 37. Implementation schedule and costs of the Angle-stemmed Myrtle (*Austromyrtus gonoclada*) national recovery plan.

Action	**Responsible Party**	**Estimated cost (AU$)**				
		2001-02	**2002-03**	**2003-04**	**2004-05**	**Total**
1. Conduct surveys for new populations	Trust fund	200	200	150	150	700
2. Provide secure habitat	Logan CC and Brisbane CC	0	0	0	0	0
3.Ecological investigations	Trust fund	3,000	3,000	3,000	1,000	10,000
4.Cultivate species and supplement existing populations	Logan CC, Brisbane CC and Trust fund	1,100	1,100	500	500	3,200
5.Establish new populations	Logan CC, Brisbane CC and Trust fund	12,400	9,300	9,300	12,400	43,400
6.Community awareness & involvement	Logan CC and Brisbane CC	0	1,000	500	0	1,500
7.Manage and reduce threats	Logan CC, Brisbane CC and Trust fund	2,700	1,700	1,700	1,700	7,800
Totals		**19,400**	**16,300**	**15,150**	**15,750**	**66,600**

CC=City Council. Source: Recovery plan for the Angle-stemmed Myrtle (*Austromyrtus gonoclada*) 2001-2005 (McNeill, 2001, pg11).

4.4.2 Community involvement in Australia's endangered species recovery

All 12 of the Australian recovery plans studied advocate maintaining and facilitating public awareness and community ownership in threatened species recovery. All of the plans contain more than one idea or action in their work plans which relates to community involvement. These ideas or actions have been organised into one of six different categories: Providing Information; Education; use of Volunteers; Social Responsibility; Species Ambassadors; and Legal Avenues (see Appendix 13).

Informing the public about threatened species recovery has been achieved for some species through the use of education leaflets (10 plans) and displays in local community libraries (8 plans) (Table 38). The displays are also exhibited at various community and environmental events held in areas in which the threatened species lives (2 plans). Increasing public awareness in the Black-throated Finch recovery plan (no.2) is to be achieved by providing

copies of the recovery plan to appropriate public libraries and local government offices, and identifying target groups and developing and distributing appropriate information packages (Black-throated Finch recovery team, 2007). Media releases on planting or release days provides a means of notifying the local community and encouraging their involvement (8 plans). For some of the plant species, a number of schools, community groups and environmental organisations have been involved in maintaining sites, collecting seeds and cuttings, searching for new populations and propagating and planting trees (no. 3,7, 9).

Table 38. Sources of information about threatened species recovery provided to the community.

	Objective or action in the work plan	**Number of plans (N=12)**
Provide Information	Education leaflet/pamphlet/fact sheet about species	10
	Media releases (e.g. television coverage, newspaper articles, videos)	8
	Publish articles in natural history/scientific journals, newsletters, magazines	8
	Provide local community with educational material (i.e. in a public library)	8
	Interpretative signs at breeding sites	4
	Develop and promote a webpage	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 13).

Since more than 60 percent of the Glossy Black Cockatoo feeding habitat and 67 percent of natural/artificial nest sites are found on private land, not covered by a Heritage Agreement, this has implications for more than 30 landholders, including three forestry corporations. As a result, strategies in the recovery plan have looked at ways in which to inform the community of recovery efforts in order to involve them in conservation of the species (Mooney & Pedler, 2005). Actions in the Glossy Black Cockatoo recovery plan which inform the community include:

- Maintaining a high profile and good communication with stakeholders;
- Production of twice yearly newsletters;
- Presentations to schools, clubs, organisations; and,
- Articles in the popular press (Mooney & Pedler, 2005).

Only one plan mentions developing and promoting a webpage dedicated to the recovery of the species (no.1, Blue Mountains Water Skink, *Eulamprus leuraensis*).

Educating the community about threatened species recovery planning is an important tool because it teaches people why a particular action may be detrimental to a species survival. Advocating appropriate land use (7 plans) and encouraging minimal disturbance to wild populations (6 plans) are measures which can be implemented through the provision of information (Table 39).

Table 39. Education initiatives aimed at involving the community in species recovery.

	Objective or action in the work plan	**Number of plans (N=12)**
Education	Appropriate land use	7
	Public talks/lectures	6
	Encourage minimal disturbance to wild populations	6
	School education/participation with site visits	3
	Pest spp. awareness/prevention/eradication (e.g. wallabies)	2
	Discourage firewood collection from habitat	2
	Displays about species at community/environment events	2

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 13).

A species which has benefited from community awareness and involvement is Muir's Corella (*Cacatua pastinator pastinator*) (no.6). The majority of the species habitat occurs on private property and on properties owned or managed by a small number of landholders. Whilst the species once fed on native shoots, bulbs and seeds, it now flocks to farmland to feed, where it can damage crops and young trees. As a result, the corellas are illegally killed by shooting and poisoning to minimise the damage caused. As part of the recovery process for the species, direct communication between the recovery team and relevant landholders, commercial tree farmers, and NRM groups as well as public talks/lectures has been deemed the most effective means of educating landholders. An information kit will also be prepared and placed on the Department of Environment and Conservation, Government of Western Australia (DEC) Naturebase website, which aims to provide information on the most effective means of reducing the damage caused by Muir's Corella (Chapman & Cale, 2008).

Using volunteers to monitor populations of threatened species (9 plans) and locate species (8 plans) enables State agencies to allocate man power to more important recovery actions (Table 40). It also enables funding to go to more expensive recovery actions, such as captive breeding. In the Glossy Black Cockatoo recovery plan (no.5), establishing and coordinating a group of volunteers with the skills necessary to support the recovery process, is deemed

necessary to ensure that the continued recovery of the species is completed during the lifespan of the recovery plan (Mooney & Pedler, 2005).

Table 40. Use of volunteers as a way in which to involve the community in species recovery.

	Objective or action in the work plan	**Number of plans (N=12)**
Volunteers	Volunteer participation in monitoring	9
	Use volunteers to locate spp.	8
	Volunteer participation in surveying	5
	Use volunteers to protect breeding sites	4
	Volunteer participation in tracking tagged animals	1
	Provide logistic support to volunteers	1
	Provide community with a survey to record sightings	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 13).

Encouraging input and involvement from Indigenous communities (7 plans) and involving community groups in threat management (6 plans) will increase the likelihood of cooperation with recovery managers in future recovery management (Table 41). The implementation of some recovery actions will inadvertently have a social impact on local communities and in particular the owners and managers on whose land threatened species live. Management agreements with and sympathetic land use by non-government landholders will play a crucial role in the conservation of the Striped Legless Lizard (no.10). Since much of the remaining Striped Legless Lizard habitat is on privately owned land, the opportunity exists for landholders to make substantial contributions towards the conservation of this species. An objective in the recovery plan for this species outlines the importance of developing management agreements with landholders which attempt to integrate conservation management practices with everyday rural land management, and to maintain a harmonious relationship between the various land managers responsible for maintaining and monitoring Striped Legless Lizard populations (Robertson & Smith, 2010).

Generally, when the recovery plans were written, negative impacts on private landholders are kept to a minimum as many habitats are either wholly or mostly publicly owned. However, landholders with land adjacent to known habitats may be affected and there is the potential that future translocation sites may occur on private land (Robertson & Smith, 1999). Personal and regular contact with landholders is a key strategy in encouraging awareness and involvement in the recovery effort. Other negative social impacts may include public

dissatisfaction with recovery plan actions that limit previously unregulated activities (such as restricted access to areas of habitat), but these can be mitigated through meetings with those affected (Ashworth & Tuckey, 2001; Chapman & Cale, 2008).

Table 41. Promoting social responsibility of species recovery in the community.

	Objective or action in the work plan	**Number of plans (N=12)**
Social Responsibility	Community ownership/guardianship	8
	Promote indigenous people's interest/partnership	7
	Involve landholders in species management	7
	Involve community groups in threat management	6
	Encourage researcher/students involvement in research	4
	Encourage community groups to seek funding	2
	Seek financial assistance fundraising/sponsorship/grants	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 13).

Only four plans mention facilitating a publically accessible captive population in a zoological facility in Australia (Pygmy Bluetongue Lizard, Helmeted Honeyeater, Striped Legless Lizard and Slater's Skink) (Table 42). Similarly, only the Pygmy Bluetongue Lizard plan (no.4) mentions involving the community in release site visits or taking species ambassadors to schools.

Table 42. Use of species ambassadors to increase community awareness of threatened species.

	Objective or action in the work plan	**Number of plans (N=12)**
Species Ambassadors	Publically accessible captive population in a zoological facility in Australia	4
	Release site visits/ known breeding or habitat visits	1
	Visits to schools with species ambassadors	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 13).

Only six out of the 12 plans mention legal avenues which can be used to assist the species recovery efforts (Table 43). All states have a legal obligation to consult with Aboriginal people in cases where a species is threatened with extinction (ALRC, 2010), however, none of the plans studied mention this.

Table 43. Legal avenues which would aid species recovery.

	Objective or action in the work plan	Number of plans (N=12)
Legal Avenues	Protection on private land	2
	Use Vegetation Management Act 1999 to declare habitat area of high nature conservation value	2
	Encourage permanent heritage-style agreements with landholders supporting populations of threatened species	2
	Enforce registration of domestic cats under the Companion Animals Act 1998	1
	Recommend local councils designate Wildlife Protection Areas under the Companion Animals Act 1998	1
	Develop formal conservation agreements	1
	Use Nature Conservation Act 1992 to declare interim conservation orders to prevent habitat destruction	1
	All trees protected by local council by-laws	1

(Number of plans refers to the number of plans that have this action written in the work plan, further detail on specific plans can be found in the matrix located in Appendix 13).

Two plans (no. 4 and 5) mention the establishment of permanent heritage-style agreements with landholders in order to support populations of threatened species (these landholders could include indigenous communities). Since illegal killing is a problem in the recovery of the Muir's Corella (no.6), there is an action in the work plan which states that all reports of illegal killing will be investigated by DEC Wildlife Officers and offenders will be prosecuted where sufficient evidence can be obtained (Chapman & Cale, 2008).

4.5 Australian case study management plans

Three species have been chosen for an in-depth analysis of their management plans, a bird, a reptile and a plant. Their plans were chosen because they represent species which face similar threats to the New Zealand species, such as loss of suitable habitat, predation and competition. All three species are currently classified as either Threatened or Endangered under the EPBC Act 1999, and are actively being researched and surveyed to determine population trends. All three plans were published by the Victorian Government, Department of Sustainability and Environment (DSE) Melbourne. The three species are the Helmeted Honeyeater (*Lichenostomus melanops cassidix*) (2008), the Striped Legless Lizard (*Delma impar*) (2010) and Aniseed Boronia (*Boronia galbraithiae*) (2006).

4.5.1 Helmeted Honeyeater (Lichenostomus melanops cassidix)

The Helmeted Honeyeater (*Lichenostomus melanops cassidix*) is listed as Endangered under the Commonwealth EPBC Act 1999 and Threatened in Schedule 2 of Victoria's *Flora and Fauna Guarantee Act 1988*. This is because the population comprises about 20 breeding pairs and their recent offspring. Fourteen breeding pairs inhabit the Yellingbo Nature Conservation Reserve (NCR) with a small re-introduced colony of 23 individuals, including six breeding pairs, at a site in Bunyip State Park. There are also currently 15 pairs held in captivity at two locations Healesville Sanctuary (18km north of Yellingbo) and Taronga Zoo.

The Helmeted Honeyeater is one of Victoria's best-known vertebrates, and has been a focus of the wildlife conservation movement in Victoria since the early 1900s. The third recovery plan (2008) for the Helmeted Honeyeater continues the emphasis on population management, particularly the establishment of new colonies in unoccupied habitat, but also refocuses attention on some habitat rehabilitation issues. The long term goal for the species is:

> "To achieve a sTable population of at least 1000 individuals in at least ten separate but interconnected colonies dispersed along several creek systems in the mid-Yarra and Western Port catchments, and thus have the taxon removed from Schedule 2 of the Environment Protection and Biodiversity Conservation Act 1999." (Menkhorst, 2008, pg7)

Management in previous plans has included: monitoring of breeding attempts; protection of nests from predators; establishment of new wild populations via release of captive-bred birds; supplementation of wild populations with captive-reared birds; and, minimisation of the risk of in-breeding via the swapping of eggs or nestlings between populations. Whilst the management of the species habitat has focused on: controlling erosion and re-instituting a natural flood regime on the flood plain of the Cockatoo Creek within Yellingbo National Conservation Reserve; and, reducing silt deposition on the flood plain, in order to preserve this critical habitat for optimal breeding success. The objectives of this recovery plan are to:

1. Increase the number and size of wild populations;
2. Maintain and enhance the value of Helmeted Honeyeater habitat;
3. Improve the management of stream flows, water quality and riparian environments throughout the Woori Yallock Creek catchment;

4. Manage the captive population of Helmeted Honeyeaters to provide insurance against the demise of the wild population and to meet the needs of the recovery program;
5. Maintain the genetic diversity and evolutionary potential of the Helmeted Honeyeater;
6. Improve public awareness of the Helmeted Honeyeater recovery program and public support for implementation of this recovery plan; and,
7. Effectively administer the recovery effort to ensure that recovery plan objectives are met (Menkhorst, 2008, pg7-8).

Each objective has a series of performance criteria which will be used to assess when the objective has been successfully carried out, and a number of actions in which to achieve the objective (for example Objective 4, Table 44).

The recovery plan details how actions in the plan will affect indigenous communities (because part of the habitat of the bird lies within the traditional lands of the Wurundjeri-balluk clan), as well as the social and economic impacts of recovery efforts on the community (which is minimal because most of the habitat lies within Crown owned land conservation reserves). The recovery plan mentions that any affected communities will be advised and consulted with by the relevant Victorian Government Department of Sustainability and Environment, Regional Indigenous Facilitator. Indigenous communities will also be invited to be involved in the implementation of the species recovery plan.

Table 44. Example of performance criteria and actions for Objective 4 outlined in the work plan of the Helmeted Honeyeater (*Lichenostomus melanops cassidix*) recovery plan.

Objective	Performance Criteria	Actions
4. Manage the captive population of Helmeted Honeyeaters to provide insurance against the demise of the wild population and to meet the needs of the recovery program	i. Maintenance of a viable population to the standards of a Category 1 species under the Australian Species Management Program. ii. Production of at least 15 young per year that are available for release. iii. Maintain 95% of the wild heterozygosity in the captive population.	4.1 Maintain the captive population at a minimum of 15 breeding pairs with a suiTable age and sex structure to allow adequate recruitment into the breeding population. 4.2 Investigate causes of low breeding success in captivity. 4.3 Review the contingency pln for emergency evacuation of birds from Healesville Sanctuary. 4.4 Review and update the captive husbandry manual.

Source: National Recovery Plan for the Helmeted Honeyeater (*Lichenostomus melanops cassidix*) (Menkhorst, 2008, pg10).

There is also an estimated budget of how much the recovery programme will cost over the five years of this recovery plan (AU$2.44 million) (Table 45).

Table 45. Estimated cost of the Helmeted Honeyeater recovery program over five years (AU$).

Year	**1**	**2**	**3**	**4**	**5**	**Total**
Totals	$449,500	$555,500	$495,500	$514,500	$425,500	$2,443,500

Source: National Recovery Plan for the Helmeted Honeyeater (*Lichenostomus melanops cassidix*) (Menkhorst, 2008, pg12).

4.5.2 Striped Legless Lizard (Delma impar)

The Striped Legless Lizard (*Delma impar*) is a member of the family Pygopodidae, the legless or flap-footed lizards. Superficially, these animals resemble snakes, but can be readily distinguished from the latter by the presence of external ear openings, a fleshy undivided tongue and a tail which, when unbroken, is longer than the body. The species is patchily distributed in grasslands of south-eastern New South Wales, the Australian Capital Territories, north-eastern, central and south-western Victoria, and south-eastern South Australia. It is believed to have declined throughout its distribution and is known to have disappeared from many sites as a result of habitat degradation and destruction (approximately 99.5 percent of natural temperate grassland has been destroyed or drastically altered since European settlement) (Robertson & Smith, 2010). Adults have successfully been held in captivity for twelve years. The species is listed as Vulnerable under the Commonwealth EPBC Act 1999; Vulnerable in NSW and ACT; Threatened in Victoria and Endangered in South Australia. Two recovery plans have been published for the species. The long term goal of the second recovery plan is to "ensure the long-term survival of *D. impar* and maintain its potential for evolutionary development in the wild across its natural geographic range" (Robertson & Smith, 2010, pg22).

Recovery efforts for the species to date have included: the coordination and communication of research and recovery actions; population viability analysis; surveys and ongoing monitoring of populations; breeding in captive breeding facilities (Zoos Victoria); and, raising awareness of the management of the species in the community (through public talks, school visits and fact sheets).

To achieve the long term goal and expand upon research and management already carried out on the species the plan outlines the following objectives:

1. Establish and maintain national forums for the discussion and organisation of the conservation of *D. impar* across its natural distribution;
2. Determine the distribution of potential *D. impar* habitat;
3. Determine the current distribution and abundance of *D. impar* in Victoria, New South Wales, the Australian Capital Territory and South Australia;
4. Establish a series of reserves and other managed areas such that viable populations are maintained across the known distribution of the species;
5. Determine the habitat use and ecological requirements of *D. impar;*
6. Identify the nature and extent of the threatening processes affecting *D. impar;*
7. Undertake a program of research and monitoring to provide a basis for adaptive management of *D. impar;*
8. Increase community awareness and involve the community in aspects of the recovery program;
9. Assess the need for salvage and translocation, determine their feasibilities, develop protocols and undertake a trial translocation if appropriate; and,
10. Ensure that captive population(s) are used to support education and research elements of the Recovery Plan (Robertson & Smith, 2010, pg22).

Most of these objectives revolve around a need for further research to be carried out on the species, such as encouraging tertiary institutions to participate in coordinated research on habitat, life history and threats. There is also a lot of emphasis on involving the community more in recovery planning such as liaising with grassland managers and developing management guidelines for landholders responsible for off-reserve land which supports populations of the Striped Legless Lizard. That is because in the ACT, the Ngunnawal people are the traditional users of the native grasslands that are habitat for Striped Legless Lizard. In NSW the indigenous communities living in the regions affected by this plan have not yet been identified; whereas in Victoria there are three different subgroups which share habitat with Striped Legless Lizard populations. The Victorian Government has developed an Indigenous Partnership Strategy and is preparing Regional Indigenous Action Plans (RIAP) which includes actions to consult with indigenous communities on land management and threatened species programmes (Robertson & Smith, 2010). Regardless of the State,

implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region.

The recovery plan also mentions that the benefits of constituting a single recovery team for threatened grassland vertebrates, such as the Striped Legless Lizard and Grassland Earless Dragon (*Tympanocryptis pinguicolla*) should be examined in the future, to ensure adequate funding is supplied to all reptile species currently threatened with extinction throughout the country. The recovery plan includes an estimate of the costs associated with each action over the five year time frame of the plan (Table 46).

Table 46. Estimated costs of some work plan actions in the five year Striped Legless Lizard (*Delma impar*) recovery plan (AU$).

Action No.	**Action**	**Estimated Cost Year 1-5 ($1000)**
c.9.1	**Specific Recovery Objective – Recovery Coordination**	
c.9.1.1	Maintain the National Recovery Team and regional working groups	150
c.9.1.2	Review performance of Recovery plan annually	10
c.9.1.3	Establish coordinated databases for each State or Territory agency	15
c.9.1.4	Encourage tertiary institutions to participate in a coordinated research effort for *D.impar*	5
c.9.1.5	Determine interim management guidelines for *D.impar* habitat	-
c.9.1.6	Determine minimum survey requirements for *D.impar*	-

Source: National Recovery Plan for the Striped Legless Lizard (*Delma impar*) (Robertson & Smith, 2010, pg37).

4.5.3 Aniseed Boronia (Boronia galbraithiae)

The Aniseed Boronia (*Boronia galbraithiae*) is listed as Vulnerable under the Commonwealth EPBC Act 1999 and is listed as Threatened under the Victorian Flora and Fauna Guarantee Act 1988. Aniseed Boronia is endemic to Victoria, where it is confined to elevated, tall open forest sites between Stockdale and Dargo in central Gippsland. About 3,000 plants occur in three populations over a total range of only about 5 km. Potential threats to these populations include logging activities, roadworks and altered fire regimes. The long term goal for the species is "to minimise the probability of extinction of *Boronia galbraithiae* in the wild and to increase the probability of important populations becoming self-sustaining in the long term" (Carter & Walsh, 2006, pg5).

The national recovery plan for Aniseed Boronia details the species distribution and biology, threats, and recovery objectives and actions necessary to ensure its long term survival. To date, and throughout the duration of this plan, recovery measures have included habitat conservation, restoration and management, combined with an understanding of the species ecological and biological requirements. To achieve these measures, the following objectives were written:

1. Acquire accurate information for conservation status assessments.
2. Identify habitat that is critical, common or potential.
3. Ensure that all populations and their habitat are protected and managed appropriately.
4. Manage threats to populations.
5. Identify key biological functions.
6. Determine the growth rates and viability of populations.
7. Establish populations in cultivation.
8. Undertake community education and information (Carter & Walsh, 2006, pg5).

A Threatened Flora Recovery Team, consisting of scientists, land managers and field naturalists will be established to oversee threatened flora recovery in Victoria in general, as well as oversee the recovery of this species. Whilst specialist subcommittees will advise on research, *in situ* management, community education and cultivation practises.
Regional recovery teams will be responsible for preparing work plans and monitoring progress toward recovery. Recovery management will aim to mitigate threatening processes (i.e. accidental destruction and inappropriate fire regimes) to prevent declines and create conditions for maintenance or increase of population size. Strategies necessary to alleviate these threats include zoning, fire management and fencing or signposting. In addition, some *ex situ* conservation measures including seed storage and germination trails, will be required (Carter & Walsh, 2006).

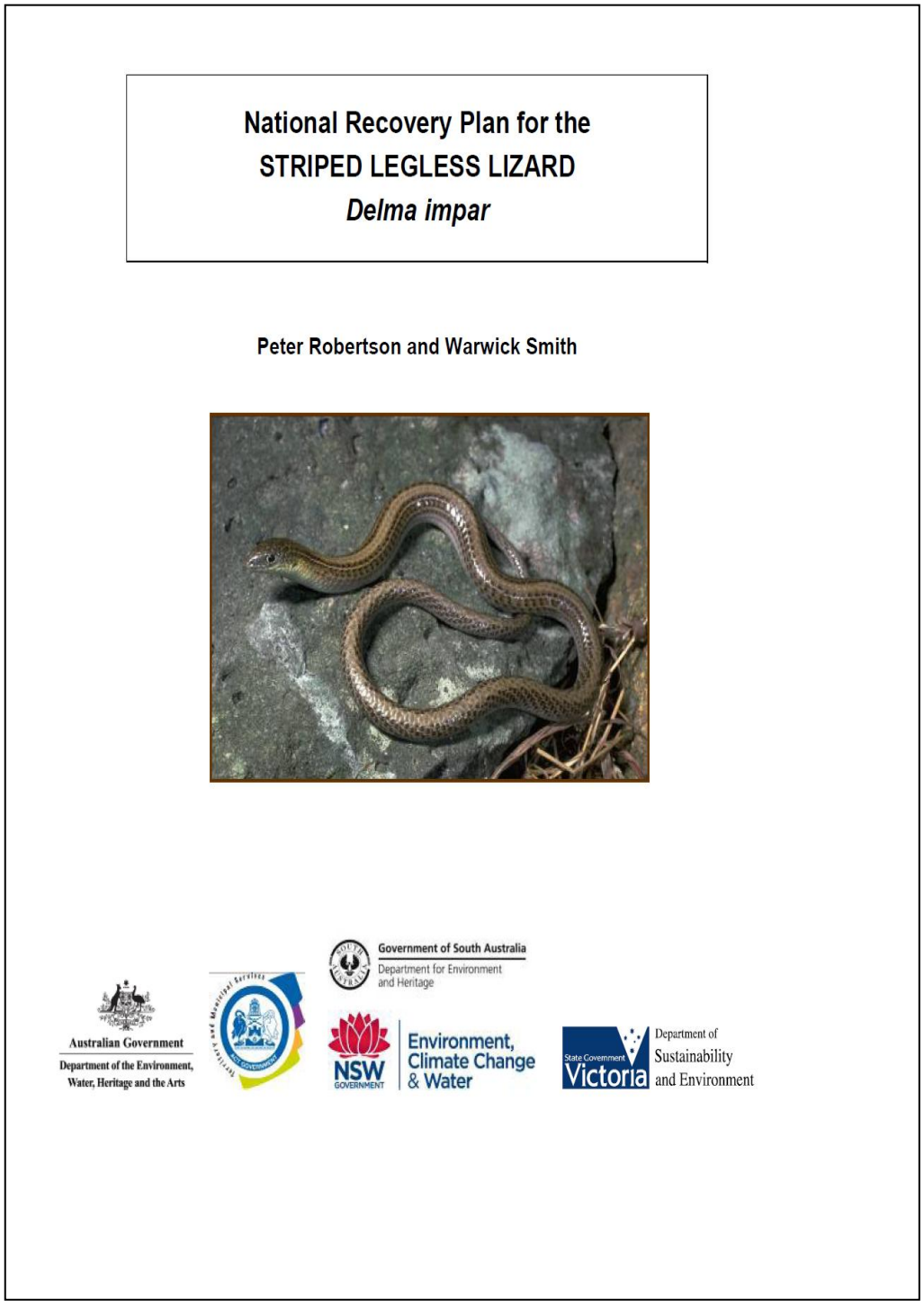
Community involvement is seen as necessary for the long term survival of the species, because providing information to land managers and the broader community in the region will increase awareness of the species, provide for increased protection of existing populations, increase the likelihood of new populations being found, and will reduce the risk of inadvertent damage occurring. The plan also provides an estimate of the costs incurred over the five-year term of this plan for each objective (Table 47).

Table 47. Priority, feasibility and estimated costs associated with some of the recovery actions outlined in the Aniseed Boronia (*Boronia galbraithiae*) recovery plan.

Action	Description	Priority	Feasibility	Responsibility	Cost Estimate (year)					
					1	2	3	4	5	Total
1. Conservation status										
1.1	Collect baseline data	1	100%	DSE	$6,000	$0	$0	$0	$0	$6,000
2. Habitat requirements										
2.1	Survey known habitat	1	100%	DSE	$10,000	$0	$0	$0	$0	$10,000
2.2	Identify, survey potential habitat	1	75%	DSE	$10,000	$0	$0	$0	$0	$10,000
3. Protection of habitat										
3.1	Protect public land habitat	1	75%	DSE	$0	$10,000	$0	$0	$0	$10,000

DSE=Victorian Government, Department of Sustainability and Environment
Source: National Recovery Plan for the Aniseed Boronia (*Boronia galbraithiae*) (Carter & Walsh, 2006, pg10).

Chapter 5. Discussion



Source: National Recovery Plan for the Striped Legless Lizard (*Delma impar*) (Robertson & Smith, 2010).

5.1 Introduction

Recovery plans should state what must be done to protect and restore populations of threatened species and habitat, as well as how to manage and reduce threatening processes (DEWHA, 2009d). Between 1991 and 2009, DOC published 61 individually tailored species recovery plans for 50 different species. Analysis of these plans has highlighted gaps in many of the chapters where ideas and strategies are missing from the plans (some of these gaps have been outlined in red in the matrix in Appendix 9 and are commented on in the rest of this chapter). These gaps highlight a lack of knowledge about particular threats and management techniques which could be indicative of a lack of reporting of successful strategies and research into threatened species recovery in New Zealand. Even an excellent plan must be implemented well. Therefore, it is important that plans be defined as clearly as possible and that a critical review of performance along with the implementation process be carried out (Miller *et al.*, 1994; Boersma *et al.*, 2001).

This chapter reviews the performance of different chapters in New Zealand and Australian threatened species recovery plans based on the analysis in the 'Results' chapter. Chapters have been ranked according to strong, poor or weak performance in order to highlight areas in recovery planning which need to be examined both now and in the future. Highlighting potential strengths and weaknesses of New Zealand and Australian plans should indicate areas in which more resources (such as funding and personnel) are needed. It also signifies that recovery plan reviews are long overdue and suggestions outlined in this chapter could be used by DOC to create and implement more concise and effective recovery plans in the future.

A flow diagram (Figure 5) was created modelled on Alexander's, 2008 (pg 17) template outlined in the 'Literature Review' (Figure 2, pg28). The diagram was redrawn in order to reflect my interpretation of how chapters in the New Zealand recovery plans should interrelate, and how removing a chapter can disrupt the formulation of strategy. A coloured flow diagram (Figure 6) appears in the evaluation of New Zealand planning, as it provides a clear summary of how each chapter in the matrix (Appendix 9) has been ranked for performance. This 'Discussion' chapter follows the list of chapters outlined in the flow diagram (Figure 5), with the exception of the 'Legislation and policy' box (which is analysed in *5.2.2 Legislation and policy*) and the 'Advocacy/public awareness/cultural

importance/stakeholders' box (these headings are commented on separately in the *5.2.3 Community involvement in endangered species recovery* chapter).

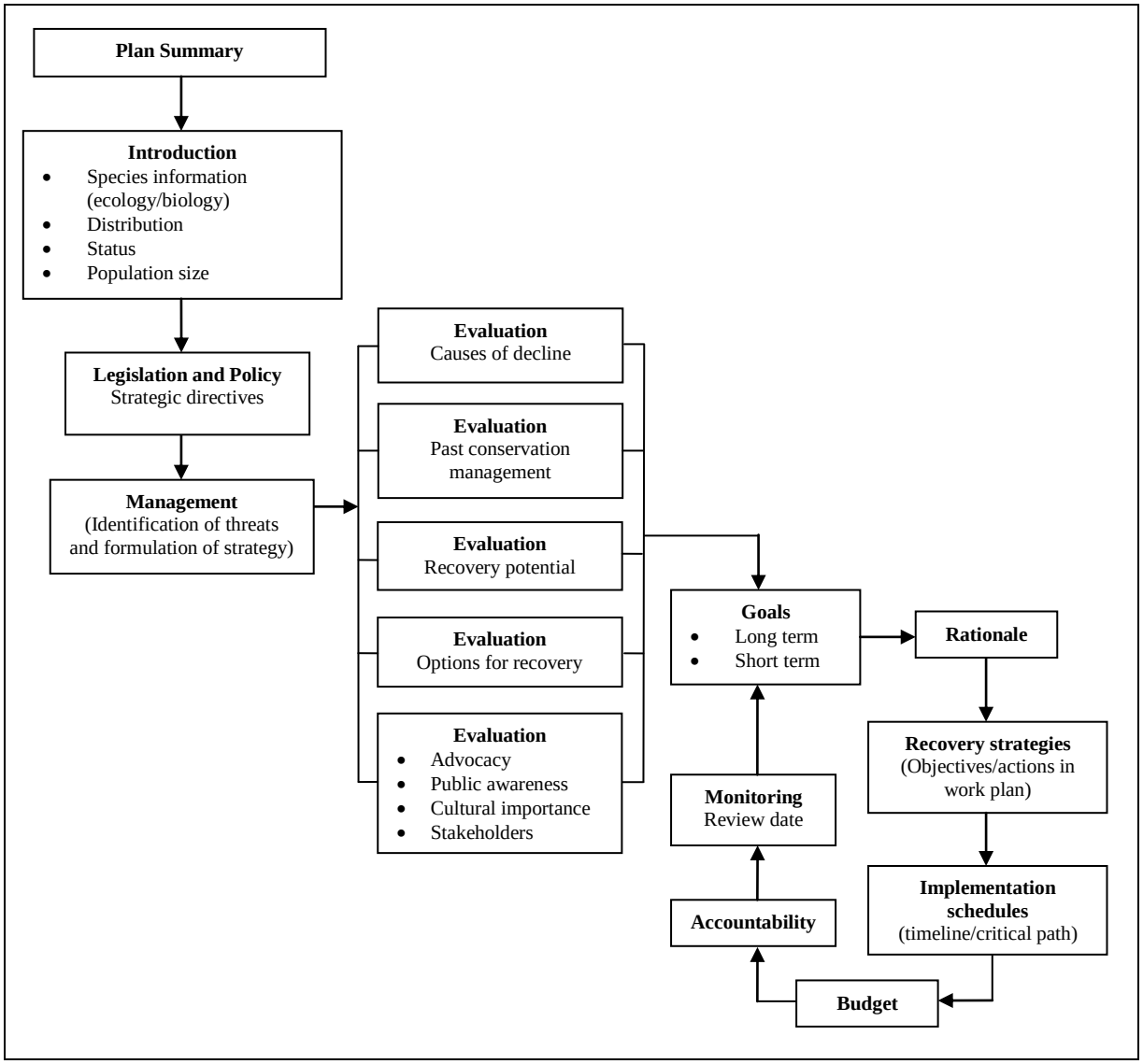


Figure 5. Flow diagram outlining how chapters relate to each other in New Zealand recovery plans (based on Figure 4 'Methodology' chapter pg 53, which has been adapted from Alexander, 2008, pg17).

