

Recovery plans

A recovery group has been established for kiwi. This group consists of people with knowledge of the ecology and management needs of the species. The role of the recovery group is to achieve recovery of the species they represent through generation and provision of high-quality technical advice. The recovery group prepared this plan in conjunction with people interested in or affected by this plan, or with an expert knowledge of the species. Drafts have been sent to relevant Conservation Boards for comment and to people or organisations with an interest in conservation management of kiwi. Changes to the plan were made as a result of that consultation.

The recovery group will review progress in implementation of this plan and will recommend to Department of Conservation managers any changes that may be required in management. Comments and suggestions regarding conservation of kiwi are welcome and should be directed to the Kiwi Recovery Group via any office of the Department or to the Manager, Biodiversity Recovery Unit, PO Box 10-420, Wellington.

The recovery planning process provides opportunities for further consultation between the Department, tangata whenua and others regarding management of this species. Those interested in being more involved in management of kiwi or in receiving information should also contact the recovery group.

The Central Regional General Manager of the Department formally approved this plan in 2003. A review of the plan is due in 2006, or sooner if new information or technology leads to a significant change in management direction. This plan will remain operative until a new plan has been prepared and approved, or become redundant if recovery is achieved and management effort enters a 'maintenance phase'.

Published recovery plans

No.	SPECIES	YEARAPPROVED
48	North Island <i>Oligosoma</i> spp. skink	2002
47	Tuatara	2001
46	Chatham Island fantail, Chatham Island tomtit and Chatham Island warbler	2001
45	Forbes' parakeet and Chatham Island red-crowned parakeet	2001
44	New Zealand shore plover	2001
43	Chatham Island shag and Pitt Island shag	2001
42	Chatham Island mollymawk, northern royal albatross, Pacific mollymawk	2001
41	Chatham Island tui	2001
40	Black robin	2001
39	Parea	2001
38	Chatham Island oystercatcher	2001
37	Chatham petrel	2001
36	Chatham Island taiko	2001
35	Hoiho	2001
34	Pygmy button daisy	2001
33	<i>Hebe cupressoides</i>	2000
32*	Inland <i>Lepidium</i>	2000
31	<i>Muehlenbeckia astonii</i>	2000
30	North Island kokako	1999
29*	Weka	1999
28*	<i>Pittosporum patulum</i>	1999
27	<i>Cyclodina</i> skinks	1999
26	Coastal cresses	1999
25	Threatened weta	1998
24	Striped skink	1998
23*	Fairy tern	1997
22*	Blue duck	1997
21	Kakapo	1996
20	Stitchbird	1996
19*	Brown teal	1996
18*	Native frogs	1996
17*	New Zealand (Hooker's) sea lion	1995
16*	<i>Dactylanthus taylorii</i>	1995
15*	Bat (peka peka)	1995
14	Otago and grand skinks	1995
13*	Giant land snail	1995
12*	Takahe	1994
11*	South Island saddleback	1994
10*	New Zealand dotterel	1993
9*	Tuatara	1993
8*	Kowhai ngutukaka	1993
7*	Subantarctic teal	1993
6*	Mohua (yellowhead)	1993
5	Chevron skink	1993
4	Black stilt	1993
3*	Whitaker's and robust skinks	1992
2	Kiwi	1991
1*	North Island kokako	1991
—*	Yellow-eyed penguin	1991

* Out of print. In-print issues are available free of charge from DOC Science Publishing, Science & Research Unit, P.O. Box 10-420, Wellington.

All recovery plans from No.25 (1998 and later) are available on the DOC website:

<http://www.doc.govt.nz> > Publications > Science and Research > Biodiversity Recovery Unit

Kiwi (*Apteryx* spp.) recovery plan

1996-2006

Hugh A. Robertson
for the Kiwi Recovery Group

THREATENED SPECIES RECOVERY PLAN 50

Published by:
Biodiversity Recovery Unit
Department of Conservation
PO Box 10-420
Wellington, New Zealand

Cover picture by Rogan Colbourne: Tokoeka (*Apteryx australis*) running.