5.2 Management of endangered species

Common occurring difficulties in threatened species recovery planning include slow decision making; decisions made without input from experts outside the organisation; failure to develop recovery plans with concise objectives that can be used to clearly evaluate progress towards the goal; and impeding effective action due to an overly complex organisational hierarchy (Miller *et al.*, 1994; Brigham, Power, Hunter, 2002; Schultz & Gerber, 2002). Similar advantages and disadvantages will appear in recovery programs with a similar design regardless of the endangered species (Alexander, 2008). Selecting the best set of management strategies to ensure the persistence of the greatest number of a nation's threatened species is a

complex and challenging problem (Bowles & Whelan, 1994). This is because it is not a simple task to know which set of management actions will provide the best overall conservation outcome. Especially when a country such as New Zealand, is presented with a vast number of species with complex ecologies, extreme management uncertainties and financial constraints (Clout, 2001). One way to address these issues is to develop and implement comprehensive management plans for threatened species and ecosystems in conjunction with relevant legislation and by eliciting the support of the community in carrying out management actions.

5.2.1 The identification of threats and formulation of strategy

Distribution, status and the ecology and biology of the threatened species have been documented in most of the plans and provide useful background information to any reader not familiar with these endemic species, or with how species management works in New Zealand and Australia. Forty-two New Zealand plans and nine of the 12 Australian plans contain distribution maps which show the present distribution of the species throughout the country. Having a map of the country and offshore islands where the species lives and recovery has taken place, gives the reader a sense of what threatened species recovery is occurring on their doorstep and may prompt them to get more involved in local conservation work.

5.2.1.1 Causes of decline

In New Zealand, the primary threat to the survival of our endemic species has been identified as the introduction of predators (56 plans, Table 10). Before predators such as Stoats and Possums were introduced, only birds of prey such as the Haast Eagle (*Harpagornis moorei*) (now extinct), New Zealand Falcon (*Falco novaeseelandiae*) and owl species such as the Morepork (*Ninox novaeseelandiae*) preyed upon native birds and reptiles. As a result, many of our bird species became flightless and are defenceless against introduced predators when young (Robertson, 2003). Predation by Cats and Dogs also threaten the survival of vulnerable bird and reptile species in seven Australian plans. Whilst grazing by domestic stock (either of the threatened species or those species relied upon) contributes to a decline in species numbers in eight of the plans (Table 32).

Fifty-one of New Zealand's recovery plans list habitat loss due to degradation, fragmentation and modification as a cause of decline and threat to the future survival of the species. For species such as the Takahe (no.12 & 61), habitat deterioration caused by high numbers of

introduced Red Deer (*Cervus elaphus*) has been the main threat to the species survival in Fiordland (Wickes *et al.*, 2009). Australia has also suffered from land clearance pressures and a significant modification of the natural environment (Olsen *et al.*, 2006). Ten out of the 12 Australian recovery plans studied list habitat degradation as the primary reason for a decline in numbers, followed by habitat loss (8 plans). For the Striped Legless Lizard (no.10), the degradation of approximately 99.5 percent of natural temperate grassland has meant that the species is now only patchily distributed throughout south-eastern Australian states and exact population numbers are hard to quantify (Robertson & Smith, 2010). For both of these species suitable habitat is severely limited. Therefore, restoring habitat will need to be included as a necessary component of recovery efforts, to ensure that recovered populations can be large enough to be viable (Tear, Scott, Hayward, Griffith, 1993).

Introduced competitors such as rats and non-native bird species have also had an impact on our threatened species (25 plans) because they compete for food, nesting sites and territories which have all become scarce as agriculture and urban development has changed the landscape of the country (Duffey, 2001). Whilst introduced pests have played an important role in reducing the numbers of native flora to threatened status. Possums have been credited with causing the decline in *Dactylanthus taylorii* populations because they eat the flowers, which limits seed production and therefore the production of the next generation (La Cock *et al.*, 2005). Three of the Australian plans mention competition and six list increasing pressure from introduced weeds as a factor in their threatened status. The invasion of non-native weed species is a constantly increasing pressure on vulnerable ecological communities (Meredith, 1993), because weeds are able to survive in fragmented or degraded environments which are unsuitable for native species (New, 2000).

The increase in the frequency and types of disease (15 plans, Table 10) and environmental events (such as floods, drought and fires) could be due to a fluctuating climate. These factors may play an important role in determining population sizes of threatened species in New Zealand and Australia in the future, especially when there are only a few individuals in a population. Changes in temperature have been linked to the increase in weed and pest species in Australia, because non-native introduced species are able to adapt to changing conditions quicker than native species (Sattler & Creighton, 2002c). The Helmeted Honeyeater (no.8) is heavily dependent on dense riparian vegetation dominated by Mountain Swamp Gum (*Eucalyptus camphora*) which needs a high and dependable rainfall. Die-off of stands of

Eucalypts has reduced the area of one important breeding colony by 50 percent (Menkhorst, 2008), and there is no way of knowing what effect long term changes in rainfall or drought events will have on the survival of this and other threatened species of bird. Changes to the fire regime (9 plans, Table 32) and increasing numbers of wildfires represent a significant threat to a number of Australia's threatened species. Such as the Minnie Daisy (no.11) and Slater's Skink (no.12) which face inappropriate fire regimes in order to control the introduced pest species Buffel Grass (Pavey, 2004; Nano & Pavey, 2008). Without effective action, populations of these species move closer to extinction and any delays in implementing recovery plan actions will make recovery of these species more challenging.

It is only in the past ten years as DNA sequencing has become more advanced that effects such as genetic variation, genetic drift and hybridisation have become more apparent in small populations (Elliot, Merton, Jansen, 2001; Lawler *et al.*, 2002). In the New Zealand plans, genetic variation/drift and hybridisation are mentioned in only six plans; whilst in the Australian plans, inbreeding depression is mentioned in three plans and hybridisation appears in two. Together with the loss of associated animal species (2 plans) and recruitment failure of single sex populations (1 plan) these causes of decline are mentioned in less than ten New Zealand plans, even though it is believed they have contributed to the slow recovery of threatened species in this country (Moran, 2008). No plans since that of the Forbes Parakeet (*Cyanoramphus auriceps forbesi*) and Chatham Island Red-crowned Parakeet (*Cyanoramphus novaezelandiae chathamensis*) (no.45, approved in 2001) mention the influence genetics may play on the long term survival of these species. For species such as the Hihi (no.54), careful breeding means birds now exist on Tiritiri Matangi and Kapiti Islands as well as at Pukaka Mount Bruce National Wildlife Centre, yet there is no mention of the risk of genetic hybridisation or inbreeding in the future because of small population sizes.

Due to the focus on predation and habitat loss which are short term threats (but which can be managed by DOC today with resources such as poison, trapping and fencing), rather than long term threats such as climate change, disease and genetic variation, this chapter in the New Zealand recovery plans is deemed weak. Recovery plans written in the future should place more emphasis on research into future causes of decline. This is because recovery plans are supposed to mitigate and implement recovery strategies throughout the lifespan of the plan, which tends to be for a period of ten to 50 years.

5.2.1.2 Past conservation management

Previous management strategies for New Zealand's threatened species have focused on the management of predators (24 plans) and habitat (24 plans, Table 11) in direct response to the primary threats and causes of decline (Table 10). By restoring and protecting critical habitat and controlling predator numbers, DOC has been able to provide an environment for some species, such as the Kiwi, which is conducive to successful breeding (Holzapfel *et al*., 2008). Only 11 of the plans make no mention of whether or not the species has been managed prior to this plan (such as no.14-18, outlined in red Appendix 9). In Australia, previous management strategies have focused on surveys (9 plans) and the monitoring of populations (8 plans, Table 33). Many of these species are already intensively managed in their respective states, and recovery under these national plans has only occurred since 2000.

All of the past conservation actions in the New Zealand plans appear in less than 24 of the plans. This chapter performs poorly in New Zealand's recovery plans due to the wide variety and lack of consistency in past conservation management. A number of different recovery actions have been carried out over the years even though proven strategies such as the breeding and translocation of endangered species to offshore islands has proven to be effective. Offshore islands that have remained free of introduced predators have been invaluable for the survival of many of New Zealand's most threatened species, such as the Kakapo and Hihi. However, habitat limitations mean that many threatened species (e.g. native plants like *Dactylanthus*) are unsuitable for translocation to offshore islands (Elliot *et al.*, 2001; Cullen *et al.*, 2005). DOC is also facing the problem of overcrowding of particular species on offshore islands and unless species are moved to other less crowded islands, or back to the mainland, inbreeding will occur in populations directly disadvantaged by being small (Wickes *et al*., 2009). Translocation appears in four of the Australian plans studied (no.3,6,8 and 10, Table 33) and it is hoped that lessons learnt by DOC would be used by Parks and Wildlife Service staff to successfully move populations of Helmeted Honeyeater (no.8) and Striped Legless Lizard (no.10) in the future.

5.2.1.3 Recovery potential

There are two chapters in the New Zealand plans which do not appear in any of the Australian plans, the 'recovery potential' of the species and 'options for recovery 'of the species (Appendix 9). Until 2001, 21 recovery plans contained a chapter which addressed the perceived recovery potential of the species, if appropriate management actions are carried out

(Table 12). It is unclear if plans no.33-61 which are missing this chapter (the chapter reappears in plan no.52, Grassy Plants of fertile sites, outlined in red Appendix 9) are thought to be unable to recover even with effective management, or whether or not the restructuring of departments within DOC during this time (recovery plans switch from being published by the threatened species unit to the science and technical publishing team) meant the chapter was deemed redundant and removed from all subsequent plans. Hopefully the chapter was not omitted because it was discovered that these species (in particular plans no.36-46 which are all species located in the Chatham Islands) would never be able to recover sufficient numbers and would therefore be a waste of valuable resources (i.e. time, money and personnel).

5.2.1.4 Options for recovery

The option for recovery chapter implies that the actions in the work plans of these species are necessary in order to maintain the status quo and prevent species populations from declining in number. Most plans (40 plans, Table 13) agree that not managing the species in any way will potentially result in the species becoming extinct in a number of years. Since plans no.20-23 are missing this chapter (outlined in red Appendix 9) and most of the options appear in less than half of the plans, this chapter poorly represents the wide variety of recovery strategies available to DOC. The results of a study by Bottrill, Walsh, Watson, Joseph, Ortega-Argueta and Possingham (2011) suggest that in the absence of a recovery plan, conservation actions can still occur. However, maintaining habitat and securing and establishing new populations are management tools preferred by DOC, and doing nothing would not lead to improved security for many of our threatened species so has been rejected on this basis for species such as the Hihi (Taylor *et al*., 2005).

5.2.1.5 Recovery strategies

Both the New Zealand and Australian recovery plans analysed contain numerous objectives and actions in their work plans which aim to effectively manage and restore populations of threatened species. The most frequently mentioned objective or action in all the plans is that of advocacy in the community (53 New Zealand plans, all 12 Australian plans). Advocacy in the community is important because it will increase public awareness of the conservation status of our threatened species and will involve the wider community (such as landholders, local and state government agencies and public authorities) in the recovery program of the species (all objectives and actions which relate to advocacy have been separately analysed and are discussed in *5.2.3 Community involvement in endangered species recovery*)

The long-term monitoring of populations (37 plans) has enabled DOC to revise recovery plans for ten New Zealand species (Table 8). Of these ten, five (North Island Kokako, Kiwi, Hihi, New Zealand Fairy Tern and the New Zealand Dotterel) include a chapter or Appendix which outlines the achievements and progress made for objectives, tasks and actions written in the previous plan. As part of adaptive management, all recovery plans should be periodically reviewed and the results of any previous management should be reported in the plan and critically analysed (Foin *et al.*, 1998). Out of these five, the New Zealand Dotterel (*Charadrius obscurus*) plan (no.58) is the most comprehensive because it mentions if the objective has been achieved or not, and includes additional comments which outline how or why not. The revised *Dactylanthus* plan (no.56) is the most systematic plan out of the ten because it replaces the original five objectives with 16 topics and 26 objectives. This gives a great indication of the amount of research which has been carried out on the species, which means that progress in the recovery of the species is definitively taking place.

Long term monitoring has also enabled DOC to measure the success of management strategies such as the translocation of individuals and populations to predator and pest free offshore islands. Translocating and actively managing species on offshore islands (33 plans), maintaining the habitat on these islands (33 plans), and creating 'insurance populations' in captivity (32 plans) are strategies which have been used with varying success for a number of different bird species as well as Tuatara. It is thought that without implementing this strategy, populations of endangered species such as the Kakapo and Black Robin could have become extinct already, and it is hoped that this strategy will work successfully in the future for other species such as Weka (*Gallirallus australis*) (no.29) and *Oligosoma* Skinks (no.48).

Since many of the Australian plans are first editions, surveying to establish distribution, population numbers and new populations (10 plans), as well as undertaking research and scientific studies on the species (10 plans), are the most commonly mentioned objectives and actions in the work plans (Table 34). At the moment, not enough is known about the biology and ecology of many of Australia's threatened species, so carrying out surveys and banding or tagging in order to calculate population density, are important first steps for species such as the Blue Mountain Water Skink (no.1) and Black-throated Finch (no.2) (Ashworth & Tuckey, 2001; Black-throated Finch recovery team, 2007). A large proportion of species with plans are improving as a result of increased survey effort (Bottrill *et al*., 2011). Perhaps one

outcome of creating recovery plans is that people are now aware of what the species looks like and therefore more likely to look for that endangered species and report its location.

5.2.1.6 Implementation schedule

Roughly half of the New Zealand plans (35 plans) and six out of the 12 studied Australian plans are lacking a timeline or implementation schedule for the work plan. A timeline or schedule which outlines a month or year in which each objective should be achieved by or implemented in, is an important tool to make sure that the recovery of a species is on track (Alexander, 2008). It also means that those responsible for an objective could be held accountable if they do not meet a deadline. Most New Zealand plans (53 plans, Table 17) and ten of the Australian plans mention who is responsible for carrying out a particular objective or action (i.e. recovery group, programme manager or community relations staff). Including this in the work plan in an implementation schedule is a strong indicator (for anyone reading the plan) of milestones for particular recovery objectives or actions, and highlights who to contact with suggestions or help.

5.2.1.7 Budget

Globally, agencies tasked with the challenge of managing a threatened species strive to achieve the most with their limited budgets (Taylor, 2005). Currently, resources marked for threatened species are allocated simply to the most threatened species first (Possingham *et al*. 2002). Only 15 New Zealand recovery plans written between 1991 and 1996 contain a budget or estimates of the costs associated with carrying out the objectives in the work plan (e.g. Table 16, outlined in red Appendix 9) and only two plans contain 'increasing funding support for the programme' as an objective in the work plan (no.59 and 61, outlined in red Appendix 9). In the Tuatara recovery plan (no.9) the approximate costs incurred by each conservancy carrying out the work plan are estimated, along with suggestions for additional funding. This changes with the revised plan, as no mention of costs or budgetary information is written in the second Tuatara recovery plan (no.47). In comparison, all 12 of the Australian recovery plans analysed contain budget information for the timeframe of the plan, which increases accountability of spending on a particular species or recovery action (Appendix 12). This information is present either as a breakdown per year of how much the recovery will cost; what the money will be spent on (i.e. employment, vehicles, breeding); the costs associated with each objective; or an overall figure of how much the recovery effort is expected to cost during the lifetime of the plan (either five or ten years) (e.g. Table 37, Angle-stemmed Myrtle recovery plan, no.3).

A recovery plan by definition is "a comprehensive plan that details, schedules and costs all actions, including research, necessary to support the recovery of a species or ecological community" (New, 2000, pg149). Having a budget or estimated cost information in a plan gives the reader an idea of how much the recovery for a particular species will cost the region, state or country in years to come. Many recovery programs are already impaired by insufficient funding for research and management, making efficiency important (Miller *et al.*, 1994; Fairburn, Hughey, Cullen, 2004; Joseph *et al.*, 2009). Therefore, it would make sense to outline how the budget for a species will be distributed and where funding shortfalls could occur in recovery planning documents.

5.2.1.8 Accountability

Most New Zealand plans (53 plans) and ten Australian plans mention who is accountable for carrying out particular objectives or actions in the work plans of the recovery plan (i.e. recovery group, programme manager or community relations staff). Approximately one-third of recovery plans in the United States are written solely by federal government employees and one-third of plans include authors with university affiliations (Clark *et al.*, 1994; Gerber & Schultz, 2001). Most of the recovery plans reviewed were written by DOC or Parks and Wildlife staff in collaboration with independent researchers and experts in the species biology (e.g. Isabel Castro who is a university researcher that helped to write the revised Hihi recovery plan, no.54). Having authors from a variety of different backgrounds is important because it is likely to strengthen the recovery planning process, and ensures that biological information in the plans is current and relevant (Gerber & Schultz, 2001; Clark *et al.*, 2002).

5.2.1.9 Monitoring

Most New Zealand plans mention what priority objectives and actions in the work plan are (either medium, high or essential), and when the action should be carried out (i.e. within three years of the plans commencement), such as in the New Zealand Dotterel recovery plan (no.58, Table 15). A study by Brigham *et al.* (2002) found that recovery plans are effectively maintaining a consistent focus in their recommendations for endangered species recovery, with the exception of monitoring. Monitoring of objectives is often not considered in the recovery process because it does not directly benefit the species in terms of increased abundance that other recovery efforts do (i.e. threat mitigation or captive breeding) (Campbell, Clark, Crampton, Guerry, Hatch, Hosseini, Lawler, O'Connor, 2002). All of the Australian plans have 'Performance criteria' for each objective in the work plan (Table 35, Appendix 12). These criteria outline how an objective or action can be monitored to see if it

has been implemented successfully or not, which serves to increase accountability of resource use. Monitoring of populations (10 plans), actively involving the community in a species recovery (8 plans) and increasing the number of individuals (i.e. through captive breeding, 7 plans) are all actions which can indicate whether or not recovery efforts are working. Performance criteria usually appear in implementation schedules or next to objectives in the work plan and therefore only appear in some New Zealand plans, such as that of the Hihi (no.54).

It is difficult to determine the reason why the review timeframes for recovery plans do not appear to be working. Recovery plans are supposed to organise, prioritise and guide the recovery process (Foin *et al.*, 1998; Boersma *et al.*, 2001). All nine Australian plans with a review date state that a review of the plan should take place five years after it comes into force. As of yet, only the Helmeted Honeyeater (no.8) and Striped Legless Lizard (no.10) plans have been reviewed and a second plan written. Several recovery plans in New Zealand have expired, such as the South Island Saddleback (*Philesturnus carunculatus carunculatus*) recovery plan (no.11), which was published in 1994 and expired in 1999, even though the long term goal is "to maintain and enhance existing populations....through the establishment of up to 12 new populations by the year 2020" (Roberts, 1994, pg10). A recovery group has been formed to oversee the recovery of the species, yet they are not being held accountable for revising the recovery planning for the species and data and information about the species is limited in journals and online.

5.2.2 Legislation and policy

One of the aims of the New Zealand Biodiversity Strategy is to "maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain their genetic diversity" (MfE, 2000, pg4). Species are to be preserved for their own sake, for their role in indigenous ecosystems, to meet public expectations and to help maintain options for current and future New Zealanders (MfE, 2000). Twelve plans contain objectives or actions which outline the need for statutory protection such as legislation, regulations, rules, incentives or policies to address threats or causes of decline for these threatened species. Of note, the last plan to be published (no.61, Takahe) makes no mention of any kind of statutory protection for the species or its habitat. Only seven plans (no. 50, 52, 57-61, Appendix 9) since 2003 have outlined whether or not the plan meets the strategic directives of the Biodiversity Strategy. For example, the Kiwi plan (no.60) supports three goals of the strategy:

Goal 1 (Community and individual action, responsibility and benefits); Goal 2 (Treaty of Waitangi); and Goal 3 (Halt the decline in New Zealand's indigenous biodiversity) (Holzapfel *et al*., 2008, pg19). All seven plans also outline whether or not the plan addresses issues in that year's DOC Statement of Intent.

Considerable effort has been focused on providing legislative protection and on developing species recovery plans in Australia. All 12 plans outline any objectives they meet under the EPBC1999 and any state acts they are bound to (Appendix 12). The EPBC1999 enables the Australian commonwealth government to join with states and territories in providing a national scheme of environment protection, by mandating the adoption of a national recovery plan for every endangered species listed under the EPBC1999 (DEWHA, 2009b; DEWHA, 2009c; DEWHA, 2010a) .

Eighteen New Zealand plans outline the need for protection of breeding areas or habitat and 19 plans imply the need for legislation to protect habitat on private land (e.g. no.29 and 55, Appendix 9). Under the WA1953, populations of indigenous wildlife of national importance are legally protected. However, threatened plants, like *Dactylanthus taylorii*, are not legally protected on private land. Plants are not necessarily protected on public land managed by other agencies either (e.g. land managed by Transit New Zealand, Ministry of Defence or local authorities) (La Cock *et al.*, 2005). Since offshore islands and mainland islands will inevitably be too small to maintain healthy populations of our threatened species. Looking towards maintaining more protected areas on the mainland, as well as actively working with landowners to maintain tracts of native bush on their properties, will be a key step in leaving enough habitat for future generations of New Zealanders to enjoy native species in their 'wild' state (MfE, 2000; DOC, 2010a). Legal avenues are a way in which the community can get involved in threatened species management. Legal protection of habitat on private land (19 plans), and protecting habitat through statutory or non-statutory advocacy (4 plans, Table 24) appear as objectives or actions in some work plans. These types of legal avenues would depend on cooperation with private landowners to comply with any rules or regulations in good faith and are mentioned in the New Zealand Large Galaxiid (no.55) and *Dactylanthus taylorii* (no.56) recovery plans. Such as Action 1.1 in the *Dactylanthus taylorii* recovery plan (no.56) which states "advocate for and assist in the legal protection of *Dactylanthus* and its habitat, at least for the populations of national importance, for the duration of the recovery plan" (La Cock *et al*., 2005, pg14). Even if habitat is protected on paper, enforcing protection

both of the habitat and species can be difficult and costly (Foin *et al.*, 1998; New, 2000). In order to carry this out, legislation for the protection of threatened and endangered species, as well as wilderness areas and habitat significant to a threatened species, combined with legislation aimed at mitigating threatening processes (Clark *et al*., 2002), will need to become a key management strategy for the future.

Only six of the 12 Australian recovery plans studied contain legal avenues, yet they encompass a wider variety of options than all of the New Zealand plans. Encouraging permanent heritage-style agreements with landholders (2 plans); protection on private land (2 plans) and use of the Vegetation Act 1999 to declare habitat areas of high conservation value (2 plans) are a few of the options outlined (Table 43). All states also have a legal obligation to consult with Aboriginal people in cases where a species is threatened with extinction (ALRC, 2010). Particularly if legal protection on private land includes aboriginal landholders. Raising community awareness of the need for legislation as well as informing and educating them about the conservation of threatened species, is one way in which to ensure the next generation of New Zealanders knows about our biodiversity and can therefore make informed decisions about their future management.

5.2.3 Community involvement in endangered species recovery

DOC is unable to achieve conservation outcomes on its own. Central government needs to develop public understanding of the importance of environmental sustainability for New Zealand's wellbeing (MfE, 2000) and the significance of some of the challenges we face in maintaining populations of our threatened endemic flora and fauna. If New Zealand is to maintain economic growth without irreversibly damaging the environment there will need to be a change in attitudes and practices. Change will take time, encouragement, information and incentives (Berkes, 2007). This message may be harder to convey at the moment due to the current economic stress (when attention is focused on socio-economic concerns and capital for investment in new technologies is harder to come by) (Carwardine, Wilson, Ceballos, Ehlich, Naidoo, Iwamura, Hajkowicz, Possingham, 2008), but the current climate may also support a change in people's awareness and interest in the environment, as is evidenced by the increased awareness of recycling schemes (Barr & Glig, 2007; DOC, 2008b; DOC, 2010a).

5.2.3.1 Advocacy and public awareness

Most New Zealand plans (53 plans) and all 12 of the Australian plans studied in-depth, acknowledge that promoting advocacy in the community is an important long term recovery strategy for our threatened species (Appendix 9 & 12). Many of these plans contain more than one objective or action in their work plans which relate to advocacy, all of which were collated and analysed under one of six different categories: Providing Information; Education; Use of Volunteers; Social Responsibility; Species Ambassadors; and Legal Avenues (Legal Avenues were mentioned in the *5.2.2 Legislation and policy chapter*) (see Appendix 11 & 13). Only nine DOC plans (no.50, 52, 54, 56-61, Appendix 9) have a dedicated chapter which outlines public awareness initiatives for the species. Without public support, funding and habitat protection plus successful re-introductions of threatened species will simply not be possible and already endangered species could become extinct (ASEC, 2006). The more people know, understand, and experience the value and benefits of conservation, the more they will support it (Morad & Jay, 2000).

5.2.3.2 Cultural Importance

Most New Zealand recovery plans comment in some way on the cultural significance of the species to Maori and iwi and how their involvement is important in recovery efforts. Yet only plans written after 1999 actively promote iwi ownership and participation in work plan actions and only eight plans, written since 2003 (no.50, 52, 56-61, Appendix 9), have a chapter dedicated to explaining the cultural importance of Maori involvement in the recovery of that particular threatened species. Despite direction by the Conservation Act 1987 and articles under the Treaty of Waitangi, DOC has few collaborative management arrangements with Maori (Taiepa *et al.*, 1997). The Tuatara recovery plan (no. 47) mentions that the ethics of genetic research on the species has become an issue for iwi. Although some research is vital for the conservation of Tuatara, other research raises concerns of manipulation, loss of whakapapa and perhaps ownership. Fortunately all parties agree that the conservation of Tuatara is paramount, and involving iwi in the recovery process has mitigated any further concerns (Gaze, 2001).

In Australia, all states have a legal obligation to consult with aboriginal people in cases where a species is threatened with extinction (ALRC, 2010). Implementation of recovery actions cannot be carried out unless the interests of local indigenous communities have been taken into consideration. As a result, some states now have indigenous managers looking after

threatened species and their habitats (Chapman & Cale, 2008). Eight plans mention the role of indigenous people in the planning and implementation of recovery actions (Table 31). In Victoria, the government developed an Indigenous Partnership Strategy which outlines consultation with indigenous communities on land management and participation in threatened species recovery (DEWHA, 2009g). Regardless of the State, implementation of recovery actions outlined in the Striped Legless Lizard recovery plan (no.10) will take into consideration the role and interests of indigenous communities in the area (Robertson & Smith, 2010).

5.2.3.3 Stakeholders

Since a large proportion of New Zealand's threatened biodiversity is found on private land (protection on private land appears in 19 plans, Table 24), the implementation of some recovery plans will inadvertently have a social impact on local communities and in particular the owners and managers on whose land threatened biodiversity dwells. Setting aside land for conservation invariably incurs social and economic costs, such as the cost of foregone primary production (agriculture or forestry), social conflicts with alternative land uses and the financial costs of land purchase and management (Carwardine *et al.*, 2008). This is a weak element of the New Zealand plans because unlike the Australian plans there is no dedicated chapter explaining stakeholder involvement in the recovery of a species.

Nine of the Australian plans (Table 31) comment on the social and economic benefits associated with the implementation of strategies in the recovery plan. In the case of the Striped Legless Lizard (no.10) in NSW, liaising with grassland managers and developing management guidelines for landholders responsible for off-reserve populations has enabled indigenous communities and landholders to feel ownership of the species and support the states recovery efforts (Robertson & Smith, 1999). Personal and regular contact with landholders is a key strategy in encouraging awareness and involvement in the recovery effort (Ashworth & Tuckey, 2001; Chapman & Cale, 2008). Eight plans also mention other affected parties such as state agencies and departments, community groups, non-government organisations and businesses which are involved as stakeholders in a species recovery. Such as consultation with indigenous communities in the Glossy Black Cockatoo recovery plan (no.5).

5.2.3.4 Providing Information

In 2007, a survey was carried out in which Auckland households were asked questions about their awareness of threatened species in New Zealand and perception of expenditure on conservation by Seabrook-Davison (2010). The findings indicated that the effectiveness of threatened species conservation awareness by DOC may need to be examined. Although some respondents were aware of our threatened species, only species which have had vast amounts of money spent on them and are 'cute and cuddly' appear to be widely recognised as endangered. A study by Tear, Scott, Hayward, Griffiths (1995) found that even though public education is mentioned in United States recovery plans (92 percent of plans in 1994), assessing public attitude towards endangered species recovery is often ignored. Public perceptions of species can have a major influence on policy formulation and implementation (Knight, 2008). Therefore, it is important to identify and understand public perceptions of threatened species (Kellert, 1985; Czech *et al.*, 1998). Invertebrates and amphibians in particular may be disadvantaged in relation to other species because the general public often views them with fear, antipathy and aversion (Knight, 2008). In reality, all four of New Zealand's frog species are critically endangered, as are many of our plant species and invertebrates which at the moment, do not receive a similar level of support as the Kiwi.

Ultimately, awareness of threatened species depends upon how people are informed. Informing the public about threatened species conservation in New Zealand tends to be through the use of education leaflets/pamphlets or fact sheets (47 plans); media releases such as television coverage (38 plans); and by publishing articles in scientific journals and magazines (23 plans, Table 19). Notably, plans no.36-46 (mainly species which live in the Chatham Islands) tend to only imply that public awareness is important and should be facilitated through the use of signs at breeding sites (5 plans) (Appendix 11). These actions are similar to those in Australian plans, as informing the public about threatened species recovery has been achieved for some species through the use of education leaflets (10 plans); displays in local community libraries (8 plans); and media releases on planting or release days (8 plans, Table 38). For three of the plant species (no.3,7,9), a number of schools, community groups and environmental organisations have been involved in maintaining sites, collecting seeds and cuttings, searching for new populations and propagating and planting trees.

A 2006 survey found that a majority of adults rated newspapers (30 percent) and television (35 percent) as their most important source of information about environmental issues (Cullen, Hughey, Kerr, 2006). Which indicates that perhaps a wider variety of articles and television programmes dedicated to conservation issues may be needed to garner more support from the community (Novacek, 2008). Only one plan (*Dactylanthus taylorii*, no.56) mentions developing a webpage to inform the community about the conservation of the species. Unfortunately, the main reason why species are threatened with extinction is because they do not have stable enough population sizes to cope with continued human and environmental pressures such as habitat destruction and introduced pests and predators (Moran, 2008). Without an informed public, threatening processes such as habitat destruction will continue because people who are unaware of the implications of their actions tend to continue living the way in which they are accustomed (Taylor, 2005).

5.2.3.5 Education

There are a number of strategies DOC has undertaken to educate the public about threatened species (14 strategies, Table 20). Educating the next generation through public talks (16 plans) and visits to schools by DOC staff (often with props such as taxidermied predators, native bird species and predator traps) (15 plans) are only mentioned in a handful of plans. But together with advocating appropriate land use (11 plans); minimising disturbance to wild populations (10 plans); and island quarantine procedure awareness (8 plans) they are all important education measures which have the potential to promote the conservation of these species in the future. Educating the community about threatened species recovery is an important long term strategy because it teaches people why a particular action may be detrimental to a threatened species survival (Novacek, 2008). These are similar to community education strategies in Australia, in which public talks and lectures (6 plans) and involving schools and community groups (3 plans, Table 39) in collecting seeds and cuttings, as well as surveys, are all used as a means of notifying the local community and encouraging their involvement in the recovery of species such as the Glossy Black Cockatoo (no.5) and Aniseed Boronia (no.9) (Mooney & Pedler, 2005; Carter & Walsh, 2006).

Environmental education will have a fundamental role to play in the conservation of endangered species (New, 2000) and is seen as the primary outcome of effective advocacy (Porter, 1988). Wider support for the recovery of species such as our threatened reptiles could be obtained by increasing education initiatives of conservation issues in facilities such as

zoological parks (Novacek, 2008). At the moment, only 3 plans advocate maintaining a publically accessible population (no. 9,12,61, outlined in red Appendix 9). The potential to use Tuatara in education to enhance public awareness of conservation issues is written in the recovery plan and will be essential to garner public support for actions written in the plan (Gaze, 2001).

5.2.3.6 Use of Volunteers

The use of volunteers in monitoring (15 plans), surveying (13 plans) and protection of breeding sites (5 plans) is managed by respective DOC conservancies and is seen as a way in which to involve the community in conservation initiatives (Table 21). Only the New Zealand Fairy Tern (no.57) and Kiwi (no.60) recovery plans mention providing logistical support to volunteers helping with recovery initiatives, such as surveying, and only one plan, Chatham Island Pigeon/Parea (*Hemiphaga novaeseelandiae chathamensis*) (no.39) mentions providing the community with a survey in which to record sightings.

Using volunteers to monitor populations of threatened species (9 plans) and locate species (8 plans, Table 40) enables people to get involved in the conservation of threatened species in Australia, whilst also freeing up Parks and Wildlife staff for more important recovery actions (Mooney & Pedler, 2005). Community volunteer groups say that from their work with conservation organisations they build strong relationships and networks, contribute to a greater sense of community, gain skills and knowledge and raise awareness and support for environmental issues (Kuehn *et al*., 2008; Manfredo, 2008). Which is why schools and community groups in the Shires of Sherbrooke and Lillydale have been actively encouraged to participate in tree planting and other hands-on work in reserves which support populations of Helmeted Honeyeater (no.8) by the community group 'Friends of the Helmeted Honeyeater'(Department of Sustainability and Environment, 2003; Menkhorst, 2008).

5.2.3.7 Social Responsibility

Community ownership or guardianship of the threatened species appears as an objective or action in 53 New Zealand recovery plans (Table 22). Social responsibility is seen as an important tool to ensure that recovery actions are able to be carried out throughout the country with support from the local community. There are now a number of national non-governmental organisations (e.g. Brown Teal Conservation Trust, plan no.59) which seek to educate and inform the public of a species threatened status and recovery and which manage, in collaboration with DOC, populations of these species. Collaborating and sharing

knowledge and techniques with these community organisations frees up resources and enables DOC to focus energy on other more technical aspects of species recovery (e.g. captive breeding) (CRESA, 1998).

Community ownership in recovery actions (8 plans) and involving indigenous communities (7 plans) particularly in threat management (6 plans, Table 41) are outlined in a number of the Australian plans as ways in which to increase the likelihood of cooperation with recovery managers in future recovery initiatives. It is known that implementing some of the recovery actions in the plans will inadvertently have a social impact on local communities and landowners (Burgmann & Lindenmayer, 1998), which is why fostering social responsibility for threatened species which live in these communities can help mitigate negative attitudes towards those carrying out actions both now and in the future (Ewing, 1999).

5.2.3.8 Species Ambassadors

The work plans of many New Zealand species plan to maintain a captive population for breeding and research (32 plans, Appendix 9). Yet, many of these captive populations are unable to be visited by the public due to their location (i.e. on offshore islands) or because the recovery of a particular species is a closely guarded secret (confidential discussion with DOC employee, 2009). Such is the case for the Takahe (no.61), as although display birds are kept at Pukaha Mount Bruce National Wildlife Centre near Wellington, and at the Te Anau Wildlife Centre, access to the Burwood Captive Rearing Unit is restricted to only one day a year for the general public. Creating a publicly accessible captive population in a zoological facility is an objective in three plans (Table 23), none of which include any of the Chatham Island species, plants, fish or Skinks (*Cyclodina* spp.).

Only four Australian plans mention keeping captive populations as species ambassadors (no.4, 8, 10, 12) and only the Pygmy Bluetongue Lizard plan (no.4) mentions involving the community in visits to release sites or taking species ambassadors to schools (Table 42). At one time, captive populations were regarded as an essential safeguard in case of a disaster striking the wild populations of some of our most threatened species, such as the Kiwi or Tuatara (Gaze, 2001). However, given the success of conservation initiatives in the wild this is no longer a valid justification for holding animals in captivity (Ray *et.al*., 2005). The captive management of species like the Tuatara does however still play an important role in raising young for release into the wild. It also provides a resource for research purposes and

ultimately raises the public profile of Tuatara (Gaze, 2001), which only serves to highlight other similarly threatened species and raise awareness and understanding of the importance of conservation.

5.3 Overall evaluation of New Zealand recovery planning

The recovery of threatened species must often be initiated with incomplete biological data and in the face of multifaceted ecological, political, economic and social obstacles (Clark *et al.*, 2002). The problem with this is how to measure the success of threatened species projects. Over time as species benefit from management and protection efforts aimed at reducing and or eliminating their threats, it is expected that species population numbers will improve and species will have their threatened status revised (Martin, 2008). Perhaps a reversal in threatened species status is the only true measure of a successful management programme (Fairburn *et al*., 2004; Cullen *et al*., 2006; Hughey *et al*., 2008). However, since no species in New Zealand with a recovery plan has as yet changed in status (or been removed from the threatened species list), it is debatable how successful threatened species management in New Zealand actually is.

One way in which to determine the success of a recovery programme is to look at the planning documents used by those implementing the programme (Alexander, 2008). Analysis of every chapter in the 61 New Zealand recovery plans has highlighted a number of gaps in the plans which indicate a lack of consistency in the way plans have been written (some of the gaps are circled in red in Appendix 9). There are clear advantages to specifying a common structure and standard contents of planning documents within an organisation. Such as improving communication between different departments, ensuring plans are easier to read and standardising the revision and monitoring process (Clark *et al*, 2002; Alexander, 2008). Every chapter in the New Zealand recovery plans has been ranked and given a score of strong (green), poor (yellow) or weak (red) performance . To summarise this information the flow diagram in Figure 5 was colour coded and redrawn in Figure 6.

Strong chapters include the introduction or background chapters which outline species information, such as the ecology and biology, distribution and status of the species. Although the ten revised recovery plans include greater detail on the species biology, threats and past conservation actions, they do not show how this information informed and changed management actions, monitoring or recovery of the species. Another strong chapter is

accountability, because 53 of the plans make reference to the DOC department who is responsible for carrying out a particular action in the work plan.

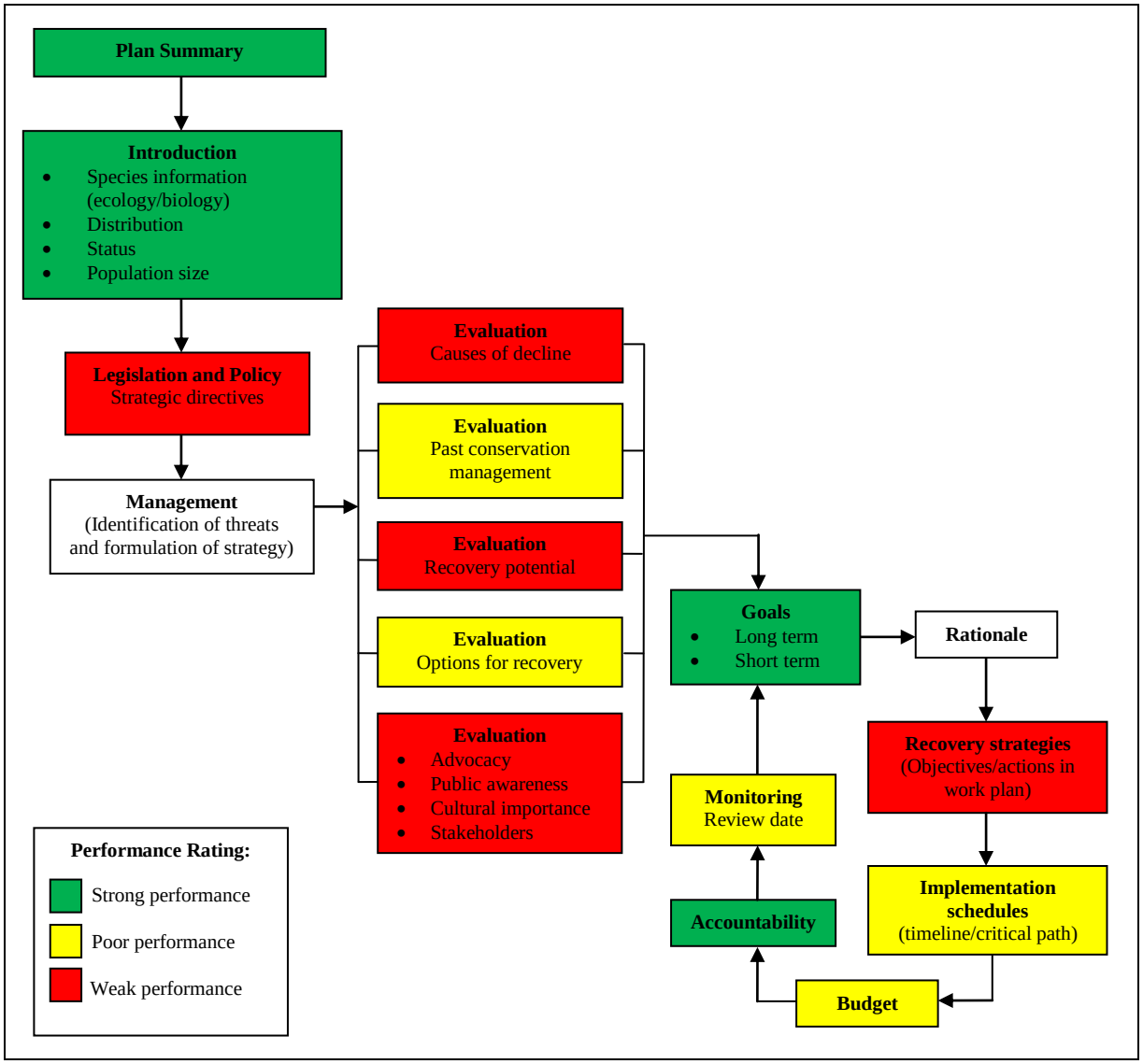


Figure 6. Flow diagram rating the performance of various chapters in New Zealand's threatened species recovery plans. Performance is based on colours assigned to these chapters/sections in the matrix in Appendix 9. Green indicates strong performance, yellow poor performance and red weak performance (based on Figure 4 'Methodology' chapter pg 53, which has been adapted from Alexander, 2008, pg17).

Past conservation management, options for recovery, presence of an implementation schedule or a budget and monitoring chapters were deemed poorly performing chapters. In the past conservation management chapter most of the strategies appear in 24 or fewer plans which indicates a lack of consistency in the way our threatened species have been managed. This is in light of the fact that the breeding and translocation of endangered species to offshore islands has proven to be an effective management tool for a number of our most endangered species, like the Kakapo. Eleven plans do not contain any information about previous management which leaves the reader questioning how the work plan in these plans was

formulated. In the options for recovery chapter most of the options appear in less than half of the plans, which inadequately represents the wide variety of recovery strategies previously used, and currently available to DOC.

Recovery plans should be systematically reviewed. When new information becomes available or a change in a species status occurs, plan revision will improve the effectiveness of future recovery planning (Boersma *et al*., 2001). Monitoring of the review date is deemed poor because 22 plans (written between 1992 and 2000) have now expired, and a further 13 plans (ten year plans published in 2001) are due to expire this year. The value of recovery plans can be undermined by the length of time it takes to complete a plan (Boersma *et al*., 2001). Environmental groups continue to sue the US Fish and Wildlife Service for taking too long to complete recovery plans, even though recovery planning training materials direct staff to complete plans in two and a half years (Clark & Harvey, 2002). Until this point in time, Kakapo and Takahe have been intensively managed (even though the Kakapo plan expired in 2005) yet both species still face the threat of extinction. Which questions whether or not there is any point in devoting a large proportion of conservation resources to these species every year. Especially when in both cases, it seems unlikely that they will ever be successfully reintroduced to the mainland unless all predators and competitors have been eliminated and the effects of inbreeding are minimised, a task which seems almost impossible.

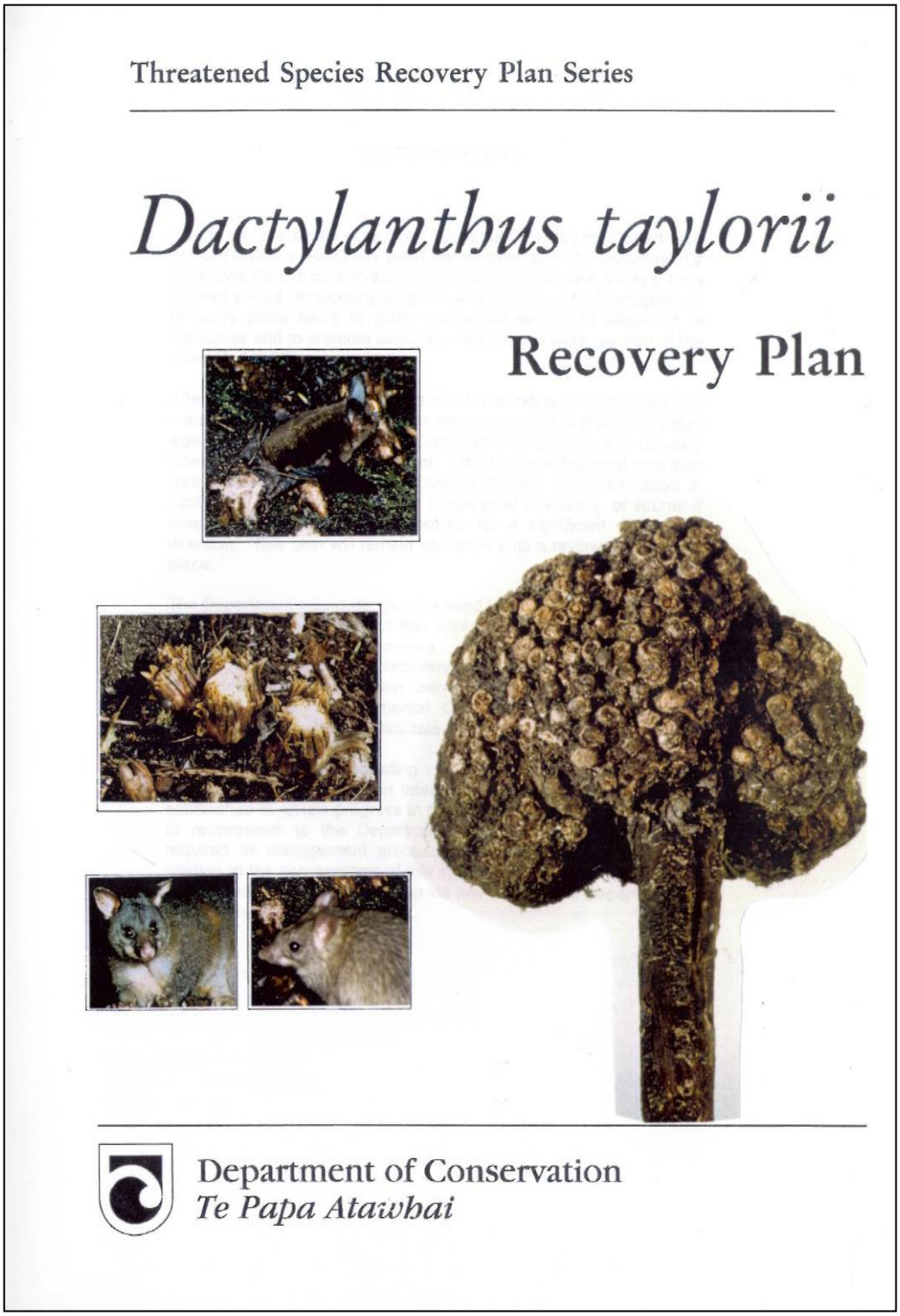
Many chapters in the New Zealand recovery plans perform weakly. This is because many of the ideas, strategies and actions in these chapters were only written in ten or fewer plans (although it should be noted that perhaps they are not relevant for all species). The causes of decline chapter does contain a number of different ideas, yet aside from predation and habitat loss many other threats are barely mentioned. In particular, long term threats such as an increase in natural events like storms (as a result of climate change) (14 plans) and genetic variation (6 plans) appear in only a couple of plans, however, they would surely impact all threatened species in New Zealand. The recovery potential chapter is perhaps the weakest of all because it has been removed from plans since 2000 (with the exception of plan no.52, Appendix 9). Excluding this chapter from many of the plans weakens the effectiveness of the plans, because it may have resulted in a lack of monitoring of actions.

The recovery strategy chapter in the work plans of the recovery plans also performs weakly because only a few strategies, such as advocacy (53 plans); long term monitoring of populations (37 plans); and maintaining habitat of mainland and island populations (33 plans)

consistently appear in the plans. This chapter is weak because half of the strategies (18 out of 36) appear in less than ten plans, even though many of these strategies are relevant to a number of other species. Such as the gap between plans no.37 and 56 where no plans mention developing captive breeding techniques, creating a recovery group or maintaining an information database (outlined in red Appendix 9). A similar gap appears between plans no.32 and 58 in which none of the plans mention the last seven recovery strategies (outlined in red Appendix 9). Of particular importance are creating a publically accessible population (3 plans, no.9 Tuatara and no.12 and 61Takahe) and increasing funding support for the programme (2 plans, no.59 Brown Teal and no.61 Takahe) (both are outlined in red Appendix 9). Both of these strategies are valuable long term strategies because they would involve the community in the recovery of endangered species and directly relate to the advocacy strategy. Of note perhaps the most important strategy for any threatened species recovery plan is to determine the species vulnerability to extinction. This strategy only appears in the Whitaker's (*Cyclodina whitakeri*) and Robust Skink (*Cyclodina alani*) recovery plan (no.3, 1992, outlined in red Appendix 9). Yet without it, strategies such as establishing additional wild populations on the mainland using translocation would be unsuccessful, because the factors causing the species to become vulnerable in the first place would not be identified.

At the moment, the resources available for threatened species management in New Zealand are not sufficient to manage every threatened species in the same way (Moran, 2003; Seabrook-Davison, 2010). Therefore, DOC needs to prioritise time, money and other resources to manage those species which can be successfully administered on the mainland and which have greater odds of surviving into the next century. Perhaps the 'optimising threatened species recovery project' begun in 2007 and the ranked list of nationally important species due to be released (2010-2011) will help determine better management for a larger number of species. Ultimately, selecting the best set of management strategies to ensure the persistence of the greatest number of a nation's threatened species is a complex and challenging problem (Bowles & Whelan, 1994). But a failure to develop concise recovery plans and a lack of cooperation between DOC conservancies and the community, must be affecting the recovery of some of our threatened species and needs to be addressed before future management strategies are developed.

Chapter 6. Conclusions



Source: *Dactylanthus taylorii* Threatened Species Recovery Plan 16 (Ecroyd, 1995).

A failure to develop and implement effective recovery planning is surely contributing to the decline in numbers of some of New Zealand's threatened and endangered endemic species. With the increasing focus on integrated natural resource management (Sattler & Creighton, 2002b), conservation program managers need to collate information on the effectiveness of existing recovery programmes and assess any constraints of planning that might exist, in order to secure funding and support for conservation initiatives (Boersma *et al*., 2001; Bottrill *et al*., 2011). Given scarce agency resources, efficiency demands that efforts to improve recovery plans be founded on an accurate understanding of existing plans (Hoekstra *et al*., 2002). Analysing what currently exists in management plans is one way in which to determine what planning has taken place and how an organisation is planning for the future.

Implementing recovery programmes will require: legal protection and procedures for implementing recovery plans; community cooperation in the management of habitats and ecosystems on private land; knowledge of appropriate management techniques; comprehensive management plans; sufficient resources (time, funding and personnel); as well as interagency cooperation; (Gunningham & Young, 1997; Boardman, 2006). In both New Zealand and Australia, government departments such as DOC and DEFRA have been using recovery plans to guide the conservation of a number of threatened species and ecosystems (DEWHA, 2009d; DOC, 2010b). A combination of appropriate legislation and community awareness and involvement has enabled species such as the Helmeted Honeyeater and Kiwi to be successfully managed and populations of these endangered bird species are beginning to increase (Robertson, 2003; Menkhorst, 2008).

A critical review of recovery plans in New Zealand has highlighted six areas of performance in the recovery plans which may need to be addressed by DOC in future planning documents. Some of these areas perform weakly, others poorly and accountability performs strongly, but they are all areas which need to be addressed to improve the comprehensiveness of recovery planning documents in the future. The six areas include, but are not limited to, inadequate legislation and policy (weak); a need for more community involvement in threatened species recovery (weak); research into the threats and management options available in which to successfully recover our endangered species (weak); unclear milestones in the form of implementation schedules (poor); accountability and resources (strong); and a lack of monitoring (poor).

6.1 Legislation and policy

Legislation, both in the form of objectives under the EPBC1999 and any relevant state legislature is written in all of the Australian national recovery plans analysed. In Australia the purpose of the national recovery plans under the EPBC1999 is to make the management of threatened species mandatory under law (DEWHA, 2009f). Although each of the states have separate management plans for individual species they were included in the development of the national plan. This means that the national plan outlines common goals for the recovery of a species which must be carried out regardless of which state the species resides in. As a result, it forces the state wildlife agencies to work together and approach the management of a species in the same manner and will eliminate the need for trial and error management of species which are already low in population numbers (New, 2000).

In New Zealand even though there is awareness of the threats facing our endangered species there is no legislation that comprehensively aims to manage these threats and there seems to be no consequences if a species becomes extinct. With the exception of the EPBC1999, most endangered species laws do not address threats directly until after a species is listed and recovery plans are drawn up (Ray & Ginsberg, 1999). In recent years, the WA1953 has been criticised for its inability to conserve threatened wildlife and in guiding DOC in recognising the full costs and benefits of natural resource use (Hartley, 1997; Moran, 2003; Cullen et al., 2005; Seabrook-Davison, 2010). Especially when there are a large number of international agreements (Appendix 1) and national Acts (Appendix 2) DOC must also take into account when managing the environment in this country. Although DOC has written recovery plans for 50 species legislation in these plans is weak because there is no legislation determining if or how the plans should be followed and it is up to individual conservancies to develop local work plans for a species. This means that successful management in one region may not be carried out in another due to a lack of communication between conservancies, which ultimately stalls the recovery of a threatened species (confidential discussion with DOC employee, 2009). National legislation aimed at managing the recovery of threatened species would provide a mandate to ensure adequate funding and resources are supplied to whoever is responsible for preventing threatened species from becoming extinct (Joseph *et al.*, 2009).

Without legislation enforcing consequences for threatening the survival of a endemic species, it is likely that any new approach to the management of threatened species will not receive

long term support, especially in the wake of changing governments. Other countries such as Australia with a similar governmental structure and conservation challenges to New Zealand have used the ESA1973 in the United States as a benchmark for their own threatened species legislation (ANZECC, 2001). When the ESA1973 was written, protection of threatened species and their habitat was given equal consideration at a national level (Goble *et al.*, 1999). A lack of legislation and policy also means that the decline in threatened species numbers will continue because there is no legal or political accountability (Joseph *et al.*, 2008; Joseph *et al.*, 2009). This is because legislation generally provides the framework for effective management and demands accountability of results (Alexander, 2008). Legislation could also be used to protect critical habitat vital to a species long term survival and could be used to 'punish' those who threaten endangered species or their habitat. Since DOC has other commitments aside from threatened species recovery, perhaps legislation at the national level will prompt greater funding for conservation initiatives from government (Seabrook-Davison, 2010), encourage greater sharing of responsibility with other government agencies and ultimately speed up the process of listing threatened species and preparing recovery plans, which are key to outlining a strategy for preventing more species becoming extinct.

6.2 Community involvement in endangered species recovery

Community awareness and involvement in threatened species planning and recovery efforts will be the only way in which sufficient manpower is available in order to carry out all strategies in our threatened species recovery plans. There is a need for greater local community involvement in conservation planning and management on public lands, and recognition of the value of voluntary community involvement in threatened species recovery (Thackway, 1997). Community awareness of the plight of New Zealand's threatened and endangered species is still weak (Seabrook-Davison, 2010). Which questions DOC's accountability and monitoring of work plan strategies, because advocacy in the community and the need to promote public awareness, interest or involvement in the recovery process appears in 53 of the recovery plans. A weak performing element of the recovery plans, it indicates that although the rhetoric implies community awareness is important in the recovery process, the reality is that not enough is being done to inform and educate the general public about conservation issues**.**

Using media such as newspapers, television, internet and teaching school children from a young age, can only but increase public awareness of conservation issues, such as the threats facing our endangered species (Evans & Birchenough, 2001; Kuehn *et al.*, 2008). Only one plan (*Dactylanthus taylorii*, no.56) mentions developing a webpage to inform the community about the conservation of the species. Using multiple media sources can actively encourage people to volunteer in monitoring projects and surveys and donate money to threatened species conservation (Kuehn *et al.*, 2008). In this day and age when many people spend part of the day in front of the computer, and children learn at school with the aid of computers, developing webpages for our endangered species would be an effective tool to get the conservation message across (only some of New Zealand's threatened species have a webpage on the DOC website). A successful example of this is the webpage the Kiwi recovery team in collaboration with the BNZ Kiwi Trust has developed, which can be accessed via the BNZ bank webpage (BNZ, 2010). Maintaining a high profile and good communication with stakeholders is deemed important because it can ensure continued support for a recovery program (Berkes, 2007). Businesses such as Bank of New Zealand provide funding for the recovery of Kiwi and in return expect brand awareness when people think about this threatened species in New Zealand. Involving these organisations in release events and getting them to adopt a species enables them to feel a part of the recovery process (Evans & Birchenough, 2001), whilst still letting DOC remain in control of how the species is managed. If more companies were encouraged to sponsor less iconic species, such as our native plants and the endangered Chatham Island Oystercatcher (no.38) perhaps recovery programmes for these species would be just as successful as that for the Kiwi.

Increasing the variety of threatened species in captive facilities such as Zoos, where many people and visitors to the country get their first glimpse of a New Zealand threatened species, could also increase awareness and promote funding needs of recovery programmes. Involving the community in caring for their natural heritage through education, sponsorship, awards, volunteer programmes, partnerships and events such as Conservation Week is vitally important because New Zealand's biodiversity continues to decline and endemic species are still being added to the threatened species list (DOC, 2009a; DOC, 2010a).

6.3 Research into recovery strategies

In the New Zealand plans, the loss of associated species (2 plans) and recruitment failure (1 plan) are threats which appear in only a couple of plans. Yet both processes may threaten other endangered species and perhaps a lack of research has been the reason why they have only been identified as threats for other species. Initial recovery strategies should emphasise research as an early priority, with planning for more complex monitoring and management strategies postponed until in-depth knowledge of the species is achieved (Campbell *et al.*, 2002). The ability to fully address a species threats in a recovery plan often requires additional research. Some species life history requirements (e.g. if breeding is contingent upon rainfall) make monitoring the effects of a threat difficult because it may take several years of research before enough information can be gathered (Martin, 2008). For example, the Helmeted Honeyeater has been the subject of a large body of research work and its life history is particularly understood. Research has included: nesting behaviour and success, genetics, population ecology, captive management, habitat utilisation, and the effects of climate change on breeding (Menkhorst, 2008).

Forty-three New Zealand plans and ten Australian plans (out of the 12 analysed) advocate undertaking research and encouraging scientific studies on the species in the future. Further research needs to be carried out on all threatened species currently under active management by DOC, in order to get a better idea of what management is needed, how recovery planning is working and what strategies are failing. Recognising and evaluating what is needed to recover a particular species is a crucial step in the recovery process. Patterns seen in recovery plans for species facing similar threats and management needs could help those who manage threatened species streamline and improve recovery planning (Foin *et al.*, 1998). Until sufficient research is carried out, the objectives of a management plan will need to change with each successive plan until all relevant information is known about the species, a factor which takes time. Kiwi (no.2, 50, 60) and North Island Kokako (no.1, 30) have been extensively researched which is reflected in the fact that both of these species have had more than one recovery plan written. It also serves to highlight the lack of knowledge about other threatened species which as yet do not have a recovery plan. The need for large bodies of field data to describe a species, its situation and discover effective conservation methods is clearly a major stumbling block when it comes to developing concise recovery plans. Without additional resources (time, funding and personnel), DOC will struggle to balance the need for

more effective management planning with the day-to-day struggles concerned with the conservation of a large number of species with very small populations.

Also lacking in many of the New Zealand plans is a list of further research questions or topics. The usefulness of research is not always apparent at the outset, and some research may never influence the management of a species but will instead contribute to our knowledge and understanding of the species (Bowles & Whelan, 1994; Brigham *et al*., 2002). There is international interest in many of New Zealand's threatened species from a variety of scientific institutions, but access to the species is strictly controlled by DOC. The achievements made in Tuatara conservation over the past decade have been largely possible because of an increase in scientific knowledge about the species (Gaze, 2001).

None of the recovery plans analysed make any reference to the management of threatened species in other countries. By increasing the sharing of knowledge between countries, mistakes can be learnt from and successful recovery strategies can be copied (Schultz & Gerber, 2002). Ultimately, this could increase the number of successful recovery programmes because it would reduce the amount of time spent on 'trial and error' management strategies. This is apparent in the case of the Helmeted Honeyeater which faces similar threats to New Zealand species (habitat loss, predation, competition) and will be needing intensive captive breeding and possible translocation of populations in the future (Menkhorst, 2008), which are management strategies used successfully for many years with a number of New Zealand species such as the Hihi and Tuatara.

6.4 Implementation schedules

The Nature Conservation Council of South Australia argues "there has been too great an emphasis on planning at the expense of implementation. While recovery plans are useful documents, they do not make tangible progress in recovery of species and communities without implementation" (DEWHA, 2009g, pg130). Investment in recovery planning cannot be justified if there is insufficient investment in implementation (Bottrill *et al*., 2011).

At the moment, 35 New Zealand plans and six Australian plans (out of the 12 studied) lack implementation schedules or timelines for the objectives and actions in the work plans. This means there is no way of knowing, from reading the plan, when milestones during the

lifespan of the plan will need to be achieved. A well planned and implemented monitoring programme provides the basis for the adoption of an adaptive management approach to consistently manage rapidly changing populations of threatened and endangered species and their habitat (Campbell *et al*., 2002). A timeline of recovery strategies and actions informs the reader at a glance in which year a strategy will be carried; the priority of the strategy; who will be carrying out the management; and roughly how much the recovery strategy will cost (e.g. Table 37 and 46). Fifty-three of the recovery plans mention which DOC office or conservancy is accountable for the implementation of actions in the work plan. Yet a lack of schedules or timetables which outline when an action needs to be implemented or successfully completed, means there is little accountability if actions fail or simply are not carried out. This can lead to inefficient management and result in waste of both time and money because recovery actions will continue to be used even if they have become obsolete or ineffective (Campbell *et al.*, 2002; Ferraro *et al.*, 2007).