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Contents

Abstract	5
<hr/>	
1. Introduction	6
<hr/>	
2. Context	6
<hr/>	
A. Overview of species	6
2.1 Species ecology and biology	6
2.2 Status and species recovery principles	6
2.3 Past and present distribution and population trends	7
2.4 Agents of decline and threats to kiwi	7
2.5 Past and current management	8
2.6 Preferred option for recovery	8
B. Strategic directives	8
C. Cultural importance	8
D. Public awareness	8
3. Goals	9
<hr/>	
3.1 Long-term recovery goal	9
3.2 Goals for the term of the plan	9
4. Implementation	9
<hr/>	
E. Community relations	9
Topic 1. Tangata whenua	9
Topic 2. Communities	10
Topic 3. Planning	11
F. Management	11
Topic 4. Threat management of agent(s) of decline (in situ pest animals or plants; climatic extremes, disease)	11
Topic 5. Restoration (translocation, ecosystem)	12
Topic 6. Maximising productivity of wild-laid eggs in captivity	12
Topic 7. Captive breeding	13
G. Research	14
Topic 8. Genetics and taxonomy	14
Topic 9. Monitoring	15
Topic 10. Autecology and population dynamics (survival, productivity, dispersal, recruitment, modelling) and management	15
Topic 11. Distribution	16
5. Acknowledgements	17
<hr/>	
6. References	18
<hr/>	
APPENDIX 1	19
<hr/>	
Results: The kiwi recovery programme, 1991-96	19

Abstract

A significant decline in the numbers and distribution of kiwi (*Apteryx* spp.) has resulted in all six taxa being classified as threatened. The 1991 kiwi recovery plan succeeded in identifying the agents of decline as predation by introduced mammalian predators, particularly intense predation of young kiwi in the first 6 months of life by stoats (*Mustela erminea*) and cats (*Felis catus*).

The current recovery plan sets in place the actions required to move into the next phase: the securing and recovery of kiwi. The kiwi is today the only icon equally cherished by all cultures in New Zealand. Public awareness, education and community involvement are therefore important tools that should be used in implementing the recovery of this bird. Furthermore, habitat restoration and protection will ensure that sufficient and appropriate habitat is available for both wild-bred and captive-bred kiwi.

1. Introduction

Kiwi (*Apteryx* spp.) are the smallest of the ratites (a taxonomic group of flightless birds). They are among the most distinctive and most loved New Zealand native animals. Their order (Apterygiformes) is endemic to New Zealand. Kiwi are an unofficial national emblem, and as a taonga species they have cultural, spiritual, historic and traditional significance for Maori.

All six taxa of kiwi are threatened. The agents of decline have been established and efforts are now concentrated on the securing and recovery of kiwi. The goal of this recovery plan and of its predecessor, the 1991–96 recovery plan, is to maintain and, where possible, enhance the current abundance, distribution and genetic diversity of kiwi.

The present kiwi recovery plan has a term of 10 years from April 1996 to April 2006 (review date: 30 April 2006).

2. Context

A. OVERVIEW OF SPECIES

2.1 Species ecology and biology

Kiwi are largely nocturnal and are flightless, having only minute vestigial wings and no tail. Kiwi hold a variety of records among birds: their eggs are extremely large and rich in energy, and take a very long time (70–85 days) to hatch. For birds, they have an exceptional sense of smell, and their nostrils are uniquely placed near the tip of the bill. Males are smaller than females, and in some taxa they perform most of the incubation; this reversal of roles is associated with monogamy, a combination which is extremely rare among birds.

2.2 Status and species recovery principles

All six taxa of kiwi are threatened: Okarito brown kiwi/rowi and Haast tokoeka are classified as Nationally Critical; North Island brown kiwi as Seriously Declining; great spotted kiwi/roroa and southern tokoeka as Gradually Declining; and little spotted kiwi as Range Restricted (Hitchmough 2002).