6.5 Accountability and resources

There are a large number of threatened species in New Zealand which currently do not have a recovery plan (over 1000 species). Even though national recovery plans have only been written and published in Australia since 2000, the plans already cater for a wider diversity of species than New Zealand's plans. Having a national plan for all threatened species means there is a guiding document for all conservancy work plans, which ensures that there is consistency in the management of a species throughout the country. The New Zealand Falcon (*Falco novaeseelandiae*) is a prime example of a species which although protected since 1970, has for many years been classified as a threatened species, yet does not have a recovery plan. As such, the majority of the research carried out on the species has been done by student researchers at Massey University and the recovery of the species has been closely monitored by the general public, such as the Raptor Association of New Zealand in annual surveys, and organisations such as Wingspan Birds of Prey Trust which takes an active role in rehabilitating juveniles ready for release back into the wild.

New Zealand recovery plans currently focus on short term threats (such as predation and habitat loss) rather than long term threats (such as increased frequency of flooding and drought events). This is because predators can be easily managed with actions such as distributing poison bait, placing trapping stations and predator proof fencing mainland island

sanctuaries. Since recovery plans are supposed to outline ways in which to recover species throughout the lifespan of the plan (10-50 years), recovery plans in the future will need to extol the importance of research into long term threats, because an ever changing climate will cause changes in the frequency and persistence of threats such as introduced predators/pests, disease and genetic variation (New, 2000; Duffey, 2001).

The New Zealand recovery plans analysed contain a number of different recovery strategies (36 strategies, Appendix 9). Yet because a majority of these strategies appear in less than ten of the plans the recovery strategies chapter is weak. Some strategies, such as translocation and captive breeding, are obviously working well in increasing the populations of some of our iconic species (such as the Kiwi and Tuatara). Since these recovery strategies have a proven track record, the fact they are not uniformly used for all our endangered species is of concern. Many of our most endangered species have small populations and are equally as valuable in maintaining the biodiversity of this country. Eleven of the 61 recovery plans (no.36-46) address species only found in the Chatham Islands or other small offshore islands. All of these species face similar threats to those on the mainland, yet translocations and captive breeding have only been used to recover a couple of species (i.e. Black Robin). These 11 recovery plans also expire this year and since none of these species will have their status changed, perhaps if the same resources and recovery strategies were applied to Chatham Island species their populations and therefore status may improve as well.

At the moment, the implementation of species recovery plans and ecosystem repair activities in New Zealand appears to be inadequately resourced. This is because the cost of species and ecosystem recovery, in addition to the restoration of ecological processes, will far outweigh the cost of managing many threatening processes (Sattler & Creighton, 2002a). DOC conservancies have to compete annually for funding, which results in multiple approaches to managing the same species and discrepancies in the amount of funding each threatened species receives (Moran, 2003; confidential discussion with DOC employee, 2009; Seabrook-Davison, 2010). Poorly defined management programmes can create conflict between different agencies, which may create distrust and unnecessary delays in future decisions for that species, or other threatened species involving the same agencies (Miller *et al*., 1994).

More money needs to be spent on controlling the pests and predators which threaten our endangered species (DOC, 2009e), and in protecting and maintaining mainland islands.

Funding will also have to be found to better manage habitat loss (as a result of degradation, agriculture, viticulture and urbanisation) (DOC, 2010a). A threat faced by many of our endangered species, habitat loss will continue as the country's population expands (MfE, 2007). Setting aside more land for protection or paying landowners to keep portions of their land in native vegetation will mean more areas of native vegetation suitable for mainland islands in the future. It will also increase the patchwork of native forest around the country, which will act as corridors for native animals to use to move around to establish new territories, find mates and find food (Taylor, 2005).

More funding will also be needed to increase community awareness and involvement in threatened species recovery programmes. Accountability of where this increase in money will be spent should be included in future recovery plans. A spreadsheet or table in the Appendix detailing the breakdown of an expected budget over the lifespan of a recovery plan (five or ten years), or a table beside each objective outlining how much the actions of that objective will cost to implement, already appears in Australian national recovery plans. Including this information in a revised or yet to be written New Zealand recovery plan could increase accountability of resources and may indicate to a person or business interested in funding recovery efforts where their money would best be spent.

6.6 Monitoring

There is little mention in New Zealand recovery plans of how recovery strategies (objectives and actions in the work plan) will be monitored in which to see if the recovery is working (a poor performing element of the recovery plans). Recovery efforts that incorporate monitoring into management plans can lead to more efficient species management, both in terms of time and money because recovery actions can be modified or discontinued if they cease to be effective (Campbell *et al.*, 2002; Lawler *et al.*, 2002; Ferraro *et al.*, 2007). Most of the Australian plans contain performance criteria for each objective, which outline how to measure the success of an objective after appropriate recovery actions have been carried out (Table 35). Creating performance criteria for objectives in future New Zealand recovery plans, would increase accountability of actions and would facilitate monitoring to track the species throughout the recovery process. The goal to 'halt the decline' in the number of species threatened with extinction in New Zealand is still a work in progress. Although the intensive management of offshore and mainland islands in the form of predator and pest

control and the creation of national parks and reserves, as well as gains made in protecting threatened species on private land have saved species such as the Kiwi, it is debateable whether or not the resources and time have been well spent.

The long term monitoring of populations of threatened species (37 plans) has enabled DOC staff to update and create a second recovery plan for ten different species and will hopefully be useful in updating other plans which have since expired. Periodic re-evaluation can help to focus attention on the management actions most needed for the recovery of the species (Tear, 1993; Elliot *et al.*, 2001). The Helmeted Honeyeater plan mentions that "the plan will be revised before the end of the plans lifespan (five years), after the plan is adopted under the EPBC Act. An external reviewer will be appointed to undertake a formal review and evaluation of the recovery programme" (Menkhorst, 2008, pg7). This is important because it will tell those responsible for the species recovery if and how the objectives are working and whether or not the strategy for the threatened species needs to change in some way, to ensure that all objectives are successfully achieved. It is also a simple way to monitor a species recovery and should be included in future Australian and New Zealand planning documents.

No New Zealand and Australian species with a recovery plan has had their status downgraded and is deemed safe from extinction (Bottrill *et al.*, 2011). Without evaluation of existing species recovery efforts, we have little idea whether or not recovery is actually occurring, and ultimately whether the rate of decline is slowing or halting (Martin, 2008). At the moment, a lack of monitoring in the plans means improvement may be occurring but may not yet be detectable without the call for further survey and research. Newer plans, such as that of the Kiwi (no.60) and Takahe (no.61) highlight the amount of time and effort which has gone into these species recovery. Regrettably, they also serve to highlight the gaps in knowledge about other less charismatic species, and serve as a reminder to DOC that there are numerous species in New Zealand which are facing the threat of extinction, and without successful management of habitat and ecosystems, perhaps many more species will be added to the list. Given the small population size of many of our threatened species, efficiency demands that efforts to improve recovery plans be founded on an accurate understanding of existing recovery actions. Therefore recovery plan reviews are an important element in the recovery planning process (Hoekstra *et al*., 2002).

6.7 Future of recovery planning

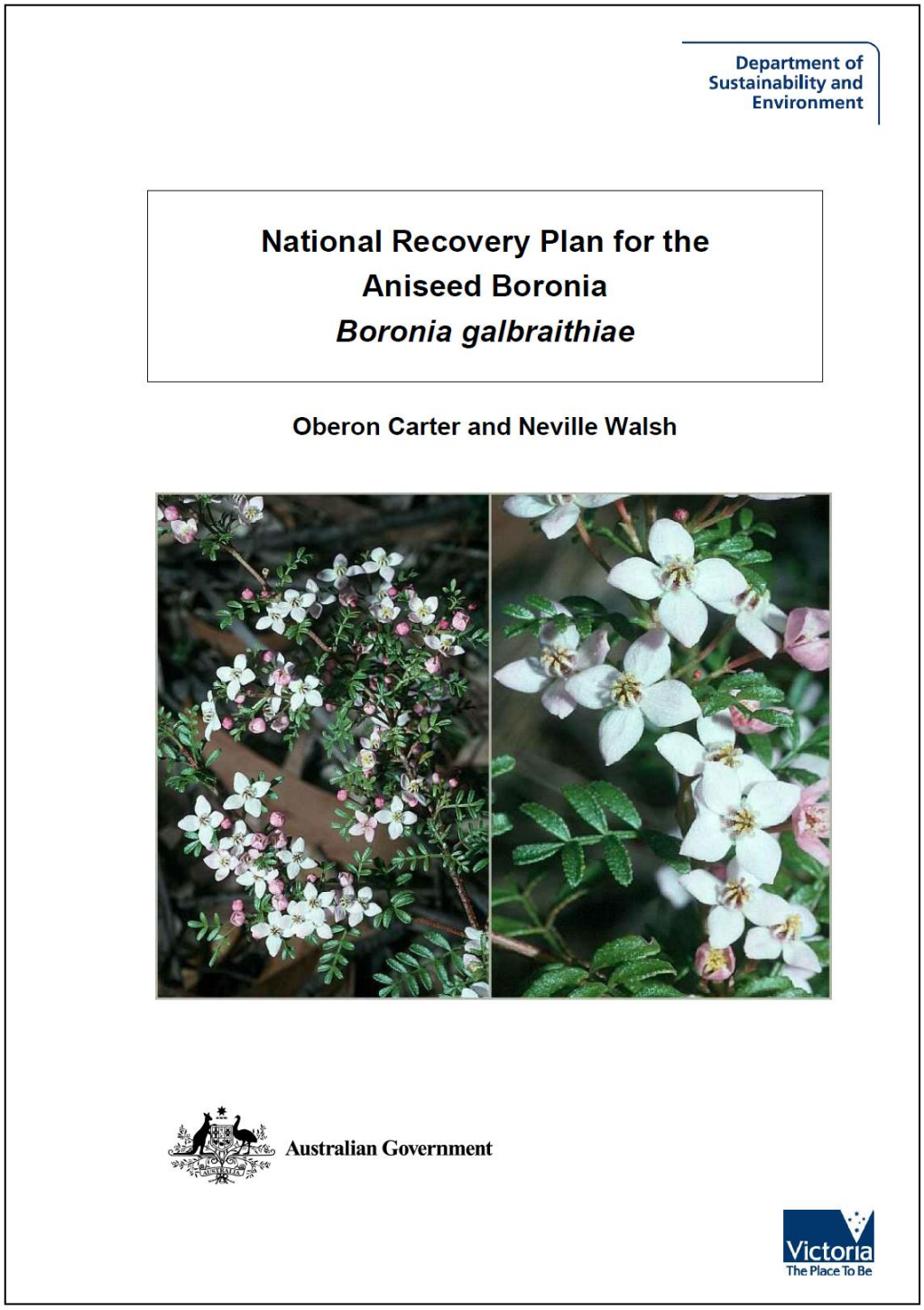
Obtaining and reading a copy of DOC's recovery plans can be a time consuming exercise. Since only limited copies of plans are printed and they are not easily accessible in libraries, finding information about threatened species recovery on the DOC website is a challenge, because you have to check the archives of the departments 'science & technical publications' for current recovery plans. Australian national recovery plans are found through the Australian Government Department of Sustainability, Environment, Water, Population and Communities website, under the topic threatened species and ecological communities. An easily accessible recovery plan is more likely to be read. Although in reality it is probably only researchers and DOC staff who read recovery plans, making them easier to find with a link on the threatened species webpage could be another way to increase public awareness of some of our less well-known threatened species, such as *Dactylanthus taylorii* and our native Skinks (*Cyclodina* spp). Ultimately, the more public awareness you raise about a particular issue, the more the public is willing to get behind and raise funds, volunteer or teach others about conservation issues (Moore *et al.*, 2006; Novacek, 2008).

Recently, the focus on threatened species conservation has shifted to the identification and conservation of ecosystems. The governments of the Australian Commonwealth, Australian Capital Territory, New South Wales, Victoria and Western Australia have all enacted legislation to protect threatened ecological communities or ecosystems. Whilst Queensland has legislation to protect endangered regional ecosystems specifically from clearing (New, 2000; ASEC, 2006). Despite the fact that it is important to manage individual threatened species in order to conserve the many varied components of biodiversity, it is far more cost-effective to prevent species from becoming threatened in the first place by conserving them as part of viable and functioning ecosystems (Bowles & Whelan, 1994; Bonnie, 1999; Joseph *et al*., 2008). The move for future planning should therefore be towards creating management plans for threatened ecosystems within a region or country, as well as maintaining and creating recovery plans for individually threatened species. Such as the Eastern Suburbs Banksia Scrub Endangered Ecological Community plan, which addresses the issues facing plants, reptiles, birds, mammals and amphibians in this area (DEWHA, 2010c). In New Zealand, only plans for Coastal Cresses (no.26, which expired in 2004) and Grassy Plants of Fertile Sites (no.52) contain any mention of planning for the conservation of the ecosystem in which these plants live. Furthermore, whilst detailed assessments of the conservation status of

individual groups such as birds can be used to identify species that need protection. No equivalent assessments have been made at the national level for threatened ecosystems in New Zealand or Australia (Garnett & Crowley, 2000; Sattler & Creighton, 2002a; Cullen *et al.*, 2004).

It is important to note that many factors besides having a scientifically sound recovery plan may contribute to a species declining in numbers (Boersma *et al*., 2001). Even an excellent plan must be implemented well. Therefore, plans should be defined as clearly as possible and a critical review of performance along with the implementation process must be carried out (Miller *et al.,* 1994; Boersma *et al.,* 2001). Ultimately, the recovery of a species threatened with extinction takes time. We are attempting to halt or reverse declines in population numbers that in some instances have been hundreds of years in the making. Creating efficient legislation, reviewing current recovery plan content, increasing the number of threatened species recovery plans as well as involving the community more in the recovery of endangered species are all achievable measures. Recovery plans can enhance endangered species management but only if they have been written succinctly and are properly implemented and frequently reviewed. Creating national recovery plans for more of our threatened species, may be a simple solution to the long term protection and management of those species that have until now have been sorely neglected, and which without attention could face the same fate as the Moa (*Dinornis* spp.).

Chapter 7. Recommendations and Further Research



Source: National Recovery Plan for the Aniseed Boronia (*Boronia galbraithiae*) (Carter & Walsh, 2006).

Developing management plans for the recovery of a species threatened with extinction achieves very little, if they are not implemented effectively in conjunction with relevant legislation and the support of the community. Slow decision making; a lack of input from experts outside the organisation; failure to develop concise recovery plans that can evaluate progress of strategies; and a complex organisational hierarchy are common problems faced by conservation managers around the world (Miller *et al.*, 1994; Brigham *et al*., 2002; Schultz & Gerber, 2002). These problems appear to be impeding the recovery of endangered species in New Zealand and could be addressed if recovery plans were developed for all threatened species and plans which have lapsed were reviewed. Realistically, DOC has neither the time, funding or personnel or create recovery plans for all species now threatened with extinction in New Zealand, but revising the legislation surrounding endangered species management; an increase in spending on endangered species recovery; increasing awareness and involvement of the community in recovery programmes; and researching threats and management strategies for all endangered species would help preserve some species that are currently being neglected.

7.1 Legislation and policy

There are numerous international agreements (Appendix 1) and national acts (Appendix 2) that DOC must work under. Determining how these agreements and acts are shaping endangered species policy in New Zealand and how they influence planning decisions could influence the success or failure of future recovery initiatives. It would also be useful to know how they are incorporated into planning documents (at the moment only seven plans written since 2003 mention legislation in the document) and the impact they may have, if any, on the implementation of ecosystem based management plans in the future.

Current national legislation that concerns endangered species should be re-examined. Perhaps a new Act similar to that of the ESA1973 or the EPBC1999 should be developed to replace the WA1953, which is outdated in terms of today's management of threatened native flora and fauna. Legislation at the national level is needed in order to mandate recovery planning for every threatened species and prioritise the management of our critically endangered species. Effective legislation could protect threatened species, their habitat which is critical for long term survival (such as habitat currently on private land) as well as establish accountability for human-induced threatening processes.

7.2 Community involvement in endangered species recovery

There is a high level of interest and awareness about only some of our endangered species, like the Kiwi (Seabrook-Davison, 2010). The need to promote public awareness, interest or involvement in the recovery process appears in 53 of the recovery plans. Yet the reality is that not enough is being done to inform and educate the general public about conservation issues. A large number of stakeholders work with DOC (Appendix 4). The level of support these stakeholders give for different recovery programmes will determine the success of these programmes long term. In particular, the role Maori and iwi will play in the future management of threatened species, as well as the cultural significance of different species, should be examined, because advocacy with Maori is written into most New Zealand recovery plans as a strategy for the future. Increasing opportunities for people to volunteer in recovery efforts, or finding a better way of informing the public of recovery actions (such as release dates, planting seedlings or tallying up numbers of bird species sighted at the beach or wetlands) could mitigate this.

Using media such as newspapers, television and internet will increase public awareness of conservation issues, such as the threats facing our endangered species. Only one plan (*Dactylanthus taylorii*, no.56) currently mentions developing a webpage to inform the community about the conservation of the species. There are detailed web pages on the DOC website (http://www.doc.govt.nz/conservation/) for a number of different threatened species which give ideas about how to help the species recovery. However, finding recovery plans for species requires hunting through publication archives and perhaps a link on the conservation webpage would help those interested in planning documents find them. Webpages could also be developed in partnership with existing and potential sponsors (i.e. like the Bank of New Zealand sponsored 'BNZ Kiwi Trust' webpage). This would benefit both parties by highlighting threatened species conservation and creating brand awareness for the company. It may also encourage greater funding for less well known 'cute and cuddly' species which would raise their public profile, thereby increasing funding and community support for their recovery programme.

Creating more opportunities for the general public to see different threatened species in New Zealand by allowing zoological facilities to hold captive populations of a wider variety of threatened species (i.e. plants, bats, skinks and fish) would also be an effective way to

increase awareness of the plight facing less known species. It is also a good way to promote conservation of threatened species in children because they will be able to see and possibly hear the species (in the case of the bird species).

7.3 Research into recovery strategies

Investigation is needed into the threats facing our endangered species in the future. The distribution of native vegetation in the landscape, vegetation structure, fire, livestock browsing, rainfall, soil condition and climate change have the potential to influence threatened species breeding and therefore population numbers. Research also needs to be carried out to determine if creating more mainland island sanctuaries is feasible in the future, because offshore islands are slowly beginning to reach capacity for some species (Wickes *et al.*, 2009). Researching these factors as well as improving knowledge about our threatened species could be achieved by universities. Encouraging involvement in threatened species research perhaps by offering scholarships to university student researchers (especially for species without a current management plan) would speed up the process of formulating comprehensive recovery plans for all species.

Research into threatened species management tools used overseas could provide new insights for future management in New Zealand. Collaboration with Parks and Wildlife staff in Australia would enable DOC to share successful strategies used in New Zealand conservation (such as translocation of vulnerable populations) and learn how to develop national threatened species legislation and write comprehensive planning documents (i.e. how to create implementation schedules/timetables and incorporate budget information in planning documents). Ecosystem based plans are already being developed in Australia, such as the Eastern Suburbs Banksia Scrub Endangered Ecological Community plan, which addresses the issues facing plants, reptiles, birds, mammals and amphibians in this area (DEWHA, 2010c). Lessons learnt from developing and implementing this plan could be used by DOC to create ecosystem based plans in New Zealand for our wetlands and other critical habitat.

Genetics is still a new and growing field which could hold answers for recovery planning. Techniques such as DNA sequencing of species to determine their phylogeny or techniques such as cryogenics (which freezes cells for future use) are still misunderstood. With further

research, these techniques could be used to safeguard a species (such as the Kakapo) against unforeseen events or be used in the future breeding of a species when more successful management tools may increase the odds of a species surviving long term.

7.4 Implementation schedules

Recovery plans are an important tool used to guide an effective management strategy for a species threatened with extinction (New, 2000, Alexander, 2008). Implementation schedules or timelines can be used to measure the effective implementation of actions proposed for the duration of the plan. They also outline milestones which need to be achieved if the long term future of the species is to be ensured. Recovery plans should state who is responsible for the implementation of each objective because it ensures accountability for actions, and informs the reader who to contact to find out more information about a particular objective or action. Implementation schedules and timeline in future New Zealand recovery plans could be modelled on that found in Australian plans, such as the one in the Aniseed Boronia plan (Table 47, Carter & Walsh, 2006, pg10).

7.5 Accountability and resources

There are a number of species threatened with extinction in New Zealand that currently do not have a recovery plan (e.g. New Zealand Falcon). The discrepancy between the number of species threatened with extinction, and the number of species with recovery plans needs to be addressed. Reptiles, invertebrates and plants are currently under represented in recovery planning, yet make up a larger proportion of the biodiversity in this country.

There is a wide variety of recovery strategies written in the New Zealand plans. Some such as translocation and captive breeding, have proven to be successful at increasing population numbers, so research should be carried out to see if they are applicable to other species. Many of the strategies also focus on short term threats rather than long term ones. A revision of the literature indicates there are a variety of different techniques which could be used to safeguard populations of threatened species against long term threats such as increased flooding events (i.e. by diverting river channels, New, 2000), and their use in New Zealand threatened species recovery should be examined.

Even though recovery plans in New Zealand are effectively national plans too, it is up to individual conservancies to create and implement their own work plans. A survey of DOC staff in 2010, found the reasons why a lack of cross-boundary management of threatened species occurs is because there are limited resources, with other priorities taking precedence and different funding pressures exist within conservancies (confidential discussion with DOC employee, 2009; Seabrook-Davison, 2010). Both this study and talks with DOC staff members reveal that a national coordination of threatened species management combined with increased communication between different conservancies, are simple steps which will improve threatened species management in this country.

When plans are written, there should be greater consistency in what content they contain. As information such as budgets, cultural significance to Maori and iwi as well as strategic directives appear in some but not all plans written since 2003. Plans number 60 and 61 should serve as a model for future plans, because they contain in-depth knowledge of the species; outline clear and concise management actions; and state when and who is responsible for implementing work plan actions. They also include dates when the plan should be reviewed, hopefully increasing accountability of recovery actions.

The budget currently available for endangered species recovery should be examined. Either not enough is being spent, particular species are receiving a majority of the funding (Moran, 2003), or more money is being spent on threat mitigation than actual population recovery techniques. Shifting some of the money from threat management towards creating concise, effective planning documents will enable a species recovery to take place even with changes in the economic and political future of this country. Increased funding should also be found to increase community awareness and involvement in threatened species recovery efforts. This would have the two-fold effect of increasing volunteer and community support for recovery programmes and would increase community awareness of funding shortfalls. Potentially encouraging more businesses and stakeholders to sponsor and invest in the recovery of our less iconic species, such as our native frogs and plants.

All of the Australian plans include budget information for the length of the plan and a rough idea of the types of costs associated with each objective. These figures are based around commonwealth and state figures. DOC should be able to do this too, since these recovery plans are fundamentally national plans as well. Accountability of all money spent on a

species should be put in a spreadsheet or implementation schedules in all future plans (detailed breakdown of all funding needed for each objective/action in the work plan). This will give an indication of how much money is spent on the species and can outline where additional funding may be needed. The importance of funding cannot be underestimated because funding is critical for translating a recovery plan into action. Even the best crafted recovery plans will fail if they are not implemented effectively and effective implementation is impossible without sufficient funding (Hoekstra, 2002).

7.6 Monitoring

Most of the Australian plans analysed contain 'performance criteria' for each objective in the work plan, which outline how to measure the success of an objective after appropriate recovery actions have been carried out. Creating performance criteria for objectives in future New Zealand recovery plans (this could be modelled on the criteria used in the Hihi recovery plan, no.54), would facilitate monitoring to track the species as recovery strategies are being carried out.

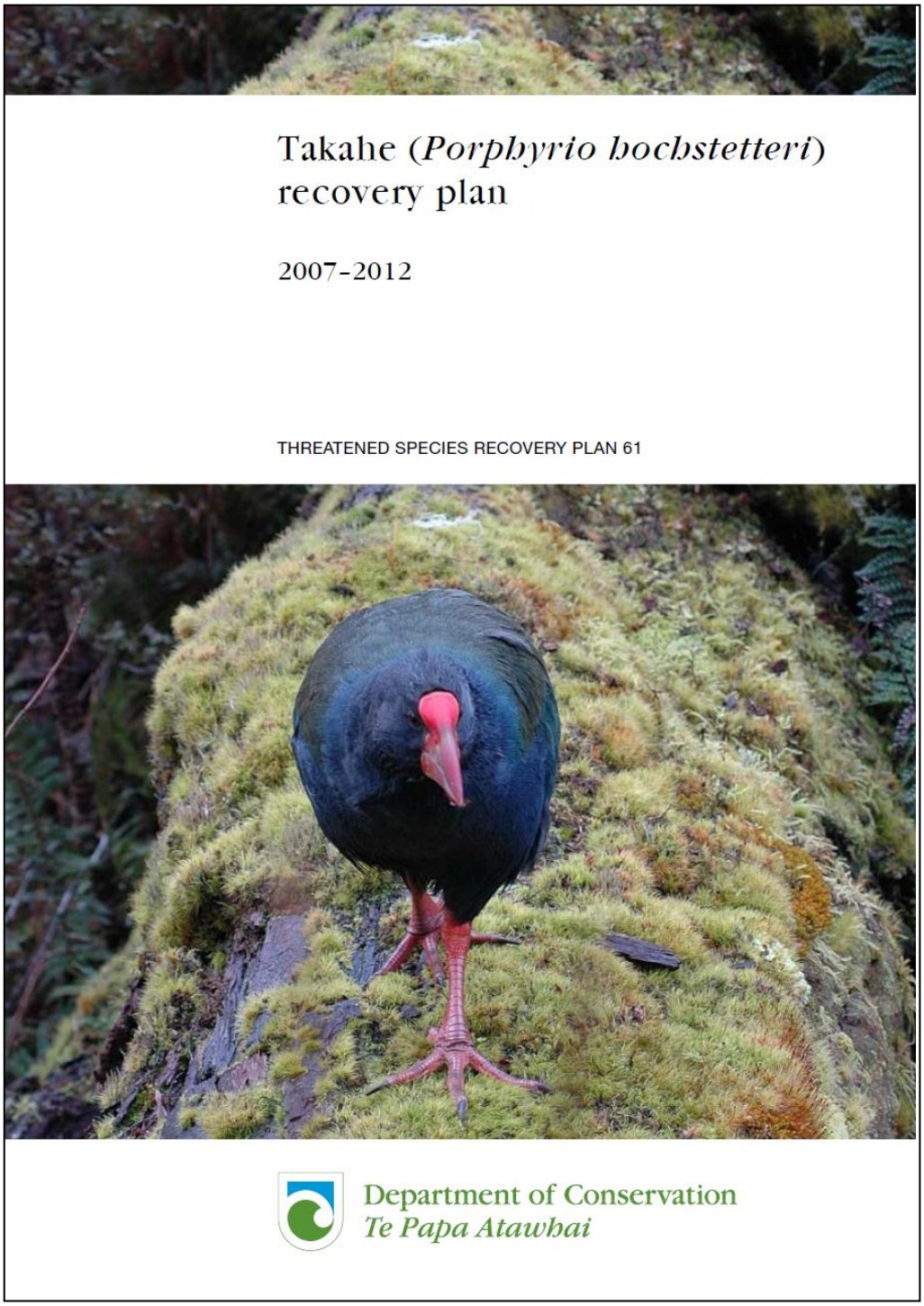
Twenty-two recovery plans have now lapsed with a further 14 plans (no.34-47) due to expire at the end of this year. Since recovery plans were first approved in 1991, only ten species have had their plans reviewed (these include iconic species such as the Kiwi and Tuatara). Plans should be reviewed within a year of their expiration to ensure that there is always a current working document for those carrying out recovery actions (Boersma *et al.*, 2001; Clark *et al.*, 2002). Perhaps it is the process for preparing conservation management strategies and plans in New Zealand (Appendix 5) that is delaying the adoption of new recovery plans. In which case, this process should be re-examined so that plans are formulated and adopted quicker. An external reviewer could also be used to formally review and evaluate recovery programmes when they lapse, like that suggested in the Helmeted Honeyeater plan (Menkhorst, 2008).

As part of adaptive management, all recovery plans should be periodically reviewed and the results of any previous management should be reported in the plan and critically analysed (Foin *et al.*, 1998). There needs to be a comprehensive review of all plans that have lapsed to see if recovery has been successful, and if not, then a new plan needs to be written to focus recovery efforts for the species for another ten year period. Reviewed plans should contain a

chapter or Appendix which details how successful objectives and actions carried in the previous work plan were, and whether or not changes need to be made to ensure they operate more effectively in the future. Good recovery plans should make provision for monitoring to track the species throughout the recovery process (Campbell, *et al*., 2002). This could be modelled in future plans on the Table in the Appendix of the New Zealand Dotterel recovery plan (no.58).

Many of these recommendations and areas of further research could be easily implemented by DOC to improve recovery planning for endangered species in New Zealand both now and in the future. The reality is many would also require additional funding, a closer look at changing current policies, and increased communication between scientific staff, head office and between conservancies. Without a willingness to accept criticism of current practices and periodic reviews of planning documents, progress in the recovery of our endangered species will stall, due to a lack of guaranteed funding and community support for the long term coordinated recovery of our threatened and already endangered endemic species.

Chapter 8. References



Source: Takahe (*Porphyrio hochstetteri*) Threatened Species Recovery Plan 61 (Wickes, Crouchley, Maxwell, 2009).

Alexander, M (2008). *Management planning for nature conservation: a theoretical basis and practical guide.* United Kingdom: Springer.

Ashworth, D., Tuckey, K. (2001). *Recovery Plan for the Blue Mountains Water Skink (Eulamprus leuraensis).* Retrieved on November 2, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/blue-mtns-water-skink/index.html.

Australian and New Zealand Environment and Conservation Council (ANZECC) (2001). *Review of the National Strategy for the Conservation of Australia's Biological Diversity*, Environment Australia, Canberra. Retrieved on October 18, 2010, from the World Wide Web: www.environment.gov.au/biodiversity/publications/review/index.html.

Australian Council of National Trusts (ACNT) (2008). *Annual report 2007-2008*. Retrieved on October 3, 2010, from the World Wide Web: http://www.nationaltrust.org.au/Annual-Reports.

Australian Government (2010). *About Australia: our government*. Retrieved on April 8, 2010, from the World Wide Web: http://australia.gov.au/about-australia/our-government/state-and-territory-government.

Australian Government Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC) (2010). *What is caring for our country?* Retrieved on October 19, 2010, from the World Wide Web: http://www.nrm.gov.au/about/caring/index.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2003). *Threatened Species Day Fact Sheet.* Retrieved on October 18, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/tsd-2003.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2006). *Species information partnerships: sharing knowledge on threatened species.* Paper prepared for the 2006 Australian State of the Environment Committee. Retrieved on October 18, 2010, from the World Wide Web: http://www.deh.gov.au/soe/2006/emerging/species-listing/index.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009a). *EPBC listed key threatening processes*. Retrieved on September 28, 2010, from the World Wide Web: http://www.environment.gov.au/cgibin/sprat/public/publicgetkeythreats.pl.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009b). *EPBC act: about the EPBC act*. Retrieved on March 28, 2010, from the World Wide Web: http://www.environment.gov.au/epbc/about/index.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009c). *EPBC Act: what is protected: threatened species and ecological communities.* Retrieved on September 8, 2010, from the World Wide Web: http://www.environment.gov.au/epbc/protect/species-communities.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009d). *Threatened species and ecological communities: recovery plans.* Retrieved on March 28, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009e). *Recovery planning – compliance checklist for legislative and process requirements.* Retrieved on September 13, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/guidelines/index.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009f). *Steps in adopting a recovery plan.* Retrieved on September 13, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery-steps.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009g). *The Australian Environment Act: Report of the Independent review of the Environment Protection and Biodiversity Conservation Act 1999*. Retrieved on February 13, 2010, from the World Wide Web: http://www.environment.gov.au/epbc/review/publications/final-report.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a). *Environment protection and biodiversity conservation act 1999 (EPBC Act) fact sheet.* Retrieved on April 8, 2010, from the World Wide Web: http://www.environment.gov.au/epbc/publications/epbc-act-fact-sheet.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010b). *Australia's international role in conserving biodiversity*. Retrieved on April 14, 2010, from the World Wide Web: http://www.environment.gov.au/ biodiversity/international/index.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010c). *EPBC Act list of threatened fauna with a recovery plan.* Retrieved on October 14, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/ threatened/recovery-list-common.html.

Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010d). *Fauna for which Recovery Plans are being prepared as at 3 August 2010*. Retrieved on October 14, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/pubs/fauna-plans-being-prepared.pdf.

Australian Law Reform Commission (ALRC) (2010). *Recognition of Aboriginal customary laws: Aboriginal participation in resource management.* Retrieved on October 25, 2010, from the World Wide Web: http://www.alrc.gov.au/publications/36.%20Securing%20 Hunting, %20Fishing%20and%20Gathering%20Rights/aboriginal-participation-resource-ma.

Australian State of the Environment Advisory Committee (ASEAC) (1996). *Australia state of the environment 1996- independent report to the Commonwealth Minister for the environment and heritage.* Retrieved on September 8, 2010, from the World Wide Web: http://www.environment.gov.au/soe/1996/publications/report/index.html.

Australian State of the Environment Committee (ASEC) (2001). *Australia state of the environment 2001- independent report to the Commonwealth Minister for the environment and heritage.* Retrieved on September 8, 2010, from the World Wide Web: http://www.environment.gov.au/soe/2001/publications/report/index.html.

Australian State of the Environment Committee (ASEC) (2006). *Australia state of the environment 2006- independent report to the Commonwealth Minister for the environment and heritage.* Retrieved on September 8, 2010, from the World Wide Web: http://www.environment.gov.au/soe/2006/index.html.

Australian Weeds Committee (Natural Resource Management Ministerial Council) (2006). *Australian weeds strategy: A national strategy for weed management in Australia*. Retrieved on April 8, 2010, from the World Wide Web: http://www.weeds.org.au/docs/ Australian_Weeds_Strategy.pdf.

Bank of New Zealand Save the Kiwi Trust (BNZ) (2010). *Resources to save kiwi*. Retrieved on April 24, 2010, from the World Wide Web: http://www.savethekiwi.org.nz/resources-to-save-kiwi/resources-to-save-kiwi.html.

Barr, S., Glig, A.W. (2007). A conceptual framework for understanding and analyzing attitudes towards environmental behaviour. *Journal of Geography and Anthropology,* 4, 361-379.

Beeton, R.J.S., Buckley, K.I., Jones, G.J., Morgan, D, Reichelt, R.E., Trewin, D (2006). *Australia State of the Environment 2006,* Independent report to the Australian Government Minister for the Environment and Heritage, Department of the Environment and Heritage, Canberra. Retrieved on September 10, 2010, from the World Wide Web: www.environment.gov.au/soe/2006/publications/report/index.html.

Bell, B.D. (1975). The rare and endangered species of the New Zealand region and the policies that exist in their management. *International Council for Bird Conservation Bulletin,* 12, 140-146.

Berrens, R.P. (2001). The safe minimum standard of conservation and endangered species: a review. *Environmental Conservation*, 28, 104-116.

Berkes, F. (2007). Community-based conservation in a globalized world. *Proceedings of the National Academy of Science USA,* 104, 39, 15188-15193.

Biodiversity Assessment Working Group (2009). *Assessment of Australia's terrestrial biodiversity*. Retrieved on November 2, 2010, from the World Wide Web: www.environment.gov.au/biodiversity/publications/terrestrial-assessment/case-studies.html.

Biodiversity Decline Working Group (2005). *A national approach to biodiversity decline, report to the natural resource management ministerial council, Australian Government, Canberra.* Retrieved on September 8, 2010, from the World Wide Web: www.environment.gov.au/biodiversity/ publications/biodiversity-decline.html.

Black-throated Finch Recovery Team (2007). *National recovery plan for the black-throated finch southern subspecies Poephila cincta cincta.* Retrieved on October 17, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery-list-common.html.

Boardman, R. (2006). *The international politics of bird conservation: biodiversity, regionalism and global governance*. Glouster, England: Edward Elgar Publishing Limited.

Boersma, P.D., Kareiva, P., Fagan, W.F., Clark, J.A., Hoekstra, J.M. (2001). How good are endangered species recovery plans? *Bioscience*, 51, 643-649.

Bonnie, R. (1999). Endangered species mitigation banking: promoting recovery through habitat conservation planning under the endangered species act. *The Science of the Total Environment*, 240, 11-19.

Bottrill, M.C., Walsh, J.C., Watson, J.E.M., Joseph, L.N., Ortega-Argueta, A., Possingham, H.P. (2011). Does recovery planning improve the status of threatened species? *Biological Conservation*, 10,10146.

Bowles, M.L., Whelan, C.J. (Eds.) (1994). *Restoration of endangered species: conceptual issues, planning and implementation*. Cambridge, England: Cambridge University Press.

Bridgman, P., Davis, G. (2003). *The Australian policy handbook (3rd ed.)*. New South Wales, Australia: Crow's Nest, Allen and Unwin.

Brigham, C.A., Power, A.G., Hunter, A. (2002). Evaluating the internal consistency of recovery plans for federally endangered species. *Ecological Applications* 12(3), 648-654.

Brown, A., Molloy, J. (1999). Species recovery planning standard operating procedure. *Department of Conservation*, Wellington.

Brown, R., Creaser, P. (Eds.) (2006). *Indigenous involvement in environmental and heritage management, case studies prepared for the 2006 Australian state of the environment committee.* Retrieved on October 19, 2010, from the World Wide Web: http://www.environment. gov.au/soe/2006/publications/integrative/indigenous/index.html.

Burgmann, M.A., Lindenmayer, D.B. (1998*). Conservation biology for the Australian environment*. NSW, Australia: Surrey Beatty & Sons PTY Limited.

Butler, D., McLennan, J. (1991). *Kiwi recovery plan. Threatened species recovery plan 2*. Retrieved on October 20, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series /threatened-species-recovery-plans/archive/

Campbell, S.P., Clark, A.J., Crampton, L.H., Guerry, A.D., Hatch, L.T., Hosseini, P.R., Lawler, J.J., O'Connor, R.J. (2002). An assessment of monitoring efforts in endangered species recovery plans. *Ecological Applications*, 12(3), 674-681.

Carter, O., Walsh, N. (2006). *National recovery plan for the Aniseed Boronia (Boronia galbraithiae)*. Retrieved on October 28, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery-list-common.html.

Carwardine, J., Wilson, K.A., Ceballos, G., Ehlich, P.R., Naidoo, R., Iwamura, T., Hajkowicz, S.A., Possingham, H.P. (2008). Cost-effective priorities for global mammal conservation. *Proceedings of the National Academy of Sciences USA*, 105,32,11466-11450.

Ceballos, G., Ehrlich, P.R. (2009). Discoveries of new mammal species and their implications for conservation and ecosystem services. *Proceedings of the National Academy of Sciences*, 106, 3841-3846.

Centre for Research, Evaluation and Social Assessment (CRESA) (1998). *Community consultation by the Department of Conservation: an independent review.* Wellington, New Zealand.

Chapin, F.S., Zavaleta, E.S., Eviner, V.Y., Naylor, R.L., Vitousek, P.M., Hooper, D.U., Lavore, S., Salai, O.E., Hobbie, S.E., Mack, M.C., Diaz, S. (2000). Consequences of changing biodiversity. *Nature*, 405, 234-242.

Chapman, T., Cale, B. (2008). *Muir's Corella (Cacatua pastinator pastinator) Recovery Plan*. Retrieved on November 2, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery-list-common.html.

Clark, J.A., Harvey, E. (2002). Assessing multi-species recovery plans under the endangered species act. *Ecological Applications*, 12, 655-662.

Clark, J.A., Hoekstra, J.M., Boersma, P.D., Kareiva, P. (2002). Improving U.S. endangered species act recovery plans: key findings and recommendation of the SCB recovery plan project. *Conservation Biology*, 16, 1510-1519.

Clark, T.W., Reading, R.P., Clarke, A.L. (Eds.) (1994). *Endangered species recovery: finding the lessons, improving the process*. Washington, United States: Island Press.

Clout, M. (2001). Where protection is not enough: active conservation in New Zealand. *Trends in Ecology and Evolution*, 16, 415-416.

Clout, M.N., Craig, J.L. (2008). The conservation of critically endangered flightless birds in New Zealand. *Ibis* 6, 181-190.

Cofinas, M., Creighton, C. (2001). *Australian Native Vegetation Assessment 2000,* Australian Natural Resources Atlas, National Land and Water Resources Audit, Canberra, www.anra.gov.au/topics/vegetation/pubs/native_vegetation/nat_veg_acks.html (Accessed 21 August 2008)

Cogger, H.G., Cameron, E.E., Sadlier, R.A., Eggler, P. (1993). *The action plan for Australian reptiles*. *Australian Nature Conservation Agency*. Retrieved on May 6, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/action/reptiles/index.html.

Commonwealth Department of the Environment, Sport and Territories (CDEST) (1996). *The national strategy for the conservation of Australia's biological diversity*. Canberra, Australia: Inprint Limited.

Commonwealth of Australia Law (ComLaw), Attorney-General's Department (2010).*Environment protection and biodiversity conservation act 1999*. Retrieved on September 1, 2010, from the World Wide Web: http://www.comlaw.gov.au/ComLaw/Legislation/ActCompilation1.

Conservation International (2007). *Biodiversity Hotspots*. Retrieved on September 16, 2010, from the World Wide Web: http://web.conservation.org/xp/CIWEB/regions/priorityareas/hotspots.xml.

Convention on Biological Diversity (CBD) (2010). *Biodiversity is life, biodiversity is our life*. Retrieved on November 2, 2010, from the World Wide Web: http://www.cbd.int/2010/welcome/.

Cork, C., Sattler, P., Creighton, C., Alexandra, J. (2006*). Biodiversity. Theme commentary prepared for the 2006 Australian State of the Environment Committee, Department of the Environment and Heritage, Canberra*. Retrieved on September 1, 2010, from the World Wide Web: http://www.environment.gov.au/soe/2006/publications/commentaries/biodiversity /index.html

Cree, A., Butler, D. (1993). *Tuatara recovery plan (Sphenodon spp.)*. Wellington, New Zealand: Department of Conservation.

Crossen, T. (2007). Should snails have standing? – towards and endangered species act for New Zealand. *Resource Management Journal*, 4, 12-17.

Cullen, R., Hughey, K., Kerr, G. (2006). *Public perceptions of New Zealand's environment*. Retrieved on October 6, 2010, from the World Wide Web: http://ageconsearch.umn.edu/bitstream/31958/1/cp06cud1.pdf.

Cullen, R., Moran, E., Hughey, K.F.D. (2005). Measuring the success and cost effectiveness of New Zealand multiple-species projects to the conservation of threatened species. *Ecological Economics,* 53, 311-323.

Czech, B., Krausman, P.R., Borkhataria, R. (1998). Social construction, political power and the allocation of benefits to endangered species. *Conservation biology*, 12, 5, 1103-1112.

Dawson, D., Shrogen, J.F. (2001). An update on priorities and expenditures under the endangered species act. *Land Economics*, 77, 527-532.

De Lange, P.J., Norton, D.A., Courtney, S.P., Heenan, P.B., Barkla, J.W., Cameron, E.K., Hitchmough, R., Townsend, A.J. (2009). Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany*, 147, 61-96.

Department of Conservation (DOC) (1997). *Conservation action: department of conservation achievements and plans 1996/1997-1997/1998*. Wellington, New Zealand: Department of Conservation.

Department of Conservation (DOC) (1998a). *Conservation action: conservation at work in 1997/1998.* Wellington, New Zealand: Department of Conservation.

Department of Conservation (DOC) (1998b). *Restoring the dawn chorus: department of conservation strategic business plan.* Wellington, New Zealand: Department of Conservation.

Department of Conservation (DOC) (2001). *The New Zealand biodiversity strategy: summary of achievements during 2000-2001*. Wellington, New Zealand: Department of Conservation.

Department of Conservation (DOC) (2006). *Consultation guidelines*. Retrieved on September 28, 2010, from the World Wide Web: http://www.doc.govt.nz/upload/documents/getting-involved/consultations/how-doc-consults/consultation-guidelines.pdf.

Department of Conservation (DOC) (2008a). *Annual report for year ended 30 June 2008.* Retrieved on September 28, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/about-doc/annual-report-for-year-ended-30-june-2008/.

Department of Conservation (DOC) (2008b).*Briefing to the new minister of conservation 2008.* Retrieved on April 28, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/about-doc/briefing-to-the-new-minister-of-conservation-2008/.

Department of Conservation (DOC) (2008c). *Conservation action*. Retrieved on April 28, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/about-doc/conservation-action/.

Department of Conservation (DOC) (2008d). *Community conservation fund guidelines*. Retrieved on August 27, 2010, from the World Wide Web: http://www.doc.govt.nz/upload/documents/getting-involved/in-your-community/community-conservation-fund/ccf-round2-guidelines.pdf.

Department of Conservation (DOC) (2009). *A short history of the department of conservation 1987-2007- born with a mission.* Retrieved on April12, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/about-doc/a-short-history-of-doc/born-with-a-mission/.

Department of Conservation (DOC) (2009a). *A short history of the department of conservation 1987-2007- the new millennium.* Retrieved on April 12, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/about-doc/a-short-history-of-doc/the-new-millennium/.

Department of Conservation (DOC) (2009b). *New Zealand biodiversity strategy*. Retrieved on July 28, 2010, from the World Wide Web: http://www.biodiversity.govt.nz/picture/doing/nzbs/summary.html

Department of Conservation (DOC) (2009c). *Conservation act 1987*. Retrieved on July 28, 2010, from the World Wide Web: http://www.doc.govt.nz/about-doc/role/legislation/conservation-act/.

Department of Conservation (DOC) (2009d). *Statement of intent 2009-2012*. Retrieved on October 23, 2010, from the World Wide Web: http://www.doc.govt.nz/upload/documents/about-doc/role/policies-and-plans/statement-of-intent/statement-of-intent-(2009-2012).pdf.

Department of Conservation (DOC) (2009e). *Annual report. For the year ended 30 June 2009*. Retrieved on October 25, 2010, from the World Wide Web: http://www.doc.govt.nz/upload/documents/about-doc/role/policies-and-plans/annual-report-for-the-year-ended-30-june-2009.pdf.

Department of Conservation (DOC) (2010a). *Statement of intent 2010-2013*. Retrieved on October 23, 2010, from the World Wide Web: http://www.doc.govt.nz/upload/documents /about-doc/role/policies-and-plans/statement-of-intent/statement-of-intent-(2010-2013).pdf.

Department of Conservation (DOC) (2010b). *How conservation management strategies & plans are prepared*. Retrieved on October 23, 2010, from the World Wide Web: http://www.doc.govt.nz/about-doc/role/policies-and-plans/conservation-management-strategies-and-plans/how-they-are-prepared/.

Department of Conservation (DOC) (2010c). *Sponsorships & partnerships.* Retrieved on October 23, 2010, from the World Wide Web: http://www.doc.govt.nz/getting-involved/sponsorships-and-partnerships/threatened-species-trust-programme/.

Department of Conservation (DOC) (2010d). *Threatened species recovery plan archive*. Retrieved on October 23, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series/threatened-species-recovery-plans/archive/.

Department of Conservation (DOC) (2010e). *Annual report. For the year ended 30 June 1010.* Retrieved on February 13, 2010, from the World Wide Web: http://www.doc.govt.nz/upload/documents/about-doc/annual-report-2010/annual-report-for-the-year-ended-30-june-2010.pdf.

Department of Land and Natural Resources (DLNR) (2001). *The Hawaii endangered bird conservation program.* Retrieved on November 2, 2010, from the World Wide Web: http://www.state.hi.us/dlnr/dofaw/captiveprop/consprog.htm.

Department of Sustainability and Environment (2003). *Flora & fauna guarantee action statement: Helmeted honeyeater*. Retrieved on September 12, 2010, from the World Wide Web: www.dse.vic.gov.au/DSE/nrenpa.nsf/LinkView.

Division of Forestry and Wildlife (DOFAW) (2005). *Hawaii's comprehensive wildlife conservation strategy*. Retrieved on August 8, 2010, from the World Wide Web: http://www.state.hi.us/dlnr/dofaw/cwcs/index.html.

Dowding, J.E., Davis, A.M. (2007). *New Zealand dotterel (Charadrius obscurus) recovery plan, 2004-14. Threatened species recovery plan 58*. Retrieved on September 3, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-andtechnical/products/series/threatened-species-recovery-plans/archive/.

Dowding, J.E., Murphy, E.C. (2001). The impact of predation by introduced mammals on endemic shorebirds in New Zealand: a conservation perspective. *Biological Conservation*, 99, 47-64.

Duffey, E. (2001). Introduced pest species and biodiversity conservation in New Zealand. *Biological Conservation*, 99, 1-1.

Duncan, R.P., Blackburn, T.M. (2004). Extinction and endemism in the New Zealand avifauna. *Global Ecology and Biogeography*, 13, 509-517.

Ecroyd, C.E. (1995). *Dactylanthus taylorii recovery plan. Threatened species recovery plan 16.* Wellington, New Zealand: Department of Conservation.

Ehrlich, P.R., Daily, G.C. (1993). Population extinction and saving biodiversity. *Ambio*, 22, 64-68.

Elliot, G.P., Merton, D.V., Jansen, P.W. (2001). Intensive management of a critically endangered species: the kakapo. *Biological Conservation*, 99, 121-133.

Evans, S.M., Birchenough, A.C. (2001). Community-based management of the environment: lessons from the past and options for the future. *Aquatic Conservation – Marine and Freshwater Ecosystems*, 11 (2), 137-147.

Ewing, S. (1999). Landcare and community-led watershed management in Victoria, Australia. *Journal of the American Water Resources Association*, 35(3), 663-673.

Fairburn, G.A., Hughey, K.F.D., Cullen, R. (2004). Cost effectiveness of endangered species management: the kokako (*Callaeas cinerea*) in New Zealand. *New Zealand Journal of Ecology*, 28 (1), 83-91.

Ferraro, P.J., McIntosh, C., Ospina, M. (2007). The effectiveness of the US endangered species act: an econometric analysis using matching methods. *Journal of Environmental Economics and Management*, 54, 245-261.

Foin, T.C., Riley, S.P.D., Pawley, A.L., Ayres, D.R., Carlson, T.M., Hodum, P.J., Switzer, P.V. (1998). Improving recovery planning for threatened and endangered species. *Bioscience*, 48, 177-184.

Galbreath, R. (1993). *Working for wildlife: a history of the New Zealand wildlife service*. Wellington, New Zealand: Bridget Williams Books Limited.

Garnett S.T., Crowley, G.M. (Eds.) (Australian Government, Department of the Environment, Water, Heritage and the Arts) (2000). *The action plan for Australian birds 2000*. Retrieved on March 29, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/ threatened/ publications/action/birds2000.

Garnett, S. (Ed.) (1992). *Threatened and extinct birds of Australia*. Victoria, Australia: Royal Australasian Ornithologists Union.

Gaze, P. (Ed.) (2001). *Tuatara recovery plan 2001-2011. Threatened species recovery plan 47*. Retrieved on October 20, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series /threatened-species-recovery-plans/archive/.

Gerber, L.R., Schultz, C.B. (2001). Authorship and the use of biological information in endangered species recovery plans. *Conservation Biology*, 15 (5), 1308-1314.

Glanznig, A. (2007). *Community biodiversity network*. Retrieved on October 4, 2010, from the World Wide Web: http://www.cbd.int/cepa/projects.shtml?s=community.

Godden, L.C., Peel, J. (2007). The environment protection and biodiversity conservation act 1999 – dark sides of virtue. *Melbourne University Law Review*, 31, 106-145.

Gong, W., Sinden, J., Braysher, M., Jones, R. (Invasive Animals Cooperative Research Centre) (2009). *The economic impacts of vertebrate pests in Australia*. Retrieved on October 8, 2010, from the World Wide Web: http://www.feral.org.au/feral_documents/ IACRC_EconomicImpactsReport.pdf.

Goble, D.D., George, S.M., Mazaika, K., Scott, J.M., Karl, J. (1999). Local and national protection of endangered species: an assessment. *Environmental Science and Policy* (2), 43-59.

Govey, I., Owen, J. (1996). The New Zealand experience: Legislation, priorities and recovery planning, in S. Stephens, S. Maxwell (Eds.). *Back from the brink: refining the threatened species recovery process*. New South Wales, Australia: Surrey Beatty & Sons Pty Limited, 37-39.

Gunningham, N., Young, M.D. (1997). Toward optimal environmental policy: the case of biodiversity conservation. *Ecology Law Quarterly* (5), 24, 243-298.

Hallas, S. (Ed.) (2005). *New Zealand large galaxiid recovery plan, 2003-13. Threatened species recovery plan 55.* Retrieved on October 27, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series/threatened-species-recovery-plans/archive/.

Hansen, K. (2006). *New Zealand fairy tern (Sterna nereis davisae) recovery plan, 2005-15. Threatened species recovery plan 57*. Retrieved on October 27, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series/threatened-species-recovery-plans/archive/.

Hardin, G 1968, The Tragedy of the Commons, *Science*, vol 162, 1243–148.

Harris, R. (2004). *Handbook of environmental law*. Wellington, New Zealand: Royal Forest and Bird Protection Society of New Zealand Inc.

Hawkes, L.A., Broderick, A.C, Godfrey, M.H., Godley, B.J. (2009). Climate change and sea turtles. *Endangered Species Research*, 7, 137-154.

Hitchmough, R, Bull, L, Cromarty, P, (compilers). 2007. *New Zealand Threat Classification System lists – 2005*. Retrieved on October 24, 2010, from the World Wide Web: http://www.doc.govt.nz/templates/MultiPageDocumentTOC.aspx?id=42704.

Hoekstra, J.M., Clack, A.J., Fagan, W.F., Dee Boersma, P. (2002). A comprehensive review of endangered species act recovery plans. *Ecological Applications*, 12(3), 630-640.

Holzapfel, S., Robertson, H.A., McLennan, J.A., Sporle, W., Hackwell, K., Impey, M. (2008). *Kiwi (Apteryx spp.) recovery plan 2008-2018. Threatened species recovery plan 60*. Retrieved on October 20, 2010, from the World Wide Web: http://www.doc.govt.nz/ publications/science-and-technical/products/series/threatened-species-recovery-plans/archive/.

Hughey, K.F.D., Kerr, G.N., Cullen, R. (2008). *Public perceptions of New Zealand's environment: 2008*. Lincoln University, EOS Ecology.

Iverson, L.R., Prasad, A.M. (1998). Predicting abundance of 80 tree species following climate change in the eastern United States. *Ecological Monographs*, 68, 465–485.

James, A.N., Gaston, K.J., Balmford, A. (1999). Balancing the earth's accounts. *Nature*, 4401, 323-324.

Joseph, L.N., Maloney, R.F., O'Connor, S.M., Cromarty, P., Jansen, P., Stephens, T., Possingham, H.P. (2008). Improving methods for allocating resources among threatened species: the case for a new national approach in New Zealand. *Pacific Conservation Biology*, 14 3,154-158.

Joseph, L.N., Maloney, R.F., Possingham, H.P.(2009). Optimal allocation of resources among threatened species: a project prioritisation protocol. *Conservation Biology*, 23, 328-338.

Kareiva, P., Levin, S.A. (Eds.)(2003). *The importance of species – perspectives on expendability and triage*. New Jersey, United States: Princeton University Press.

Kellert, S.R. (1985). Social and perceptual factors in endangered species management. *Journal of Wildlife Management*, 49(2), 528-536.

Klinkenborg, V. (2009). Last One. *National Geographic*, January, 82-107.

Knight, A.J. (2008). 'Bats, snakes and spiders, Oh my!' How aesthetic and negativistic attitudes, and other concepts predict support for species protection. *Journal of Environmental Psychology*, 28, 94-103.

Kuehn, E., Feldman, R., Harpke, A., Hirneisen, N., Musche, M., Leopold, P., Settele, J. (2008). Getting the public involved in butterfly conservation: lessons learned from a new monitoring scheme in Germany. *Israel Journal of Ecology & Evolution*, 54 (1), 89-103.

La Cock, G.D., Holzapfel, S., King, D., Singers, N. (2005). *Dactylanthus taylorii recovery plan, 2004-2014. Threatened species recovery plan 56.* Retrieved on October 20, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series/threatened-species-recovery-plans/archive/.

Lane, R., Wills, J., Vanclay, F., Lucas, D. (2008). Vernacular heritage and evolving environmental policy in Australia: lessons from the Murray-Darling outreach project. *Geoforum*, 39, 1305-1317.

Langpap, C. (2005). Conservation of endangered species: can incentives work for private landowners? *Ecological Economics*, 57, 558-572.

Lawler, J.J., Campbell, S.P., Guerry, A.D., Kolozsvary, M.B., O'Connor, R.J., Seward, L.C.N. (2002). The scope and treatment of threats in endangered species recovery plans. *Ecological Applications*, 12 (3), 663-667.

Le Prestre, P.G. (Ed.) (2002). *Governing global biodiversity: the evolution and implementation of the convention on biological diversity*. Hampshire, England: Ashgate Publishing Limited.

Lundquist, C.J., Diehl, J.M., Harvey, E., Botsford, L.W. (2002). Factors affecting implementation of recovery plans. *Ecological Applications*,12,713–718.

Lunney, D. (Ed.)(1991). *Conservation of Australia's forest fauna*. New South Wales, Australia: The Royal Zoological Society of New South Wales.

Male, B. (1994). Recovery action for threatened species – an Australian perspective. *Ibis*, 147, 204-208.

Manfredo, M.J. (2008). *Who cares about wildlife?* New York: Springer.

Martin, C.M. (2008). Recovering endangered species and restoring ecosystems: conservation planning for the twenty-first century in the United States. *Ibis*, 137 (1), 198-203.

McGrath, C. (2005). Key concepts of environment protection and biodiversity act 1999. *Environmental and Planning Law Journal*, 20, 20-39.

McLeod, R. (Cooperative Research Centre for Pest Animal Control) (2004). *Counting the cost: impact of invasive animals in Australia, 2004*. Retrieved on March 9, 2010, from the World Wide Web: http://www.invasiveanimals.com/publications/downloads/Counting-The-Cost.pdf.

McNeely, J.A., Miller, K.R., Reid, W.V., Mittermeier, R.A., Werner, T.B. (1990). *Conserving the world's biological diversity*. Washington, United States: World Bank Publications.

McNeill, F. (Ed.) (2001). *Recovery plan for the angle-stemmed myrtle Austromyrtus gonoclada 2001-2005.* Retrieved on November 2, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/a-gonoclada/index.html.

Menkhorst, P. (2008). *National recovery plan for the helmeted honeyeater, Lichenostomus melanops cassidix.* Retrieved on November 2, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery-list-common.html.

Meredith, L.D. (Ed.)(1993). *Integrated plant conservation in Australia*. Canberra, Australia: Australian Network for Plant Conservation.

Miller, B., Reading, R., Conway, C., Jackson, J.A., Hutchins, M., Snyder, N., Forrest, S., Frazier, J., Derrickson, S. (1994). A model for improving endangered species recovery programs. *Environmental Management*, 18 (5), 637-645.

Miller, R.M., Rodriguez, J.P., Aniskowicz-Fowler, T., Bambaradeniya, C., Boles, R., Eaton, M.A., Gardenfors, U., Keller, V., Molur, S., Pollock, C. (2007). National threatened species listing based on IUCN criteria and regional guidelines: current status and future perspectives. *Conservation Biology*, 21 (3), 684-696.

Milne, T., Hutchinson, M., Clarke, S. (2000). *National recovery plan for the Pygmy Bluetongue Lizard (Tiliqua adelaidensis).* Retrieved on November 2, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/pygmy-bluetongue/index.html.

Ministry for the Environment (MfE) (1998). *Learning to care for our environment: a national strategy for environmental education*. Retrieved on September 10, 2010, from the World Wide Web: http://www.mfe.govt.nz/publications/general/environment-education-strategy-jun98.html.

Ministry for the Environment (MfE) (2000). *The New Zealand biodiversity strategy: our chance to turn the tide*. Retrieved on September 10, 2010, from the World Wide Web: https://www.biodiversity.govt.nz/picture/doing/nzbs/summary.html.

Ministry for the Environment (MfE) (2007). *Environment New Zealand 2007*. Retrieved on September 19, 2010, from the World Wide Web: http://www.mfe.govt.nz/publications/ser/enz07-dec07/.

Mooney, P.A., Pedler, L.P. (2005). *Recovery Plan for the South Australian subspecies of the Glossy Black-Cockatoo (Calyptorhynchus lathami halmaturinus) 2005-2010*. Retrieved on October 17, 2010, from the World Wide Web: http://www.environment.gov.au/ biodiversity/threatened/recovery-list-common.html.

Moore, M., Townsend, M., Oldroyd, J. (2006). Linking human and ecosystem health: the benefits of community involvement in conservation groups. *EcoHealth*, 3, 255-261.

Morad, M., Jay, M. (2000). Kaitiakitanga: protecting New Zealand's native biodiversity. *Biologist*, 47(4), 197-201.

Moran, E. (2003). *An analysis of the costs of New Zealand threatened species programmes*. Unpublished Master's thesis, Lincoln University, Christchurch, New Zealand.

Mulder, M., Coppolillo, P. (2005). *Conservation: linking ecology, economics and culture*. Oxfordshire, England: Princeton University Press.

Mummery, J., Hardy, N. (1994). *Australia's biodiversity: an overview of selected significant components. Biodiversity Series, paper no.2*. Canberra, Australia: Biodiversity Unit, Commonwealth Department of the Environment, Sport and Territories.

Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B., Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Naidoo, R., Balmford, A., Ferraro, P.J., Polasky, S., Ricketts, T.H., Rouget, M. (2006). Integrating economic costs into conservation planning. *Trends in Ecology & Evolution*, 21, 681-687.

Nano, C., Pavey, C. (2008). *National recovery plan for Olearia macdonnellensis, Minuria tridens (Minnie Daisy) and Actinotus schwarzii (Desert Flannel Flower).* Department of Natural Resources, Environment, the Arts and Sport, Northern Territory. Retrieved on October 17, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery-list-common.html.

National Biodiversity Strategy Review Task Group (NBSRTG) (2009). *Australia's biodiversity conservation strategy 2010-2020 consultation draft*. Retrieved on September 5, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/strategy/draft-strategy.html.

Natural Resource Management Ministerial Council (NRMMC) (2004). *National Biodiversity and Climate Change Action Plan 2004–2007*, Australian Government, Canberra. Retrieved on September 1, 2010, from the World Wide Web: www.environment.gov.au/biodiversity/publications/nbccap.

New, T.R. (2000). *Conservation biology: an introduction for southern Australia*. Victoria, Australia: Oxford University Press.

Newman, D.G. (1996). *Native frog (Leiopelma spp.) recovery plan. Threatened species recovery plan18.* Wellington, New Zealand: Department of Conservation.