The agents of decline for kiwi have been established, and all taxa are now in the ‘secure’ or ‘recover’ phase of the recovery action model¹. This kiwi recovery plan includes elements of all of the themes identified in the ‘Species Development in the Department’ model².

¹ P. Jansen 2001, cited in unpublished draft Recovery Plan Instructions Template by S. O’Connor and J. Falconer (WGNCR-36725, Department of Conservation, Wellington).

² D. Hunt 2001, cited in draft Recovery Plan Instructions Template: see footnote 1.

2.3 Past and present distribution and population trends

Archaeological finds and historical evidence show that all species of kiwi were once more widespread than they are today. In the North Island, brown and little spotted kiwi were found in the Tararuas, Mt Hikurangi, and the Kaimanawas, among other places. In the South Island, all four species of kiwi were there when Europeans arrived. Little is recorded about their historical presence on offshore islands.

Today, some species have been preserved on offshore islands, and some of these populations have become self-sustaining. Overall, however, all reports indicate a decreasing kiwi population on the mainland, especially in southern Northland, the Bay of Plenty, western Waikato, Hawke's Bay and the West Coast (Table 1).

2.4 Agents of decline and threats to kiwi

Numbers and distribution of kiwi are in rapid decline on the two main islands of New Zealand (hereafter referred to as the mainland). Radio-telemetry studies at a number of unmanaged sites indicate that North Island brown kiwi are declining at an average rate of 5.8% per year (approximately halving every decade). This decline mainly results from intense predation of young kiwi in the first 6 months of life by stoats (*Mustela erminea*) and cats (*Felis catus*) (McLennan et al. 1996). Predation of adult kiwi by dogs (*Canus familiaris*) and ferrets (*Mustela furo*) can cause catastrophic local declines in populations (e.g. Taborsky 1988; Pierce & Sporle 1997). Because the main agents of decline are widespread, it is likely that all mainland kiwi taxa are declining at a similar rate, except perhaps at high altitude in the South Island. As populations decline, the rate of decline in the effective population size accelerates as populations become fragmented and sex ratios become skewed in isolated populations. Of the six taxa, only numbers of the little spotted kiwi were increasing in 1996, following several successful transfers to predator-free offshore islands (Colbourne & Robertson 1997).

TABLE 1: DISTRIBUTION AND POPULATION ESTIMATES OF THE SIX KIWI TAXA CURRENTLY RECOGNISED (DATA FOR 2006: PROJECTED, WITHOUT MANAGEMENT).

	LOCATION	1996	2006
North Island brown kiwi <i>Apteryx mantelli</i>	North Island	35 000	20 000
Okarito brown kiwi/rowi <i>A. mantelli</i> 'Okarito'	Okarito, South Island	150	100
Haast tokoeka <i>A. australis</i> 'Haast'	Near Haast, South Island	225	125
Southern tokoeka <i>A. australis</i>	Stewart Island/Rakiura and Fiordland, South Island	27 000	24 000
Great spotted kiwi/roeroa <i>A. baastii</i>	Northern South Island	22 000	12 000
Little spotted kiwi <i>A. owenii</i>	Kapiti Island and several smaller offshore islands	1 100	1 200
TOTAL (rounded)		85 000	57 000

2.5 Past and current management

In 1991 the Department of Conservation published the first Kiwi Recovery Plan (Butler & McLennan 1991) and has since implemented the Kiwi Recovery Programme in conjunction with the Bank of New Zealand and the Royal Forest & Bird Protection Society, and latterly with the Bank of New Zealand Kiwi Recovery Trust. Appendix 1 summarises the significant gains made in detecting, diagnosing and halting the decline of kiwi during the period 1991-96; the present recovery plan proposes the subsequent 10-year programme of management and research to save these unique and threatened birds.

2.6 Preferred option for recovery

The preferred option for recovery of kiwi is to manage kiwi in their natural range by reducing their exposure to predators.