Novacek, M.J. (2008). Engaging the public in biodiversity issues. *Proceedings of the National Academy of Science,* 105(1), 11571-11578.

NSW National Parks and Wildlife Service (2001). *The recovery plan for the Blue Mountains Water skink (Eulamprus leuraensis).* Retrieved in September 5, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/blue-mtns-water-skink/index.html.

O'Connor, S.M., Maloney, R.F., Pierce, R.J. (2007). *Pateke (Anas chlorotis) recovery plan, 2005-2010. Threatened species recovery plan 59*. Retrieved on September 3, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-andtechnical/products/series/threatened-species-recovery-plans/archive/.

Olsen, P., Silcocks, A., Weston, M., Tzaros, C. (2006). *Birds of woodlands and grasslands paper for the 2006 Australian State of the Environment Committee*. Retrieved on September 13, 2010, from the World Wide Web: http://www.environment.gov.au/soe/2006/publications/emerging/birds/index.html.

Organisation for Economic Co-operation and Development (OECD) (1999). *Handbook of incentive measures for biodiversity- design and implementation*. Paris, France: OECD Publications.

Parliamentary Counsel Office (2010). *Wildlife Act 1953*. Retrieved on September 5, 2010, from the World Wide Web: http://www.legislation.govt.nz/act/public/1953/0031/latest/DLM276814.html.

Patterson, M, and Cole, A. (1999). *Assessing the Value of New Zealand's Biodiversity*. Palmerston North: School of Resource and Environmental Planning, Massey University.

Pavey, C. (2004). *Recovery plan for Slater's skink (Egernia slateri) 2005-2010*. Retrieved on October 17, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/recovery-list-common.html.

Prestre, P.G. (Ed.)(2002). *Governing global biodiversity*. Hampshire, England: Ashgate Publishing Limited.

Porter, R. (1988). New Zealand lizards- the neglected animals. *Forest and Bird* 19 (3), 14-17.

Possingham, H.P., Andelman, S.J., Burgman, M.A., Medellen, R.A., Master, L.L., Keith, D.A. (2002). Limits to the use of threatened species lists. *Trends in Ecology and Evolution*, 17 (11), 503-507.

Rasch, G., Boyd, S., Clegg, S. (1996). *Stitchbird (Hihi), Notiomystis cincta recovery plan. Threatened species recovery plan 20*. Wellington, New Zealand: Department of Conservation.

Rasch, G., Saunders, A. (Eds.) (1990). *Proceedings of a threatened species workshop held in Turangi. April 27–May 2 1990.Threatened Species Occasional Publication 1*. Retrieved on September 5, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series/older-series/threatened-species-occasional-publication-archive/.

Ray, J.C., Redford, K.H., Steneck, R.S., Berger, J. (2005). *Large carnivores and the conservation of biodiversity*. Washington, United States: Island Press.

Ray, J.C., Ginsberg, J.R. (1999). Endangered species legislation beyond the borders of the United States. *Conservation Biology* (13), 5, 956-958.

Roberts, A. (1994). *South Island saddleback recovery plan (Philesturnus carunculatus carunculatus) Threatened species recovery plan 11*. Retrieved on September 3, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-andtechnical/products/series/threatened-species-recovery-plans/archive/.

Robertson, H.A. (2003). *Kiwi (Apteryx spp.) recovery plan 1996-2006. Threatened species recovery plan 50*. Retrieved on September 3, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-andtechnical/products/series/threatened-species-recovery-plans/archive/.

Robertson P., Smith, W. (2010). *National recovery plan for the Striped Legless Lizard (Delma impar)*. Retrieved on October 28, 2010, from the World Wide Web: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/striped-legless-lizard/index.html.

Sattler, P., Creighton, C. (Editors of the National Land and Water Resources Audit) (2002a). *Australian terrestrial biodiversity assessment: threatened ecosystems and species*. Retrieved on April 8, 2010, from the World Wide Web: http://www.anra.gov.au/topics/vegetation/ pubs/biodiversity/bio_assess_threat.html.

Sattler, P., Creighton, C. (Editors of the National Land and Water Resources Audit) (2002b). *Australian terrestrial biodiversity assessment: biodiversity conservation across the wider landscape.* Retrieved on April 8, 2010, from the World Wide Web: http://www.anra.gov.au/topics/vegetation/pubs/biodiversity/bio_assess_conservation.html.

Sattler, P., Creighton, C. (Editors of the National Land and Water Resources Audit) (2002c). *Australian terrestrial biodiversity assessment: birds.* Retrieved on September 8, 2010, from the World Wide Web: http://www.anra.gov.au/topics/vegetation/ pubs/biodiversity/bio_assess_birds.html.

Saunders, A., Norton, D A. (2001). Ecological restoration at mainland islands in New Zealand. *Biological Conservation*, vol 99, pp 109–119.

Schultz, C.B., Gerber, L.R. (2002). Are recovery plans improving with practice? *Ecological Applications* 12, 641–647.

Seabrook-Davison, M.N.H. (2010). *An evaluation of the conservation of New Zealand's threatened biodiversity: management, species recovery and legislation*. Unpublished PhD thesis, Massey University, Auckland, New Zealand.

Secretariat of the Convention on Biological Diversity (SCBD) (2006). *Global biodiversity outlook 2*. Retrieved on March 7, 2011, from the World Wide Web: http://www.biodiv.org/GBO2.

Stevens, S., Maxwell, S. (Eds.) (1996). *Back from the brink: refining the threatened species recovery process*. Sydney, Australia: Surrey, Beatty & Sons.

Sutherland, W.J. (Ed.) (1998). *Conservation science and action*. Oxford, United Kingdom: Blackwell Science Ltd.

Swanson, T.M. (1994). *The international regulation of extinction*. Hampshire, England: The MacMillan Press Ltd.

Schwartz, M.W. (2008). The performance of the endangered species act. *Annual Review of Ecology, Evolution, and Systematics*, 39(1), 279-299.

Taiepa, T., Lyver, P., Horsley, P., Davis, J., Bragg, M., Moller, H. (1997). Co-management of New Zealand's conservation estate by Maori and Pakeha: a review. *Environmental Conservation*, 24(3), 236-250.

Taylor, P. (2005). *Beyond conservation: a wildland strategy*. Wiltshire, England: Cromwell Press.

Taylor, S., Castro, I., Griffiths, R. (2005). *Hihi/Stitchbird (Notiomystis cincta) recovery plan 2004-2009. Threatened species recovery plan 54*. Retrieved on October 20, 2010, from the World Wide Web: http://www.doc.govt.nz/ publications/science-and-technical/products/series/threatened-species-recovery-plans/archive/.

Tear, T.H., Scott, J.M., Hayward, P.H., Griffiths, B. (1993). Status and prospects for success of the endangered species act: a look at recovery plans. *Science*, 262, 976-977.

Tear, T.H., Scott, J.M., Hayward, P.H., Griffiths, B. (1995). Recovery plans and the endangered species act: are criticisms supported by data? *Conservation Biology*, 9(1),182-195.

Thackway, R. (1997). Significant trends in nature conservation in Australia. *Natural Areas Journal*, 17 (3), 233-240.

United States Fish and Wildlife Service (FWS) (2005). *Recovering threatened and endangered species Fiscal years 2005-2006*. Retrieved on April 9, 2010, from the World Wide Web: http://www.fws.gov/endangered/recovery.

United States Fish and Wildlife Service (FWS) (2008a). *A history of the endangered species act of 1973*. Retrieved on April 9, 2010, from the World Wide Web: http://www.fws.gov/endangered/recovery.

United States Fish and Wildlife Service (FWS) (2008b). *Report to congress on the recovery of threatened and endangered species: fiscal years 2007-2008*. Retrieved on October 20, 2010, from the World Wide Web: http://www.fws.gov/endangered/esa-library/pdf/Recovery_Report_2008.pdf.

United States Fish and Wildlife Service (FWS) (2009). *Listing a species as threatened or endangered: section 4 of the endangered species act.* Retrieved on October 9, 2010, from the World Wide Web: http://www.fws.gov/endangered/esa-library/pdf/listing.pdf.

United States Fish and Wildlife Service (FWS) (2010). *Listed FWS/Joint FWS and NMFS species and populations with recovery plans (sorted by plan date).* Retrieved on October 20, 2010, from the World Wide Web: http://ecos.fws.gov/tess_public/TESSWebpage Recovery?sort=2.

Wallace, P. (2009). *Where the wild things are: examining the intersection between the RMA1991 and the Wildlife Act1953.* Unpublished thesis, Department of Geography, Tourism and Environmental Planning, University of Waikato, Hamilton, New Zealand.

Wickes, C., Crouchley, D., Maxwell, J. (2009). *Takahe (Porphyrio hochstetteri) recovery plan 2007-2012. Threatened species recovery plan 61*. Retrieved on October 20, 2010, from the World Wide Web: http://www.doc.govt.nz/publications/science-and-technical/products/series/threatened-species-recovery-plans/archive/.

Wilcove, D.S., Chen, L.Y. (1998). Management costs for endangered species. *Conservation Biology*, 12 (6), 1405-1407.

Wilcove, D.S., Rothstein, D., Dubow, J., Philips, A., Losos, E. (1998). Quantifying threats to imperilled species in the United States. *BioScience*, 28 (8), 607-615.

Williams, J., Read, C., Norton, T., Dovers, S., Burgman, M., Proctor, W., Anderson, H. (2001). *Biodiversity theme report. Australia state of the environment report 2001*. *For the Department of Sustainability, Environment, Water, Population and Communities*. Retrieved on October 12, 2010, from the World Wide Web: http://www.environment.gov.au/soe/2001/publications/themereports/biodiversity/biodiversity06-4.html.

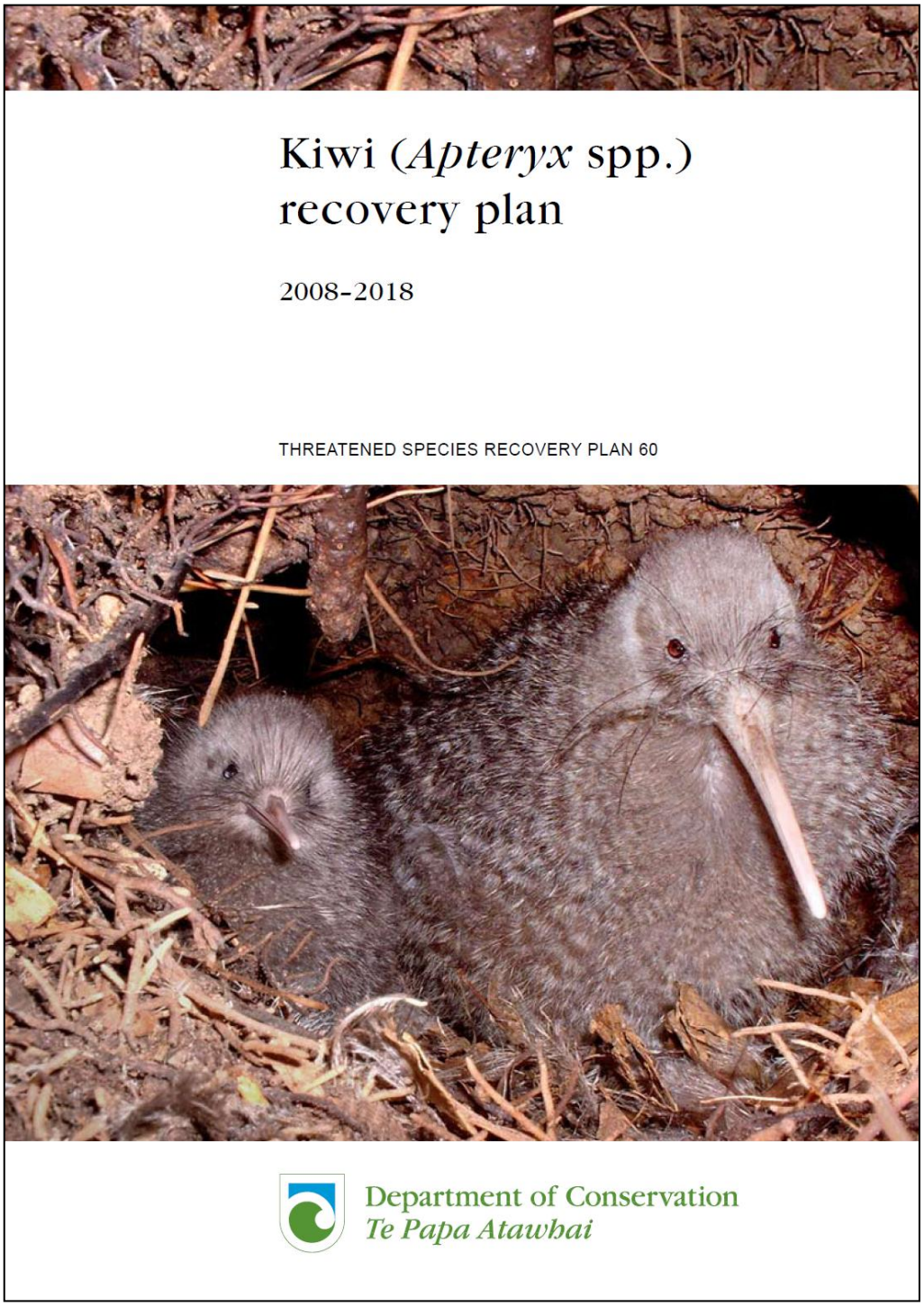
Willock, C. (1991). *Wildfight: a history of conservation*. London, England: Butler and Tanner Ltd.

Winter, C. (2005). Preferences for forests and wetlands: a comparison of farmers, environmentalists and the general public in Australia. *Society and Natural Resources*, 18, 541-555.

Yibarbuk, D., Whitehead, P.J., Russel-Smith, J., Jackson, D., Godjuwa, C., Fisher, A., Cooke, P., Choquenot, D., Bowman, D.M.J.S. (2001). Fire ecology and Aboriginal land management in central Arnhem Land, northern Australia: a tradition of ecosystem management. *Journal of Biogeography*, 28(3), 325-343.

Young, D. (2004). *Our islands, our selves – a history of conservation in New Zealand*. Dunedin, New Zealand: University of Otago Press.

Chapter 9. Appendices



Source: Kiwi (*Apteryx* spp.) Threatened Species Recovery Plan 60 (Holzapfel, Robertson, McLennan, Sporle, Hackwell, Impey, 2008).

List of Appendices

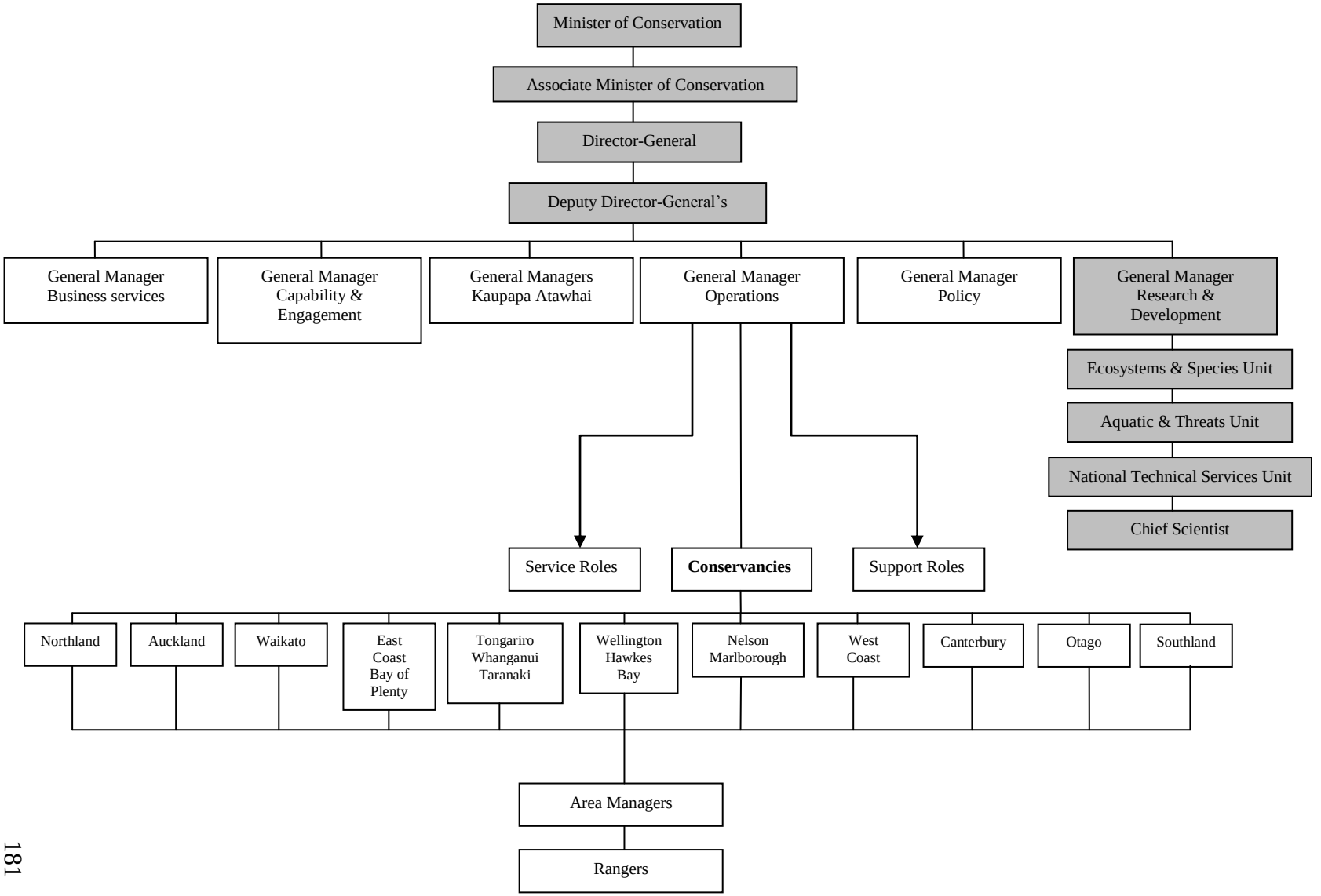
Appendix 1 List of international agreements the New Zealand government and DOC have to take into account when managing the environment (Source: DOC, 2008a; DOC, 2008b; DOC, 2009).

- Agreement for the Conservation of Albatross and Petrels (ACAP);
- Antarctic Treaty System (ATS);
- Convention concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention);
- Convention on Biological Diversity (CBD);
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES);
- Convention on the Conservation of Antarctic Marine Living Resource (CCAMLR);
- Convention on the Conservation of Migratory Species of Wild Animals (CCMS);
- Convention on the Conservation of Nature in the South Pacific (Apia Convention);
- Convention on the Conservation of Southern Bluefin Tuna (CCSBT);
- Convention on Wetlands of International Importance. Especially as Waterfowl Habitat (Ramsar Convention);
- International Convention for the Regulation of Whaling;
- IUCN – World Conservation Union;
- Memorandum of Understanding for the Conservation of Cetaceans and Their Habitats in the Pacific Islands Region;
- Natural Resource Management Council; Environment Protection and Heritage Council;
- Protocol on Environmental Protection to the Antarctic Treaty United;
- Nations Convention on the Law of the Sea (UNCLOS);
- South Pacific Regional Environment Programme (SPREP);
- United Nations Open-ended Informal Consultative Process on Oceans and Law of the Sea (UNICPOLOS); and,
- World Heritage Convention.

Appendix 2 List of Acts the Department of Conservation must work under
(Source: DOC, 2008a; DOC, 2008b; DOC, 2010a).

- Biosecurity Act 1993;
- Canterbury Provincial Buildings Vesting Act 1928;
- Conservation Act 1987;
- Crown Forest Assets Act 1989;
- Crown Minerals Act 1991;
- Crown Pastoral Land Act 1998;
- Fisheries Act 1996;
- Foreshore and Seabed Act 2004;
- Forest and Rural Fires Act 1977;
- Forests Act 1949;
- Harbour Boards Dry Land Endowment Revesting Act 1991;
- Hauraki Gulf Marine Park Act 2000;
- Kapiti Island Public Reserve Act 1897;
- Lake Wanaka Preservation Act 1973;
- Land Act 1948;
- Local Government Act 1974;
- Local Government Act 2002;
- Marine Mammals Protection Act 1978;
- Marine Reserves Act 1971;
- Maori Land Amendment and Maori Land Claims Adjustment Act 1926;
- Mount Egmont Vesting Act 1978;
- National Parks Act 1980;
- Native Plants Protection Act 1934;
- New Zealand Animal Protection Act 1867;
- Ngai Tahu (Tutaepatu Lagoon Vesting) Act 1998;
- Public Works Act 1981;
- Queen Elizabeth the Second National Trust Act 1977;
- Queenstown Reserves Vesting and Empowering Act 1971;
- Reserves Act 1977;
- Resource Management Act 1991;
- Stewart Island Reserves Empowering Act 1976;
- Sugar Loaf Islands Marine Protected Area Act 1991;
- Trade In Endangered Species Act 1989;
- Treaty of Waitangi Settlement Acts;
- Tutae-Ka-Wetoweto Forest Act 2001;
- Waitangi Endowment Act 1932-1933;
- Waitangi National Trust Board Act 1932;
- Waitutu Block Settlement Act 1997;
- Wild Animal Control Act 1977; and,
- Wildlife Act 1953.

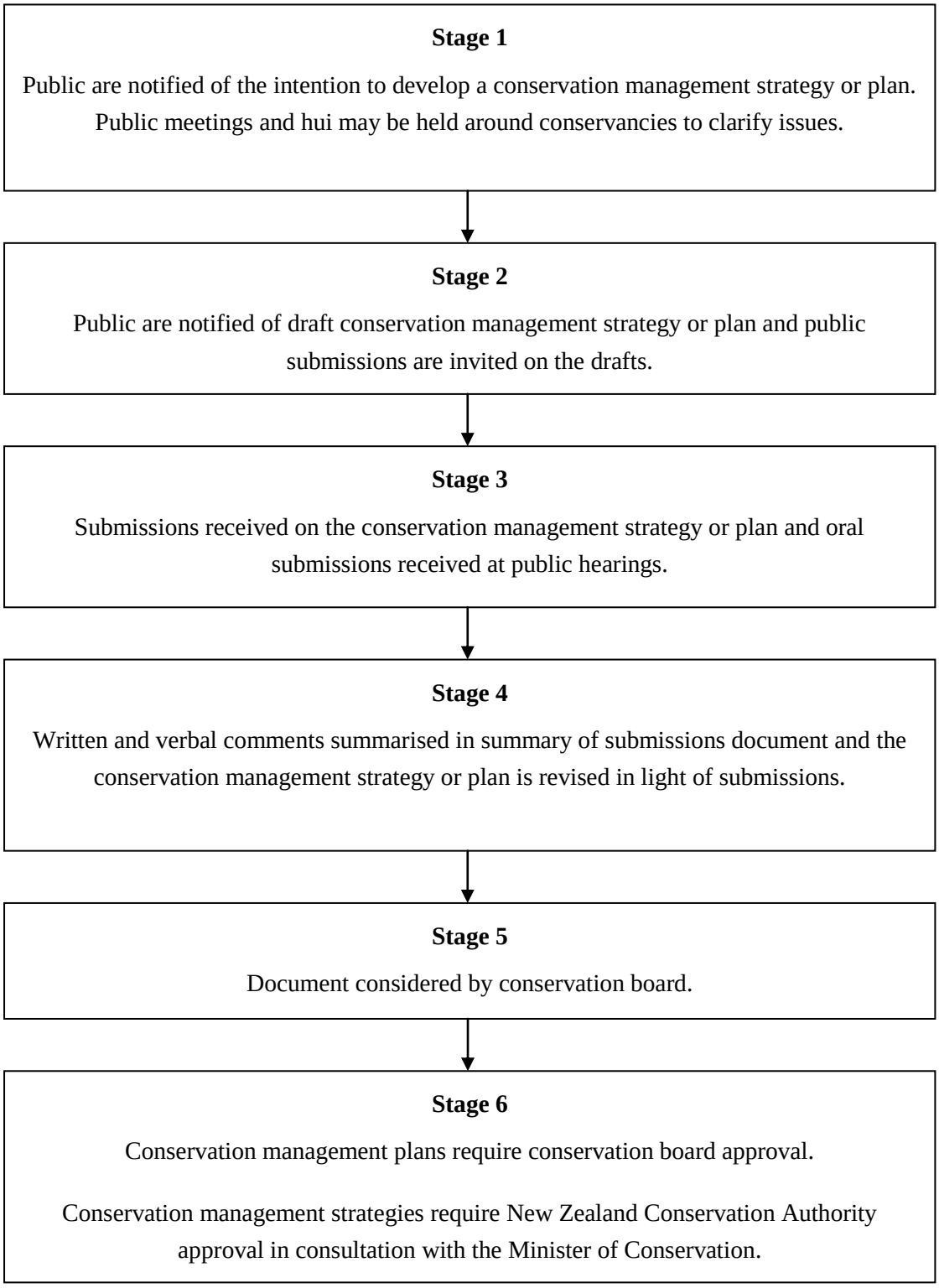
Appendix 3 The Department of Conservation's management structure (departments which relate to the development of threatened species recovery plans are shaded in grey) (Source: DOC, 2010a).



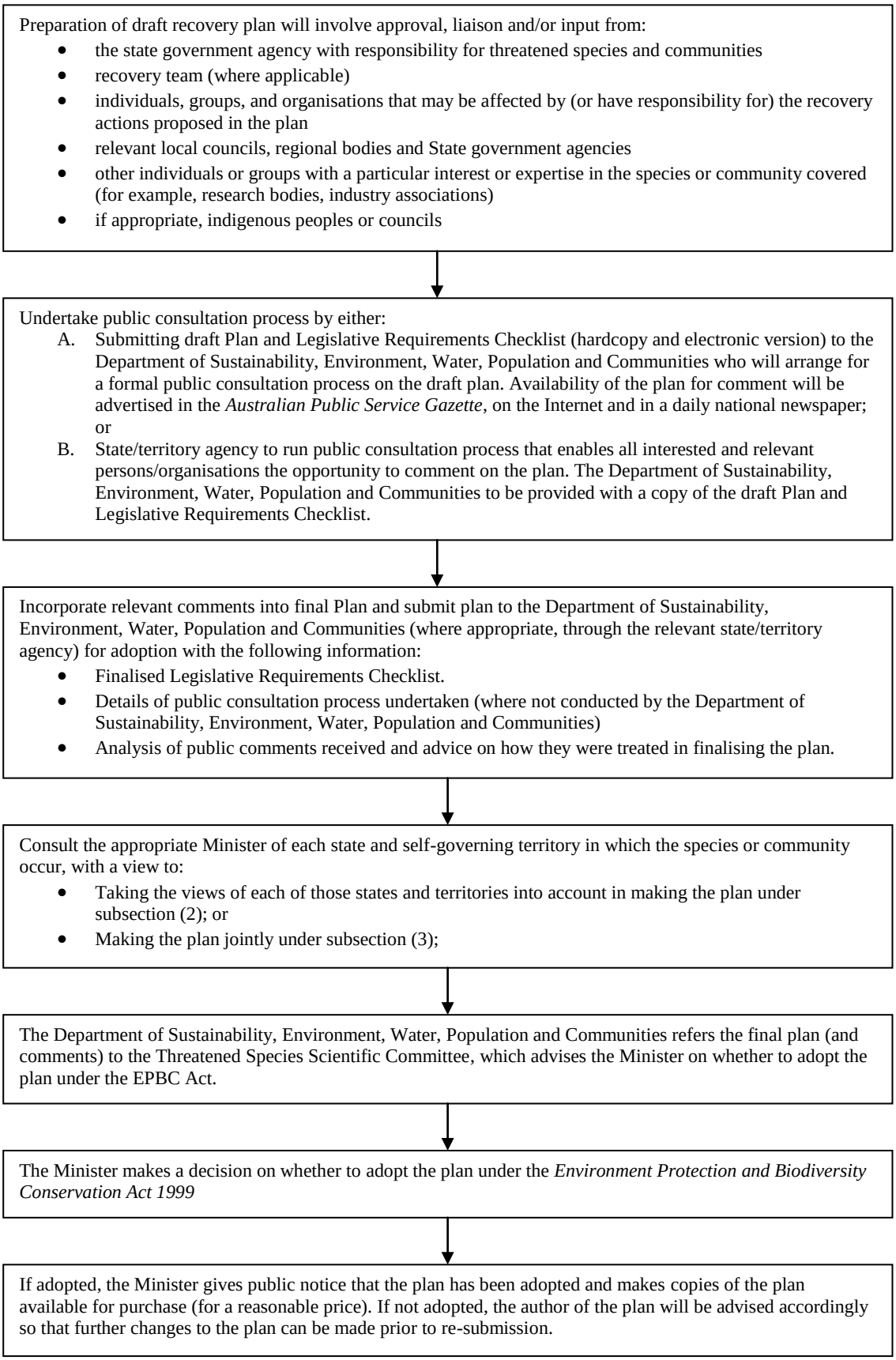
Appendix 4 Stakeholders working with the Department of Conservation (Source: DOC, 2006; DOC, 2008a; DOC, 2008b; DOC, 2010a).

- Tangata whenua and Maori organisations (e.g. NZ Maori Council, hapu, trust boards);
- Conservation boards, NZCA;
- Historic Places Trust;
- Local government and Regional government;
- Central government departments;
- Crown agencies (e.g. Animal health board, Te Papa);
- State owned enterprises;
- Affected businesses;
- Concessionaires;
- Farmers, landowners, neighbours;
- Conservation groups (e.g. Forest and Bird, Fish and Game Council);
- Recreation groups (e.g. Federated Mountain Clubs, Deerstalkers Association);
- Other groups (e.g. National Council of Women, SPCA);
- Universities/education groups/outdoor education;
- Scientific groups (e.g. Royal Society, Ornithological Society);
- Research organizations (e.g. Crown Research Institutes, Cawthron Institute);
- Technical or professional experts (e.g. IPENZ, Geological Association);
- Sector groups (tourism, forestry, fishing etc.) (e.g. Bus and Coach Association, Fishing Industry Board);
- Conservation Volunteers;
- Local community groups (e.g. Ratepayers and Residents Associations, organisations running Conservation Corps);and,
- Media.

Appendix 5 The process for preparing conservation management strategies and plans in New Zealand (Source: DOC, 2010b).



Appendix 6 Steps taken in adopting a recovery plan in Australia (Source: DEWHA, 2009f).



Appendix 7 Selected government programmes encouraging private landholder and community programmes in Australia since 1999 (Source: Williams *et al.*, 2001).

- Landcare groups include the Ginninderra Catchment Group, Canberra Ornithologists Group, O'Connor Ridge Park Care Group, Sullivans Creek Catchment Group (ACT);
- National Heritage Trust (NHT) funding of $941,326 for environment projects (ACT);
- Under the Wildlife Refuge program, 600 refuges have been declared since 1950 (ACT);
- Land for Wildlife program and Farming for the Future, which includes a module on biodiversity issues (ACT);
- NPWS Discovery program, Save Our Species Program and Community Biodiversity Survey Manual (ACT);
- Community Assistance Program (CAP) (ACT);
- Indigenous involvement in protected area management (NT)
- 'Friends' groups for individual parks (e.g. Friends of Alice Springs Desert Park launched in 1998-99 with over 900 members) (NT);
- Volunteers on Parks Program and a Junior Ranger Program (NT);
- Environment Protection Agency (EPA) grants totalling $988,917 to coastal community organisations for 60 projects under the Coastcare Grants Program (QLD);
- Nature Search Program with part-time coordinators and volunteers to gather records about Queensland's native species;
- Funding of $7 million from the National Heritage Trust for Bushcare programmes for 95 projects (QLD);
- Queensland extended the Land for Wildlife Program to assist landholders to integrate wildlife habitat protection principles into management of their properties;
- Community Nature Conservation extension network was established to deploy extension officers to assist landholders and community groups to pursue conservation objectives (QLD);
- Over 120 volunteers from community groups and industry enlisted as part of the Queensland Turtle Conservation Program;
- The Gladstone-based volunteer group Friends of Capricornia established to control weeds and monitor wildlife on Capricorn and Bunker Islands;
- Regional state government ecologists to provide assistance to landholders (SA);
- Minister for the Environment's Community Conservation Grants (WA);
- Land for Wildlife Scheme (WA).

Appendix 8 Species with a recovery plan in New Zealand (pgs 187-195) (Source: DOC,2010d).

Plan no.	Year approved	Plan time frame	Author	Species	Status	Current Distribution	Key Conservancies	Responsibility
1	1991	1990-1995	R Hay (ed.), North Island Kokako Recovery Group, DOC Science and Research	North Island Kokako	Endangered	27 scattered populations in Northland, Hauraki Gulf, Waikato, King Country, Bay of Plenty, East Cape, Taranaki, National Wildlife Centre	Northland, Auckland, Bay of Plenty, Waikato, Wanganui, Wellington, East Coast	Conservancy staff, Forest Bird Research Group, Auckland Regional Authority, OSNZ
2	1991	1991-1996	D Butler, J McLennan, Threatened Species Unit, DSIR Land Resources	Kiwi	Little spotted - Endangered Great spotted - Threatened Brown - Threatened	Kapiti I, Red Mercury I South I, west of the Alps Scattered populations throughout NI, north and south of Fiordland, offshore islands	All except Otago	Conservancy staff, recovery group, Zoo industry, OSNZ, Forest & Bird, Massey University
3	1992	1991-1996	D Towns, Threatened species unit DOC	Whitaker's and Robust Skinks	Whitaker's - Threatened Robust - Threatened	Middle I, Castle I, Pukerua Bay, Coromandel, Wellington Ecological Districts Middle I, Castle I, Green I, Matapia I, Moturoa I, Coromandel	Auckland, Waikato, Wellington,	Conservancy staff, Society for Reptile and Amphibian Research NZ, threatened species unit, Auckland zoo, NZ Herpetological Society, National Wildlife Centre
4	1993	1993-1998	C.E.M Reed, D.P Murray, Threatened species unit DOC	Black Stilt	Critically Endangered	Braided rivers and wetlands of the Mackenzie Basin, Ahuriri river South Island.	Canterbury	Canterbury DOC, Recovery Group
5	1993	1993-2000	D Towns, I McFadden, Threatened species unit DOC	Chevron Skink	Vulnerable	Little and Great Barrier I	Auckland	Auckland conservancies, Public awareness unit, Auckland Conservation Board, Auckland Zoo, NZ Herpetological Society
6	1993	1993	C.Donnell, Threatened Species Unit DOC	Mohua (Yellowhead)	Threatened	Marlborough Sounds, Arthurs Pass, South Westland, Southland, Fiordland, Mt Aspiring National Park	Nelson/Marlborough, Southland, Otago, West Coast	All South Island conservancies
7	1993	1993-2000	P McClelland, Threatened species unit DOC	Subantarctic Teal	Endangered	Campbell I, Auckland I	Southland, Wellington (captive population)	Southland conservancy, Public awareness unit, Teal Research, National Wildlife Centre

8	1993	1993-1998	W.B Shaw, Threatened species unit DOC	Kowhai ngutukaka	Endangered	Kaipara, East Coast, Te Urewera	East Coast, Auckland	East Coast, Auckland conservancies, Recovery Team, Threatened species unit
9	1993	1993-1998	A Cree, D Butler, Threatened species unit DOC	Tuatara	Brothers - Endangered Northern - Vulnerable Cook Strait - Rare	North Brother I Poor Knights group, Hen and Chicken group, Mercury group, Aldermen group Stephens I, North Trio I , South Trio I	Northland, Auckland, Waikato, Bay of Plenty, Nelson-Marlborough	Conservancy staff, Auckland zoo, all holders of tuatara
10	1993	1993-1997	J Dowding, Threatened species unit DOC	New Zealand Dotterel	Vulnerable	North I, Great Barrier I, Stewart I, Nelson coast	Northland, Auckland, Waikato, Bay of Plenty, East Coast, Southland	Conservancies with breeding sites, members of OSNZ and RF&BPS, the recovery group
11	1994	1994-2020	A Roberts, Threatened species unit DOC	South Island Saddleback	Endangered	Titi, Breaksea, Motuara, Big, Kaimohu, Kapiti, Kundy and Allports islands	Southland, Nelson	Southland, Nelson Conservancies, Threatened species unit, Rakiura Maori
12	1994	1994-1999	D Crouchley, Threatened species unit DOC	Takahe	Endangered	Murchison Mountains, Stuart Mountains, Maud I, Mana I, wapiti I, Tiritiri Matangi I	South Island	Te Anau Field Centre, National Wildlife Centre, Threatened species unit
13	1995	1994-1995	R Parrish, G Sherley, M Aviss, Threatened species unit DOC	Giant Land Snail	Threatened/Endangered	Northland, Motuhoropapa I, Waitakere Ranges, Awhitu Peninsula, Kaimai Ranges, Poor Knights Islands	Auckland, Bay of Plenty	Northland, Auckland conservancies, Te Paki Field Centre, Save our Snails Society, Whangarei Shell Club,
14	1995	1995-1999	A.H Whitaker, G Loh, Threatened species unit DOC	Otago and Grand Skinks	Grand - Vulnerable Otago - Regionally Vulnerable	eastern Central Otago, Lindis River catchment, Lake Hawea	Dunedin, Christchurch, Wanganui	Conservancy staff, Threatened species unit, Otago University, Auckland zoo
15	1995	1995-2005	J Molloy, Threatened species unit DOC	Native Bats	Lesser short-tailed - Vulnerable Long-tailed - Vulnerable	Codfish I, Northland, Little Barrier I, north/east Taranaki, King Country, Urewera National Park, Mt Ruapehu NI, Great Barrier I, Little Barrier I, Kapiti I, South Island, Stewart I	Relevant conservancies	Conservancy staff, Public awareness unit, Science and Research division, Bat Recovery Group

16	1995	1994-2005	C.E Ecroyd, Threatened species unit DOC	*Dactylanthus taylorii*	Endangered	central North Island	Northland, Auckland, Waikato, Bay of Plenty, East Coast, Hawkes Bay, Tongariro-Taupo, Wanganui, Wellington	Conservancy staff, QEII National Trust, Royal Forest and Bird Society, Maruia Society, Botanical societies
17	1995	1995	N Gales, Threatened species unit DOC	New Zealand (Hooker's) Sea Lion	Vulnerable	subantarctic islands (Dundas, Enderby, Figure of Eight), Campbell I, Snares I, South Island and south-west North Island	Southland, Otago	Conservancy staff, MAF Fisheries, fishing industry
18	1996	1996-2001	D Newman, Threatened species unit DOC	Native Frogs	Hamilton's - Endangered Maud I - Vulnerable Archey's - Vulnerable Hochstetter's - Vulnerable	Stephen's I Maud I Mount Moehau, central Coromandel Range, southern Coromandel Ranges eastern Bay of Plenty, scattered populations in the North Island	Northland, Auckland, Waikato, Bay of Plenty, East Coast, Nelson/Marlborough	Conservancy staff, DOC Science and Research, Threatened species unit, Public Awareness unit, recovery group
19	1996	1995-2005	M Williams, G Dumbell, Threatened species unit, Ducks Unlimited	Pateke (Brown Teal)	Endangered	GBI, east coast of Northland, LBI, Kapiti I, Tiritiri Matangi I, Moturoa I	Northland, Auckland	Conservancy staff, Ducks Unlimited NZ 'Operation Pateke', zoo/ captive breeding facilities
20	1996	1995-2000	G Rasch, S Boyd, S Clegg, Threatened species unit DOC	Hihi (Stitchbird)	Nationally Endangered	Little Barrier, Kapiti, Tiritiri Matangi islands and National Wildlife Centre Mt Bruce	Auckland, Wellington	Conservancy staff, Mokoia I Trust Board, Threatened species unit, Public awareness unit
21	1996	1996-2005	M Cresswell, Threatened species unit DOC	Kakapo	Critically Endangered	Codfish I, Anchor I	Southland, Wellington (captive population)	Southland conservancy, Public awareness unit,
22	1997	1997-2007	J Adams, Threatened species unit DOC	Blue Duck	Nationally Endangered	Catchments in eastern, central North Island, Nelson, West Coast, Fiordland	North/South Island conservancies with Blue duck habitat	Conservancy staff, Ducks Unlimited, Science and Research division, recovery group

23	1997	1997-2002	R Parrish, L Honnor, Northland Conservancy DOC	NZ Fairy Tern	Endangered	Waipu, Mangawhai, South Kaipara Head, Kaipara Harbour, Papakanui Spit	Northland, Auckland	Conservancies with breeding pairs, Whangarei and Warkworth Field Centres, Public Awareness Unit, Auckland/Northland OSNZ members, Auckland zoo, Shorebird protection officers
24	1998	1998-2003	A.H Whitaker, Biodiversity Recovery Unit DOC	Striped Skink	Vulnerable	40 locations between Northland, Bay of Plenty, south Taranaki, Great Barrier I, Little Barrier I	Auckland, Waikato, Bay of Plenty, Wanganui	Conservancy staff, Biodiversity Recovery Group
25	1998	1998-2002	G Sherley, Science and Research Unit DOC	Threatened Weta	Endangered - Vulnerable	Mainland and offshore islands	Northland, Auckland, Waikato, Wellington, Nelson/Marlborough, Southland, Canterbury	Conservancy staff, Zoos, non-government conservation groups/facilities
26	1999	1999-2009	D.A Norton, P.J deLange, Te Wai Pounamu Conservation, DOC	Coastal Cresses (Nau)	*Lepidium banksii* - Critically Endangered *Lepidium flexicaule* - Endangered *Lepidium naufragorum* - Rare *Lepidium oleraceum* - Endangered *Lepidium tenuicaule* - Vulnerable *Rorippa divaricata* - Endangered	Abel Tasman National Park Auckland, Coromandel, west coast South Island west coast South Island northern NZ, Waikato coastline, south western North Island, northern South Island, Otago, Foveaux Strait - southern islands, Chatham islands south eastern Otago-Southland coastline, Kapiti I, Titahi Bay northern North Island	Northland, Auckland, Waikato, Bay of Plenty, East Cape/Hawkes Bay, Wanganui, Wellington, Nelson/Marlborough, West Coast, Otago, Southland	Conservancy staff, Head office advocacy staff, Auckland Regional Botanical Gardens, Southland Threatened Plant Garden staff, recovery group
27	1999	1999-2004	D Towns, DOC Biodiversity Recovery Unit	*Cyclodina* Skinks	Copper - None Robust - Threatened McGregor's - Threatened Marbled - None Mokohinau - Highly Vulnerable Ornate - None Whitaker's - Threatened	Maud I, Mercury I group, Great Barrier I, Little Barrier I, Aldermen I, Wellington, Wairarapa, North Island Mokohinau Group, Mercury group, Castle I Mana I, Motuharakeke I, Mauitaha I, Sail Rock, Lady Alice I Great Barrier I, Little Barrier I, Aldermen group, Mercury group, Poor Knights group Mokohinau Group, Hen and Chicken group Scattered populations throughout North Island, Kapiti I Mercury group, Castle I, Pukerua Bay	Auckland, Waikato, Wellington, Northland, Bay of Plenty	Conservancy staff, supporters of Tiritiri Matangi Inc, Motuora Restoration Society, DOC Science Technology and Information Services

28	1999	1999-2009	A.J Townsend, Biodiversity Recovery Unit	*Pittosporum patulum*	Nationally Endangered	North west Nelson, East Nelson south to Lake Hawea	Nelson/Marlborough, Canterbury, Otago/Southland	Conservancy staff, Science and Research division, recovery group
29	1999	1999-2009	A.J Beauchamp, D.J Butler, D King, Biodiversity Recovery Unit	Weka	North Island - Critically Endangered Western weka 'Fiordland' - Endangered Western weka 'northern South Island and West coast' - Vulnerable Stewart I - Vulnerable Buff - Endangered	Northland (Opua), Rakitu I, Kawau I, Pakatoa I, Whanganui I, East Coast, Mokoia I, Kapiti I, Karori Wildlife Sanctuary Chalky Sound to Milford Sound, most Fiordland I Kahurangi National Park, Richmond Range, Nelson Lakes National Park, Marlborough Sounds, south Westland Stewart I and Stewart I group Main Chatham, Pitt I	Auckland, Bay of Plenty, Wellington	Conservancy staff, national captive weka management co-ordinator
30	1999	1999-2009	J Innes, I Flux, Landcare Research, DOC Science and Research	North Island Kokako	Endangered	Little Barrier I, Kapiti I, Tiritiri Matangi I, predator free reserves such as Mapara, Mount Bruce	All North Island conservancies	Conservancy staff, Science and Research division, recovery group, Auckland Regional Council, Kaharoa/Manawahe Community Trusts
31	2000	2000-2010	P Lange, C Jones, Biodiversity Recovery Unit	*Muehlenbeckia astonii*	Endangered	Central eastern NZ	Wellington, Nelson/Marlborough, Canterbury	Conservancy staff, community relations staff
32	2000	2000-2010	R.B Allen, Landcare Research	Inland Le*pidium*	*L. sisymbrioides matau* - Critically Endangered *L. sisymbrioides* kawarau - Critically Endangered *L. sisymbrioides sisymbrioides* - Declining	Central Otago Central Otago, Kawarau Gorge, Manuherikia river valley North Canterbury, eastern Central Otago	Otago, Canterbury	Conservancy staff, Biodiversity program officers, technical support officer, Landcare research scientists
33	2000	2000-2010	D Norton, Te Wai Pounamu Conservation	*Hebe cupressoides*	Endangered	19 populations from north Canterbury to Central Otago	Canterbury, Otago	Conservancy staff, Recovery group, Consultative group, Yellow-eyed penguin trust, local government, tourism industry
34	2001	2001-2011	D Given and Associates, DOC	Pygmy Button Daisy	Critically Endangered	Titahi Bay (Wellington), Rai Valley (Marlborough), Mount Pleasant (Canterbury)	Wellington, Nelson/Marlborough, Canterbury	Conservancy staff, local authorities, local nurseries
35	2001	2000-2025	B McKinlay, Biodiversity Recovery Unit	Hoiho/Yellow eyed Penguin	Threatened	Banks Peninsula, North Otago, Otago Peninsula, Catlins, Stewart I, offshore islands of Chatham I, Auckland I, Campbell I	Otago, Southland, Canterbury	Conservancy staff, Recovery group, Consultative group, Yellow-eyed penguin trust, local government, tourism industry

36	2001	2001-2011	DOC Threatened species unit	Chatham Island Taiko	Critically Endangered	South Chatham I	Wellington	Chatham I Area Office, Taiko Expedition
37	2001	2001-2011	DOC Threatened species unit	Chatham Petrel	Critically Endangered	Rangatira I, Chatham I	Wellington	Chatham I Area Office
38	2001	2001-2011	DOC Threatened species unit	Chatham Island Oystercatcher	Endangered	Chatham I, Rangatira I, Pitt I, Mangere I	Wellington	Chatham I Area Office
39	2001	2001-2011	DOC Threatened species unit	Parea (Chatham Island Pigeon)	Endangered	Chatham I, Pitt I	Wellington	Chatham I Area Office
40	2001	2001-2011	DOC Threatened species unit	Black Robin	Endangered	Mangere I, Rangatira I	Wellington	Chatham I Area Office
41	2001	2001-2011	DOC Threatened species unit	Chatham Island Tui	Endangered	Pitt I, Rangatira I, southern Chatham I	Wellington	Chatham I Area Office
42	2001	2001-2011	DOC Threatened species unit	Chatham Island Mollymawk, Northern Royal Albatross, Pacific Mollymawk	Chatham I mollymawk - Critically Endangered Northern Royal Albatross - Endangered Pacific Mollymawk - Vulnerable	Breed only on The Pyramid in the Chatham Island's 99% breeds in the Chatham I's on the Forty-fours and Big and Little Sister I's Breeds in the Chatham I's on the Forty-fours and Big and Little Sister I's and Rosemary Rock in the Three Kings	Wellington	Chatham I Area Office
43	2001	2001-2011	DOC Threatened species unit	Chatham Island Shag and Pitt Island Shag	Chatham I Shag - Endangered Pitt I Shag - Vulnerable	Chatham I, Rabbit I, Star Keys Chatham I, Pitt I, Rangatira I, Mangere I, Little Mangere I, Star Keys, The Pyramid, The Forty Fours, Big and Middle Sister I, The Murumurus, Rabbit I, Western Reef I, Castle I	Wellington	Chatham I Area Office
44	2001	2001-2011	DOC Threatened species unit	NZ Shore Plover	Endangered	Motuora I, Rangatira I, Western Reef	Wellington	Chatham I Area Office
45	2001	2001-2011	DOC Threatened species unit	Forbe's Parakeet and Chatham Island red-crowned Parakeet	Forbe's Parakeet - Endangered Chatham I red-crowned Parakeet - Vulnerable	Mangere I, Little Mangere I southern Chatham I, Pitt I, Rangatira I	Wellington	Chatham I Area Office

46	2001	2001-2011	DOC Threatened species unit	Chatham Island Fantail, Tomtit and Warbler	Chatham I Fantail - Vulnerable Chatham I Tomtit - Vulnerable Chatham I Warbler - Vulnerable	Chatham I, Pitt I, Rangatira I, Mangere I Pitt I, Rangatira I, Mangere I Rangatira I, Mangere I, Little Mangere I, Star Keys, Pitt I, Chatham I	Wellington	Chatham I Area Office
47	2001	2001-2011	P Gaze, Nelson/Marlborough conservancy DOC	Tuatara	Northern/Cook Strait - Vulnerable Brothers - Endangered	35 islands including 7 in the Cook Strait and islands on the east coast if the NI	Bay of Plenty, Wellington, Nelson/Marlborough	All conservancies with captive tuatara, recovery group
48	2002	2002-2012	DOC Science and Research Unit	North Island *Oligosoma* spp. Skink	Brown - None Chevron - Threatened Common - None Egg-laying - None Moko - None Narrow-bodied - Data Deficient Shore - None Small-scaled - Threatened Speckled - Near Threatened Spotted - None Striped - Threatened Three Kings - Near Threatened	Taranaki, western half southern North Island Great Barrier I, Little Barrier I southern North Island, South Island Islands off northern and north-eastern North Island, northern Northland, Coromandel Peninsula 33 offshore islands Hokianga 70 island populations, Auckland west coast, Gisborne and east coast southern Te Urewera district, Kaimanawa Range to the northern Ruahine Range, Motutaiko I in Lake Taupo Volcanic plateau of North Island, scattered populations throughout NI southern North Island, islands in Wellington harbour 40 locations from Northland, GBI, LBI, Bay of Plenty, Waikato, South Taranaki Three Kings Group	Auckland, Waikato, Bay of Plenty, Tongariro/Taupo, Wanganui, East Coast/Hawkes Bay, Wellington	Conservancy staff, Science and Research unit, STIS
49	2003	2003-2013	K Walker, DOC Threatened species unit	*Powelliphanta* Land Snails	Threatened - Endangered	Lower North Island, East Cape to Fiordland	East Coast, Hawkes Bay, Tongariro/Taupo, Wanganui, Wellington, Nelson/Marlborough, West Coast, Southland,	Conservancy staff

50	2003	1996-2006	H Robertson, Biodiversity Recovery Unit	Kiwi	NI brown - Seriously Declining Okarito brown - Nationally Critical Haast tokoeka - Nationally Critical Southern tokoeka - Gradually Declining Great spotted - Gradually Declining Little spotted - Range Restricted	North Island Okarito South Island Haast South Island Stewart I, Rakiura and Fiordland South Island northern South Island Kapiti I other small offshore islands	All conservancies with kiwi habitat	Conservancy staff, External relations division, Science and Research division, captive breeding institutions
51	2003	2003-2013	R Barrier, Biodiversity Recovery Unit	Mudfish	Canterbury mudfish - Nationally Endangered Brown mudfish - Threatened Black mudfish - Threatened Northland mudfish - Nationally Endangered	Canterbury southern North Island, west coast of the South Island northern North Island Northland from Kaikohe to Kerikeri	All conservancies with known mudfish habitat	Community relations officer, Freshwater technical support officer, recovery group
52	2004	2003-2013	C Jones, Science and Research Unit	Grassy plants of fertile sites	Nationally Endangered	South Marlborough, North Canterbury, Otago,	Nelson/Marlborough, Canterbury, Otago/Southland	Conservancy staff, biodiversity program managers, recovery group, community relations staff, technical support officers
53	2004	2003-2013	R Allibone, R Barrier, Biodiversity Recovery Unit	NZ non-migratory Galaxiid Fish	Data Deficient - Nationally Endangered	Northland, Auckland, West Coast, Nelson/Marlborough, Wellington, Manawatu, Hawke's Bay, Bay of Plenty, Waikato, eastern/central Otago river catchments, throughout South Island	Wellington, Wanganui, East Coast/Hawke's Bay, Nelson/Marlborough, Canterbury, West Coast, Otago and Southland	Conservancy staff, Freshwater Technical Support Officers, Programme Managers and Community Relations Officers for those Conservancies and Areas
54	2004	2004-2009	S Taylor, I Castro, R Griffiths, Biodiversity Recovery Unit	Hihi (Stitchbird)	Nationally Endangered	Little Barrier I, Tiritiri Matangi I, Kapiti I, Mount Bruce Wildlife Centre, Cascade Kauri Park	Auckland and Wellington (Warkworth, Kapiti, Mt Bruce offices)	Conservancy staff, biodiversity managers, recovery group,
55	2004	2003-2013	S Hallas (Ed.), Biodiversity Recovery Unit	NZ large Galaxiid	Shortjaw Kokopu - Gradual Decline Giant Kokopu - Gradual Decline Banded Kokopu - Not Threatened Koaro - Not Threatened	North and South Island except east coasts North and South Island, Stewart I, Great Barrier I, Little Barrier I, Chatham I Throughout NZ and offshore islands Throughout NZ and offshore islands	All	Conservancy staff, Programme Managers, Freshwater Technical Science Officers (Kaupapa Atawhai Managers to assist), recovery group

56	2005	2004-2014	G.D La Cock, S Holzapfel, D King, N Singers, Science and Technical Publishing DOC	*Dactylanthus taylorii*	Serious Decline	Throughout the North Island, Little Barrier I	All North island conservancies	Conservancy staff, recovery group, Friends of dactylanthus Recovery group
57	2006	2005-2015	Science and Technical Publishing DOC	NZ Fairy Tern	Nationally Critical	Mangawhai, Waipu, Papakanui Spit, Pakiri, South Kaipara Head	All conservancies with breeding grounds	Con Conservancy staff, program managers, community relations staff, Auckland Zoo
58	2006	2004-2014	J Dowding, A.M Davis Threatened species unit DOC	NZ Dotterel	North Island subspecies - Nationally Vulnerable SI subspecies - Nationally Critical	coastal North Island (east coast Northland, Auckland, Coromandel, Bay of Plenty), Matakana I, Gisbourne area Stewart I, Awarua Bay Southland	All North Island conservancies (except Tongariro/Taupo/Wellington) Southland and Stewart I	Conservancy staff, Recovery group, Consultative group, Yellow-eyed penguin trust, local government, tourism industry
59	2006	2005-2010	Science and Technical Publishing DOC	Pateke(Brown Teal)	Nationally Endangered	Aotea, eastern Northland, eastern Coromandel Peninsula, small populations on islands in Fiordland	Northland, Auckland, Bay of Plenty	Conservancy staff, recovery group, Tutukaka Landcare Coalition, Ducks Unlimited, Brown Teal Conservation Trust
60	2008	2008-2018	S Holzapfel, H Robertson, J McLennan, W Sporle, K Hackwell, M Impey	Kiwi	Brown - Serious Decline Rowi - Nationally Critical Tokoeka Haast - Nationally Critical Tokoeka n Fiordland - Gradual Decline Tokoeka s Fiordland - Gradual Decline Tokoeka Stewart I - Gradual Decline Great spotted - Gradual Decline Little spotted - Range Restricted	Northland, Coromandal, North Island Okarito sanctuary Haast range, Arawhata river northern Fiordland southern Fiordland Stewart I northwest Nelson, Nelson Lakes national park, West Coast, Southern Alps, Kapiti I, Red Mercury I, Tiritiri Matangi I, Long I, Karori Wildlife Sanctuary	All conservancies with kiwi habitat	Conservancy staff, recovery group, BNZ Save the Kiwi Trust, research and development group, external relations division, Science and Research division, captive breeding institutions
61	2008	2007-2012	C Wickes, D Crouchley, J Maxwell	Takahe	Nationally Critical	Fiordland, Maud I, Mana I, Kapiti I, Tiritiri Matangi I, Maungatautari mainland sanctuary	Southland	Conservancy staff, programme managers, island coordinators, Burwood programme staff, community relations staff, research team

Appendix 9 Summary of key attributes in all 61 of New Zealand's recovery plans (Source: DOC, 2010d).

Performance rating: Strong performance; Poor performance; Weak performance

Written in plan; Mammal; Bird; Reptile; Amphibian; Fish; Mollusc or Insect; Plant

Chapter headings (in bold) and their contents	Year approved # of plans	% of plans	1 1991	2 1991	3 1992	4 1993	5 1993	6 1993	7 1993	8 1993	9 1993	10 1993	11 1994	12 1994	13 1995	14 1995	15 1995	16 1995	17 1995	18 1996	19 1996	20 1996	21 1996	22 1997	23 1997	24 1998	25 1998	26 1999	27 1999	28 1999	29 1999	30 1999	31 2000	32 2000	33 2000	34 2001	35 2001	36 2001	37 2001	38 2001	39 2001	40 2001	41 2001	42 2001	43 2001	44 2001	45 2001	46 2001	47 2001	48 2002	49 2003	50 2003	51 2003	52 2004	53 2004	54 2004	55 2004	56 2005	57 2006	58 2006	59 2006	60 2008	61 2008
Introduction																																																																	
Past Distribution	61	100.0																																																															
Present Distribution	59	96.7																																																														
Wild population	61	100.0																																																														
Captive population	16	26.2																																																														
Distribution map																																																																	
Past Distribution	25	41.0																																																																
Present Distribution	42	68.9																																																														
Status	61	100.0																																																														
Estimated population size	37	60.7																																																														
Ecology/Biology																																																																	
Habitat selection and use	58	95.1																																																																	
Breeding behaviour/success (e.g rituals/pollination/dispersal)	55	90.2																																																																
Diet/Feeding	41	67.2																																																															
Behaviour	29	47.5																																																														
Vulnerability to predation	12	19.7																																																														
Population dynamics/statistics	10	16.4																																																														
Competition	8	13.1																																																														
Causes of Decline and Threats to Long Term Survival																																																																	
Predation	56	91.8																																																															
Habitat loss due to degradation/fragmentation/modification	51	83.6																																																														
Competition	25	41.0																																																														
Hunting/collecting (Legal & illegal)	16	26.2																																																														
Disease	15	24.6																																																														
Natural events (e.g. storms, drought)	14	23.0																																																														
Human/animal disturbance at breeding sites	13	21.3																																																														
Low productivity/long incubation or nesting period	7	11.5																																																														
Genetic variation/drift/hybridisation	6	9.8																																																														
Agricultural/pest eradication toxins (e.g. herbicides, 1080, cyanide)	6	9.8																																																													
Fishing industry bycatch	3	4.9																																																													
Loss associated animal spp.	2	3.3																																																													
Recruitment failure of single sex populations	1	1.6																																																													
Past Conservation Management																																																																
Management of predators	24	39.3																																																														
Habitat management (restoration, protection, enhancement)	24	39.3																																																														
Monitoring of populations	23	37.7																																																													
Research	22	36.1																																																													
Captive population breeding	21	34.4																																																												
Translocation of populations	20	32.8																																																												
Surveys/census (e.g. banding)	18	29.5																																																													
Management of pests	15	24.6																																																												
Releases of captive-reared individuals	14	23.0																																																												
Advocacy/promote public interest	11	18.0																																																												
Egg manipulation/incubation/cross-fostering	8	13.1																																																												
Quarantine measures	3	4.9																																																											
Culling of hybrids	1	1.6																																																											
Fishery regulation	1	1.6																																																											
Recovery Potential (Ability of species to recover)																																																																
With habitat free from disturbance and predators/pests	16	26.2																																																												
With breeding in captivity	11	18.0																																																											
With translocations	7	11.5																																																											
Survival within present range	5	8.2																																																											
Only with conservation	4	6.6																																																										
With development of *in situ* management	4	6.6																																																										
With community support	2	3.3																																																										
With management to prevent extinction due to genetic events	1	1.6																																																										
Second generation research	1	1.6																																																									
With egg manipulation/multiple clutching	1	1.6																																																								
Options for Recovery																																																																
Do nothing	40	65.6																																																										
Maintain populations through management *in situ*	36	59.0																																																										
Maintain/protect/increase island populations	33	54.1																																																										
Translocation to suitable locations (e.g islands, former range)	27	44.3																																																										
Maintain/protect/increase mainland populations	21	34.4																																																										
Establish/maintain captive population	19	31.1																																																									
Control pests/predators	15	24.6																																																									
Intensively manage as many populations as possible	13	21.3																																																									
Survey/monitor populations	13	21.3																																																									
Maintain solely as captive population (cultivation)	7	11.5																																																									
Research	7	11.5																																																									
Undertake national priority work	5	8.2																																																								
Advocacy in community (farmers, landowners)	2	3.3																																																								
Determine conservation status	1	1.6																																																								
Protect minimum numbers of each taxon	1	1.6																																																								

Plans 1-61 have been colour coded to indicate whether the recovery plan is for a mammal, bird, reptile, amphibian, fish, mollusc/insect, or plant. Chapters have also been graded for performance (this is outlined in the '# of plans' and % of plans' columns). Green indicates strong performance (30 or more plans); yellow poor performance (10-30 plans); and red weak performance (10 or less plans). The large red circles indicate gaps in knowledge that are commented on in the 'Discussion' chapter.

Appendix 9 (cont.) Summary of key attributes in all 61 of New Zealand's recovery plans (pgs 163-164) (Source: DOC, 2010d).

Performance rating: Strong performance; Poor performance; Weak performance

Written in plan; Mammal; Bird; Reptile; Amphibian; Fish; Mollusc or Insect; Plant

Chapter headings (in bold) and their contents	# of plans	% of plans
Strategic directives	7	11.5
Cultural importance	8	13.1
Public awareness	9	14.8
Goals		
Long term (50 years)	59	96.7
Short term (10 years)	26	42.6
Aims	4	6.6
Recovery Strategies (Objectives/actions in the workplan)		
Advocacy in the community (consult with iwi, community members)	53	86.9
Long term monitoring of populations (distribution/abundance/status)	37	60.7
Establish additional wild populations on offshore islands (translocation)	33	54.1
Maintain habitat of mainland populations (monitor/protect)	33	54.1
Maintain habitat of island populations (monitor/protect)	33	54.1
Maintain captive breeding population	32	52.5
Establish/maintain predator control	24	39.3
Monitor poorly known populations (surveys/census)	22	36.1
Maintain all populations	20	32.8
Breeding habitat protection and restoration	18	29.5
Habitat protection on private land	18	29.5
Undertake genetic research (genetic diversity/taxonomy)	16	26.2
Establish additional wild populations on mainland (translocation)	15	24.6
Increase breeding productivity of population in the wild	14	23.0
Establish/maintain pest control	13	21.3
Maintain population *in situ*	13	21.3
Establish self-sustaining population on islands	12	19.7
Statutory protection	12	19.7
Establish conservation partnership with local authorities/landowners	10	16.4
Develop captive breeding techniques (egg-manipulation/incubation)	7	11.5
Create a recovery group	6	9.8
Research benefit of captive breeding	6	9.8
Maintain information database	6	9.8
Protect populations on land outside crown control	5	8.2
Protect adults at breeding sites (create artificial breeding sites)	5	8.2
Determine successful management techniques/strategies	4	6.6
Protect habitat through statutory/non-statutory advocacy	4	6.6
Monitor mortality due to fishing operations	3	4.9
Establish self-sustaining population on mainland	3	4.9
Create publically accessible population	3	4.9
Support for captive breeding programme	3	4.9
Develop contingency plans for different threats	2	3.3
Commercial/Doc cultivation of plants	2	3.3
Increase funding support for programme	2	3.3
Determine vulnerability to extinction	1	1.6
Establish new island sanctuaries	1	1.6
Carry out Research	43	70.5
Priority of each objective (Date of completion)	45	73.8
Accountability (Area managers, programme manager, recovery group, conservancies, NGOS)	53	86.9
List of key people involved in the plan/recovery group	23	37.7
Review date	29	47.5
Acknowledgements	32	52.5
References	60	98.4
Appendices	59	96.7
Timeline/Critical path	26	42.6
Results of past management	23	37.7
Budget/Funding estimates	15	24.6
List of experts involved with species conservation	14	23.0
Contact details for experts	5	8.2
References/ documents relevant to species	1	1.6
Published by/prepared for		
DOC (Science & Technical Publishing team)	25	41.0
Threatened species unit	20	32.8
Biodiversity Recovery Unit	14	23.0
Recovery Group	3	4.9

Year approved

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
1991	1991	1992	1993	1993	1993	1993	1993	1993	1993	1994	1994	1995	1995	1995	1995	1995	1996	1996	1996	1996	1997	1997	1998	1998	1999	1999	1999	1999	1999	2000	2000	2000	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2002	2003	2003	2003	2004	2004	2004	2004	2005	2006	2006	2006	2006	2008	2008

Plans 1-61 have been colour coded to indicate whether the recovery plan is for a mammal, bird, reptile, amphibian, fish, mollusc/insect, or plant. Chapters have also been graded for performance (this is outlined in the '# of plans' and % of plans' columns). Green indicates strong performance (30 or more plans); yellow poor performance (10-30 plans); and red weak performance (10 or less plans). The large red circles indicate gaps in knowledge that are commented on in the 'Discussion' chapter.

Appendix 10 Community focused objective in the work plans of all 61 New Zealand recovery plans (pgs 198-202) (Source: DOC, 2010d).

Plan no.	Year approved	Species	Community focused Objective	Work plan	Community Involvement
1	1991	North Island Kokako	9 Promote public interest and involvement in kokako conservation	Make recovery plan available for public comment, media releases, volunteer participation in survey/monitoring, visits	Public awareness, volunteer help in surveying/monitoring populations
2	1991	Kiwi	10 Promote public interest and involvement in kiwi conservation	Evaluate proposals to transfer kiwi to open sanctuary islands where they can act as a resource for advocacy and education (e.g. Tiritiri Matangi), encourage display of NI brown kiwi at suiTable zoological gardens here and overseas, produce a leaflet for landowners with kiwi on their land, those taking dogs into native forest, those involved in trapping and poisoning of possums, encourage the involvement of volunteers in kiwi surveys	Public awareness, education of public to reduce losses of kiwi during hunting and trapping activities, volunteer help in field work
3	1992	Whitaker's and Robust Skinks	8 Promote public interest and involvement in the recovery of Whitaker's and Robust skink and in community restoration	Using local people as guardians of Pukerua Bay reserve, emphasise the role of Whitaker's and Robust skinks in ecological restoration by linking recovery of these species to tuatara	Public awareness and support
4	1993	Black Stilt	5 Encourage public interest in and support for the program through advocacy and education	Complete viewing hide and display room at captive management site, encourage minimal disturbance to wild birds, investigate sponsorship for public viewing of captive/wild stilts, encourage active participation by schools	Public awareness
5	1993	Chevron Skink	6 Promote public interest and involvement in chevron skink recovery, habitat rehabilitation and in the conservation values of GBI	Provide educational material for community/schools on GBI, breed/display skinks at Auckland Zoo, involve Auckland Zoo in fundraising and promoting chevron skink conservation	Public awareness, pest prevention awareness
6	1993	Mohua (Yellowhead)	4 Promotion of public awareness of mohua and the values and ecology of mainland forests	Media releases, displays, public talks, summer programmes, videos	Public awareness, volunteer surveying
7	1993	Subantarctic Teal	7 Advocacy: advocate the conservation of subantarctic teal and emphasize the importance of predator free islands	Promote and publicise the subantarctic teal recovery program, educate public about importance of predator free islands, sub-Antarctic islands	Public awareness
8	1993	Kowhai ngutukaka	7 Advocacy: advocacy of the conservation of kowhai ngutukaka	Protection of wild populations on private lands, press releases, information packages and television coverage	Public awareness
9	1993	Tuatara	17 Advocacy: increase public awareness of and support for tuatara conservation measures	Establishment/partnerships between involved organisations, regular press releases, pamphlets, visits to schools, opportunity to participate in field surveys, zoo displays and education	Public awareness
10	1993	New Zealand Dotterel	3 Advocacy: increase public knowledge with the specific aim of creating opportunities for greater public participation	Wardens should be knowledgeable, permanent interpretative signs at access points, explanatory pamphlets, DOC staff should address schools, community groups and conduct field trips	Monitoring, public awareness
11	1994	South Island Saddleback	5 Promote public interest and involvement in recovery of saddlebacks and their habitats	Promote recovery program, identify opportunities for public participation in conservation work, develop a public display facility	Public awareness
12	1994	Takahe	3 Promote public awareness of takahe and their conservation	Hold breeding pairs for display, encourage public visits to island sanctuaries, press releases of all major events	Public awareness
13	1995	Giant Land Snail	none	Surveying	None
14	1995	Otago and Grand Skinks	none	Habitat protection with landowner involvement	None
15	1995	Native Bats	5 To raise public awareness of bats and to involve the public in bat conservation	Prepare/implement communication plan	Public awareness, encourage help with surveys

16	1995	*Dactylanthus taylorii*	2 Promote public interest and involvement in the recovery of *Dactylanthus taylorii*, encourage its protection on private land	Form a network of people willing to assist with locating/protecting plants, talks, media displays, press releases, handouts	Public awareness, reduced collection of wood roses, protection of plants on private land
17	1995	New Zealand (Hooker's) Sea Lion	5 Raise awareness of New Zealand sea lion	Information brochures, articles in natural history/scientific publications, general educational material for schools	Public awareness
18	1996	Native Frogs	6 Raise public awareness and public advocacy for protection of native frogs and their habitat	Distribute fact sheet, prepare an article for popular press and produce a video on frog conservation	Public awareness, encourage help with surveys
19	1996	Pateke (Brown Teal)	7 To broaden the public constituency of support for brown teal conservation and to involve all elements of that constituency fully in the recovery programme for brown teal	Make use of community support and involve community in the programme and create a widespread partnership and ownership of the programme	Public awareness, population monitoring
20	1996	Hihi (Stitchbird)	4 Raise public awareness of the stitchbird recovery program	Media releases, educational publications, maintain a captive display, provide information to tour boat operators and visitors	Public awareness
21	1996	Kakapo	7 Increase public awareness of kakapo conservation	Identify/liaise with conservation groups, maintain communication with the Minister and media, use volunteers	Public awareness, volunteers
22	1997	Blue Duck	3 Protect blue duck habitat through legal protection and advocacy 6 Manage captive blue duck in order to fulfil an education and advocacy role	Continue advocacy in hydroscheme resource consent renewal process, protect habitat through non-statutory advocacy Improve blue duck husbandry at public viewing facilities	Public awareness, sighting reports
23	1997	NZ Fairy Tern	5 Raise public awareness of the need for conservation of fairy tern.	Continue media releases on the results of fairy tern breeding attempts, publish articles, produce a pamphlet, erect further signage at Papakanui Spit and Waikiri Creek, involve local people, create fact sheet	Public awareness, sighting reports
24	1998	Striped Skink	4 Initiate an advocacy program	Ensure regular publicity in newspapers, publish/circulate a brochure/pamphlet, arrange meetings with community groups in target areas	Public awareness
25	1998	Threatened Weta	10 Promote public interest and involvement in weta conservation	Enhance the public profile of weta by creating posters/pamphlets for schools and the general public, display weta at National Wildlife Centre, zoos, other institutions	Public awareness
26	1999	Coastal Cresses (Nau)	1 Promote iwi and public interest and involvement in the recovery of coastal cress species	Promote writing of magazine articles, provide identification material to facilitate DOC staff, iwi and general public in identifying these plants, oral presentations, field trips	Iwi consultation, public awareness
27	1999	*Cyclodina* Skinks	11 Promote public interest in recovery of *Cyclodina* skinks and in ecological restoration	Develop partnerships with iwi, promote public interest in NZ lizards and ecological restoration, promote values of Pukerua Bay Scientific reserve	Public awareness
28	1999	*Pittosporum patulum*	1 Promote public/iwi interest and involvement in the recovery of *P patulum*	Identify iwi, establish working relationship, develop brochures	Public awareness
29	1999	Weka	8 Recognise and promote community understanding/involvement in weka conservation	Advocate appropriate landuses, active public involvement in the protection of weka particularly in places where weka are part of the local environment, removal of wallabies from Kawau I	Weka protection on private land, public awareness
30	1999	North Island Kokako	9 Promote public interest and involvement in kokako conservation	Advocacy program at Mount Bruce National Wildlife Centre, iwi involvement in kokako translocations, media releases/articles on management success	Translocation volunteers and re-introduction location monitoring, public awareness
31	2000	*Muehlenbeckia astonii*	1 Involve stakeholders including landowners, iwi, local government and public in the recovery of *M. astonii* by June 2002	Identify interested parties and establish working relationship, arrange briefings for relevant local bodies with the species within their jurisdiction, re-contact people every 2 years, produce a brochure, empower groups to manage/monitor species	Active managing/monitoring on private land, public awareness

32	2000	Inland L*epidium*	1 Promote public, iwi and particularly landowner interest in the conservation of inland *Lepidium* population	Produce a brochure, conduct field excursions for DOC staff and the public, hold meetings with affected landowners, publish articles	Active managing/monitoring on private land, public awareness
33	2000	*Hebe cupressoides*	1 Promote landowner/manager, public and iwi interest and involvement in the recovery of *H. cupressoides*	Formal consultation with all landowners/managers and interested iwi, work with the public and iwi to assist them in better understanding the problems this species is facing, presentations, field trips, publication of articles	Active managing/monitoring on private land, public awareness
34	2001	Pygmy Button Daisy	2 Raise public/iwi awareness of button daisy conservation	Identify stakeholders, consult with iwi, establish/maintain signs to educate public at wild sites	Public awareness in schools and for rock climbers
35	2001	Hoiho/Yellow eyed Penguin	7 Ensure continued public support for hoiho conservation by maintaining existing consultative structures and developing new advocacy initiatives	Develop a strategy for measuring the effectiveness of advocacy activities, maintain hoiho consultative group, disseminate information	Public awareness, hoiho rehabilitation, tourism operators
36	2001	Chatham Island Taiko	None	Habitat protection with landowner involvement	Public awareness
37	2001	Chatham Petrel	1 action 1.1 Implement quarantine measures, restrict visitors and enforce the Wildlife and Reserves Acts in relation to illegal landing and mutton-birding on Rangatira	New people visiting the island need to be aware of these quarantine measures, restrictions on the number of people visiting the island should continue	Public awareness
38	2001	Chatham Island Oystercatcher	1 action 1.2 Minimise destruction of nests and disturbance of breeding CI oystercatcher from domestic stock, dogs and people in managed areas	Erect signs warning people of the threat they pose by motorbiking, walking or letting dogs roam near breeding CI oystercatcher territories, education of the community about oystercatcher's plight and its management program	Public awareness
39	2001	Parea (Chatham Island pigeon)	1 action 1.2 Monitor parea population numbers and distribution, including their dispersal from southern Chatham I	A calendar survey has been distributed to all householders on Chatham and Pitt requesting records of all parea sightings between August 2000 and July 2001	Public awareness
40	2001	Black Robin	1 action 1.1 Implement quarantine measures and restrict visitors to Rangatira and Mangere	Quarantine measures have been in place on Rangatira and Mangere, new people visiting these islands need to be made aware of these measures	Public awareness
41	2001	Chatham Island Tui	1 action 1.1 Implement quarantine measures and restrict people to Rangatira and promote measures to prevent the introduction of pests on Pitt I	Quarantine measures have been in place on Rangatira for many years, new people visiting these islands need to be made aware of these measures	Public awareness
42	2001	Chatham Island Mollymawk, Northern royal Albatross, Pacific Mollymawk	1 Seek the support and cooperative participation of island owners in all albatross monitoring and management programme 3 Advocate for the protection of albatross breeding colonies in the Chatham I's	Initiate discussions with island owners to seek their support for the development of a programme to be undertaken on the islands, The populations will need continued protection from human-induced threats at their breeding grounds, such as the introduction of predators, avian disease or illegal harvest of birds	Public awareness, protection on private ground
43	2001	Chatham Island Shag and Pitt Island Shag	1 action 1.4 Encourage and assist landowners to protect colonies from stock and pigs and to control predators if practicable 3 Promote the protection of shags from persecution and accidental catch during fishing operations in the Chatham I	The exclusion of stock from colonies that are currently accessible should be promoted Advocacy is needed to ensure people are aware of the populations vulnerability to such persecution	Public awareness, bycatch prevention
44	2001	NZ Shore Plover	1 action 1.2 Implement quarantine measures and restrict visitors to Rangatira 1 action 1.3 Minimise human impacts on Western Reef	Quarantine measures have been in place on Rangatira for many years, new people visiting these islands need to be made aware of these measures DOC should restrict its visits to those essential for gathering basic information	Public awareness

45	2001	Forbe's Parakeet and Chatham Island red-crowned Parakeet	3 action 3.1 Implement quarantine measures and restrict visitors to Mangere I	Quarantine measures have been in place on Mangere for many years, new people visiting these islands need to be made aware of these measures	Public awareness
46	2001	Chatham Island Fantail, Tomtit and Warbler	1 action 1.1 Implement quarantine measures on Rangatira, Mangere and Pitt islands	Quarantine measures have been in place on Rangatira and Mangere for many years, new people visiting these islands need to be made aware of these measure	Public awareness
47	2001	Tuatara	3 Public awareness of tuatara and related conservation issues will be promoted through accessibility to captive animals and certain wild populations of tuatara	Promote controlled public access to certain wild populations, promote knowledge through captive tuatara, interpretative material is available with displays	Knowledge of iwi and interest groups encouraged for advocacy, public awareness campaign
48	2002	North Island *Oligosoma* spp. Skink	10 Develop advocacy programmes to protect populations of skinks either on or off public land	Provide island care brochures to boating communities, publish/distribute fact sheets about species of skink, encourage control of pests on private land, establish links with community groups as a means of maintaining information about projects	Public awareness campaign
49	2003	*Powelliphanta* Land Snails	Issue 4 Though large and handsome *Powelliphanta* are surprisingly little known, both in NZ and overseas. Lack of general knowledge of the group, even within DOC makes conservation difficult	Distribute *Powelliphanta* distribution maps and identification guides to DOC and public, promote public interest and involvement in the conservation of *Powelliphanta* by ensuring public access to robust snail populations	Public awareness
50	2003	Kiwi	1 To encourage and support public and community protection of kiwi and their habitat throughout the term of this plan	Inform iwi/public about kiwi conservation, maintain open communication with all interested parties, empower people to develop own conservation projects	Public awareness, conservation groups, translocation volunteers, pest/predator monitoring
51	2003	Mudfish	3 Identify and advocate for the protection and sustainable management of all mudfish habitat	Advocate through regional/district plans, work with local communities to protect habitat, acknowledge 'mudfish friendly' land management practices	Public awareness, mudfish friendly land management practices, protection of habitat from vegetation clearance
52	2004	Grassy plants of fertile sites	1 To encourage public awareness and protection of these plants and their habitats	Identify stakeholders, raise awareness of plants conservation status through publicity material, maintain contact with stakeholders	Public awareness, protection of plants and habitat on private property
53	2004	NZ non-migratory Galaxiid fishes	2 Seek to identify, protect, manage, or advocate sustainable site management for all non-migratory galaxiid habitat 3 Give effect to DOC's responsibilities under Section 4 of the Treaty of Waitangi by seeking to involve Iwi in the implementation of this recovery plan	Advocate protection of non-migratory galaxiids through Regional and District Plans, work with local communities and stakeholders to protect habitat, nominate private landowners of non-migratory galaxiid sites who demonstrate environment-friendly land management practices for environment awards Consult with tangata whenua, report at least annually, notify relevant tangata whenua of all translocation events, fish removal operations and new barrier construction projects, where Customary Freshwater Fisheries regulations exist, consult about identification of rahui areas for non-migratory galaxiid species, these areas would be exempt from fishing activity or introductions of threat freshwater fish species	Public awareness, encourage private landowners of non-migratory galaxiid sites to demonstrate environment-friendly land management practices
54	2004	Hihi (Stitchbird)	2 Raise awareness and support for hihi recovery	Create advocacy plan, increase public/iwi awareness, seek organisations to sponsor the hihi recovery program, provide annual reports to interested parties,	Public awareness, sponsorship, translocation/breeding season management

55	2004	NZ large Galaxiid	1 Identify, manage and advocate the protection of habitat and migratory pathways 7 Involve iwi in the implementation of this recovery plan	Liaise with landowners of sites with large galaxiids, seek protection of wetlands on private land, advocate through statutory planning protection of habitat (including migratory pathways), undertake monitoring, control and educational programmes to prevent the spread/establishment of introduced fish into large galaxiid habitat, write a community relations plan by 2006, prepare a fact sheet template on large galaxiids by 2007 Engage local tangata whenua on a project by project basis, report regularly, incorporate actions arising out of Treaty settlements as the need arises	Public awareness, encourage private landowners of rivers/streams with large galaxiid sites to demonstrate environment-friendly land management practices
56	2005	*Dactylanthus taylorii*	Topic 2 1 Opportunities to involve the public and local authorities in management of dactylanthus are recognised and realised 2 Information is shared between DOC staff and the public	Continue and increase number of dactylanthus management projects that involve the public, seek financial assistance from local/national sources, articles in the popular press Maintain and strengthen 'Friends of dactylanthus' network, develop and promote dactylanthus web page	Public awareness, volunteer workdays, volunteer assisted surveys, school group visits
57	2006	NZ Fairy Tern	5 Raise public awareness of the need for conservation and increase community involvement 6 Involvement of volunteers in the conservation of NZ fairy terns	Involve media in the recovery programme, maintain/improve signage that advocates protection and provides information of NZ fairy tern and their habitat, identify opportunities for community and iwi to be involved, follow up opportunities for sponsorship and funding Provide volunteers with logistic support as they are an essential part of the recovery programme, increase support	Volunteers (nest monitoring, sightings, banding, surveys)
58	2006	NZ Dotterel	4 Increase community involvement and partnerships with other agencies	Compile a report identifying opportunities/requirements, promote/coordinate/support management by community groups outside DOC	Public awareness, volunteers (nest monitoring, sightings, banding, surveys)
59	2006	Pateke(Brown Teal)	5.2 Topic 6 Community-led conservation initiatives	Share pateke knowledge and provide ongoing technical advice to iwi and community groups, prepare a survival pack for pateke protection, encourage iwi and community ownership of pateke issues (e.g. road-kills, pets and predators), advocate for reduced disturbance,	Public awareness, volunteers (nest monitoring, sightings)
60	2008	Kiwi	Goal 4.2 Community relations and engagement Topic 18 Advocacy Topic 19 Tangata whenua Topic 20 Community led initiatives	To increase awareness and support for kiwi protection through advocacy at all levels To ensure iwi are involved at all levels of kiwi management and research in an interactive way To ensure community involvement in kiwi protection is optimised and follows best practice	Public awareness, support structure for local kiwi projects Include tangata whenua in development of plans Facilitate sharing between community-led projects, provide regular forums and training opportunities
61	2008	Takahe	5.2 Community relations Topic 6 Tangata whenua Topic 7 Public awareness	Inform tangata whenua of recovery progress, consult in accordance with the Ngai Tahu Claims Settlement Act Complete annually a public awareness programme in Te Anau promoting Takahe, maintain non-breeding display takahe, update annually education pack on takahe for school students	Invite Ngai Tahu representatives to participate in field work Public awareness through captive animal displays, school education programme

Appendix 11 Summary of community involvement actions written in the 'Recovery Strategy' chapter in all 61 New Zealand recovery plans (Source: DOC, 2010d).

			Written in plan	Mammal	Bird	Reptile	Amphibian	Fish	Mollusc or Insect	Plant
		Year approved	1991 1991 1992 1993 1993 1993 1993 1993 1993 1993 1994 1994 1995 1995 1995 1995 1995 1996 1996 1996 1996 1997 1997 1998 1998 1999 1999 1999 1999 2000 2000 2000 2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 2002 2003 2003 2003 2004 2004 2004 2004 2005 2006 2006 2006 2008 2008
Objective or action in the work plan		# of plans	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61
Promote public awareness, interest or involvement		53	
Provide Information	Education leaflet/pamphlet/fact sheet about species	47	
	Media releases (e.g. television coverage, newspaper articles, videos)	38	
	Publish articles in natural history/scientific journals and magazines	23	
	Provide local community with educational material	16	
	Interpretative signs at breeding sites	8	
	Pamphlet/signs warning of dog responsibility	4	
	Provide conservation/species information to local boat operators	3	
	Possum control pamphlet	1	
	Develop and promote a webpage	1	
Education	Public talks/lectures	16	
	School education/participation with site visits	15	
	Appropriate land use	11	
	Encourage minimal disturbance to wild populations	10	
	Pest spp. awareness/prevention/eradication (e.g. wallabies)	8	
	Island quarantine procedures/awareness	8	
	Predator free island education	3	
	Emphasise relationship with umbrella spp./ecological restoration	3	
	Hunter/duck-shooter species awareness	3	
	Promote protection from persecution/accidental bycatch/illegal harvest	3	
	Summer awareness programme	2	
	Educate to minimise road deaths	1	
	Educate landowners to protect colonies from stock	1	
	Subantarctic island education	1	
Volunteers	Volunteer participation in monitoring	15	
	Volunteer participation in surveying	13	
	Use volunteers to locate spp.	7	
	Use volunteers to protect breeding sites	5	
	Volunteer participation in tracking tagged animals	3	
	Provide logistic support to volunteers	2	
	Provide community with a survey to record sightings	1	
Social Responsibility	Community ownership/guardianship	53	
	Promote iwi interest/partnership	17	
	Seek financial assistance fundraising/sponsorship/grants	9	
	Nominate landowners for environmental awards	3	
Species Ambassadors	Release site visits/ known breeding or habitat visits	14	
	Visits to schools with species ambassadors	6	
	Mainland island/offshore island visits	4	
	Publically accessible captive population in a zoological facility in NZ	3	
	Publically accessible captive population in a zoological facility overseas	2	
	Viewing hide/display at captive management site	2	
Legal Avenues	Protection on private land	19	
	Protect habitat through statutory/non-statuatory advocacy	4	

Plans 1-61 have been colour coded to indicate whether the recovery plan is for a mammal, bird, reptile, amphibian, fish, mollusc/insect, or plant.

Appendix 12 Summary of key attributes in 12 of Australia's recovery plans (Source: DEWHA, 2009d).

		Written in plan		Bird		Reptile		Plant					
	State plan published in	NSW	NSW/QLD	QLD	SA	SA	WA	WA	VIC	VIC	VIC	NT	NT
	Year approved	2001	2004	2001	2000	2005	2008	2003	2008	2008	1999	2008	2004
Chapter headings (in bold) and their contents	# of plans	% of plans	1	2	3	4	5	6	7	8	9	10	11	12
Executive summary	11	91.7												
Introduction	12	100.0												
Species Information														
Conservation status	12	100.0												
Habitat	12	100.0												
Description	12	100.0												
Distribution	12	100.0												
Distribution map	9	75.0												
Life history	9	75.0												
Taxonomy	6	50.0												
Captive breeding	1	8.3												
Goals														
Long term (5+ years)	8	66.7												
Short term (5 years of plan)	12	100.0												
General Requirements														
Biodiversity benefits	12	100.0												
Objectives under the EPBC Act1999	12	100.0												
Legislative context (State acts)	12	100.0												
International obligations	9	75.0												
Social and economic benefits	9	75.0												
Affected interests	8	66.7												
Role of indigenous people	8	66.7												
Environmental assessment	2	16.7												
Threatening Processes (causes of decline)														
Habitat degradation	10	83.3												
Changes in fire regimes	9	75.0												
Habitat loss	8	66.7												
Grazing by domestic stock (either of spp. Or spp. relied upon)	8	66.7												
Predation (cats, rabbits, kangaroos)	7	58.3												
Introduced weeds	6	50.0												
Human recreation (trapping, hunting, firewood collection)	5	41.7												
Small population size (recruitment of next generation)	5	41.7												
Competition	3	25.0												
Inbreeding depression	3	25.0												
Pollution/fertilizers/pesticides	3	25.0												
Hybridisation	2	16.7												
Road maintenance threatening populations (grading, chemical spraying)	2	16.7												
Past Conservation Management														
Surveys of habitat/population	9	75.0												
Monitoring of populations	8	66.7												
Research	7	58.3												
Habitat protection and management	7	58.3												
Formation of a recovery team	6	50.0												
Identification of habitat	6	50.0												
Captive breeding	6	50.0												
Community awareness and involvement	5	41.7												
Translocation	4	33.3												
Population protection	4	33.3												
Management of pest species	2	16.7												
Management in national parks	1	8.3												
Management of predators	1	8.3												
Recovery Strategies (objectives & actions in the workplan)														
Long term objectives	12	100.0												
Advocacy in the community (encourage/involve/raise community awareness)	12	100.0												
Survey (distribution, find new populations)	10	83.3												
Undertake research/encourage scientific studies	10	83.3												
Monitor representative populations	9	75.0												
Establish reserves/managed areas/secure habitat	9	75.0												
Monitor threats	8	66.7												
Assess potential habitat	8	66.7												
Maintain captive populations (seed banks, genetic diversity)	8	66.7												
Identify threats to habitat	7	58.3												
Manage threats (pests species such as bees or humans)	7	58.3												
Map critical habitat/populations	6	50.0												
Identify threats to species	5	41.7												
Establish or determine feasibility of new populations/translocation	5	41.7												
Increase number of individuals/populations	5	41.7												
Manage threats (predators, competitors)	5	41.7												
Develop/implement fire management strategy	4	33.3												
Improve habitat management	4	33.3												
Determine current distribution/abundance	4	33.3												
Establish/coordinate/train volunteers	3	25.0												
Use captive species to heighten community understanding	3	25.0												
Seek funding to implement recovery actions	2	16.7												
Coordinate recovery actions	2	16.7												
Develop guidelines for road maintenance	2	16.7												
Secure existing populations	2	16.7												
Reassess conservation status	1	8.3												
Establish/maintain national forums	1	8.3												
Review performance of recovery plan annually	1	8.3												
Investigate development of statutory planning instruments	1	8.3												
Establish database for each state/territory agency	1	8.3												
Performance Criteria														
Monitor populations	10	83.3												
Actively involve community in recovery program	8	66.7												
Increase number of individuals	7	58.3												
Inform community about conservation of species	7	58.3												
Identify threats to species	3	25.0												
More informed recovery/management strategies	3	25.0												
Assess success of research/management programs	3	25.0												
Reassess State status	3	25.0												
Study completed within lifespan of plan	3	25.0												
Targeted survey of species	2	16.7												
Prepare state management plans	2	16.7												
Identify threats to habitat	2	16.7												
Reassess National status	2	16.7												
Implementation schedule/timetable	6	50.0												
Recovery costs/budget	12	100.0												
Research	6	50.0												
Preparation details (people involved in writing plan)														
Recovery team	8	66.7												
Non-statuatory group	6	50.0												
Parks and Wildlife service staff	5	41.7												
Wildlife consultants	3	25.0												
Review date	9	75.0												
Contact details	5	41.7												
References	12	100.0												
Appendices														
Species profile	4	33.3												
Environmental impact assessment guidelines	2	16.7												
Current status and relevant legislation	2	16.7												
Preliminary site assessment data	1	8.3												
Experimental designs for recovery actions	1	8.3												
Form to collect info	1	8.3												

To make the layout of the matrix the same as the New Zealand matrix (Appendix 9) the 12 Australian recovery plans studied have been given a number from 1-12 (see Table 3 for species names). Plans 1-12 have also been colour coded to indicate whether the recovery plan is for a bird, reptile or plant.

Appendix 13 Summary of community involvement actions written in the 'Recovery Strategy' chapter in all 12 Australian recovery plan (Source: DEWHA, 2009d).

			Written in plan			Bird		Reptile		Plant					
		State plan published in	NSW	NSW/QLD	QLD	SA	SA	WA	WA	VIC	VIC	VIC	NT	NT
		Year approved	2001	2004	2001	2000	2005	2008	2003	2008	2008	1999	2008	2004
Objective or action in the work plan		# of plans	1	2	3	4	5	6	7	8	9	10	11	12
Promote public awareness, interest or involvement		12												
Provide Information	Education leaflet/pamphlet/fact sheet about species	10												
	Media releases (e.g. television coverage, newspaper articles, videos)	8												
	Publish articles natural history/scientific journals/newsletters and magazines	8												
	Provide local community with educational material (i.e in a public library)	8												
	Interpretative signs at breeding sites	4												
	Develop and promote a webpage	1												
Education	Appropriate landuse	7												
	Public talks/lectures	6												
	Encourage minimal disturbance to wild populations	6												
	School education/participation with site visits	3												
	Pest spp. awareness/prevention/eradication (e.g. wallabies)	2												
	Discourage firewood collection from habitat	2												
	Displays about species at community/environment events	2												
Volunteers	Volunteer participation in monitoring	9												
	Use volunteers to locate spp.	8												
	Volunteer participation in surveying	5												
	Use volunteers to protect breeding sites	4												
	Volunteer participation in tracking tagged animals	1												
	Provide logistic support to volunteers	1												
	Provide community with a survey to record sightings	1												
Social Responsibility	Community ownership/guardianship	8												
	Promote indigenous people's interest/partnership	7												
	Involve landholders in species management	7												
	Involve community groups in threat management	6												
	Encourage researcher/students involvement in research	4												
	Encourage community groups to seek funding	2												
	Seek financial assistance fundraising/sponsorship/grants	1												
Species Ambassadors	Publically accessible captive population in a zoological facility in Australia	4												
	Release site visits/ known breeding or habitat visits	1												
	Visits to schools with species ambassadors	1												
Legal Avenues	Protection on private land	2												
	Use Vegetation Management Act 1999 to declare habitat area of high nature conservation value	2												
	Encourage permanent heritage-style agreements with landholders supporting populations of threatened species	2												
	Enforce registration of domestic cats under the Companion Animals Act 1998	1												
	Recommend local councils designate Wildlife Protection Areas under the Companion Animals Act 1998	1												
	Develop formal conservation agreements	1												
	Use Nature Conservation Act 1992 to declare interim conservation orders to prevent habitat destruction	1												
	All trees protected by local council by-laws	1												

To make the layout of the matrix the same as the New Zealand matrix (Appendix 9) the 12 Australian recovery plans studied have been given a number from 1-12 (see Table 3 for species names). Plans 1-12 have also been colour coded to indicate whether the recovery plan is for a bird, reptile or plant.