B. STRATEGIC DIRECTIVES

This recovery plan supports National Priority Outcome 1.2 in the Department's Statement of Intent for 2002-05:

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.

C. CULTURAL IMPORTANCE

The image of the kiwi and the image of Aotearoa, New Zealand have been part of each other for a long time. The bird itself has always been taonga (treasure) to tangata whenua (Maori people), who have a strong cultural, spiritual and historic association with the kiwi. Also, its feathers are valued for ceremonial use. The bird was admired by Europeans and later arrivals as well, and the kiwi is today one of the only icons equally cherished by all cultures in this country.

The Ngai Tahu relationship with South Island kiwi (southern tokoeka, Haast tokoeka, Okarito brown kiwi/rowi and great spotted kiwi/roroa) has been formalised in the Ngai Tahu Claims Settlement Act 1998.

D. PUBLIC AWARENESS

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. Individual programmes are encouraging involvement of their communities through open days, participation in kiwi releases, and through minimisation of threats to kiwi.

3. Goals

3.1 Long-term recovery goal

The long-term goal for kiwi recovery is: to maintain and, where possible, enhance the current abundance, distribution and genetic diversity of kiwi.

3.2 Goals for the term of the plan

1. To encourage and support public and community protection of kiwi and their habitat throughout the term of this plan.
2. To secure representative populations of all kiwi taxa in the wild and in their natural range by April 2006.
3. To identify all genetically distinct kiwi populations, and determine their range, trends, threats, and suitable management units by April 2006.

4. Implementation

All actions included in the tables will be completed according to their priority as follows:

Priority 1: Considered essential for kiwi recovery. Action must be completed during the 10-year term of this plan.

Priority 2: Considered to be necessary for achievement of long-term goal. Progress should be made towards completing action, and ideally action should be carried out during the 10-year term of this plan.

Priority 3: Considered to support kiwi recovery. Should be a priority for kiwi work, and should ideally be progressed during the 10-year term of this plan.

E. COMMUNITY RELATIONS

Topic 1 Tangata whenua

The kiwi is one of New Zealand's best-loved symbols. Its protection is not the prerogative of one group of people alone, nor does the information essential to this protection come from one source only. Both research and management are assisted by all of the New Zealand community. Tangata whenua have observed kiwi for centuries, and the information held by them is of inestimable value. Tangata whenua involvement in the protection and preservation of kiwi is welcomed and encouraged. Ngai Tahu has a special association with kiwi, which has seen kiwi included in Schedule 97/Taonga Species of the Ngai Tahu Claims Settlement Act 1998. Through the Act, the Crown formally acknowledges taonga species which include the kiwi species of the South Island. The requirements of the Act, in particular ss 293 and 294, are pertinent to this plan.

Issue

Tangata whenua may not be involved in kiwi recovery in a way appropriate to parties' commitments and expectations under the Treaty of Waitangi.

Objective

Iwi are involved at all levels of kiwi research and management in an interactive way and in a way appropriate to all parties' commitments and expectations under the Treaty of Waitangi, taking particular note of the requirements of the Ngai Tahu Claims Settlement Act 1998.

ACTIONS	ACCOUNTABILITY	PRIORITY
1.1 Identify any gaps in the current presentation of data on kiwi protection to ensure that tangata whenua are fully aware of all activities related to this protection.	External Relations Division, Kiwi Coordinators (Conservancies).	Priority 1
1.2 Ensure that tangata whenua have access to taonga material according to processes as agreed between them and the Department of Conservation.	Conservancies (Kiwi Coordinator, Operations and Planning).	Priority 1
1.3 Ensure that the Department acts in synergy with tangata whenua to maintain open communication about, and involvement in kiwi management and research, welcoming and respecting contributions from tangata whenua.	Kiwi Coordinator, Operations and Planning (Conservancies, Kiwi Coordinator, Research and Monitoring, SRU).	Priority 1
1.4 Assess methods of kiwi conservation which are now in place with respect to the full sharing of knowledge with tangata whenua.	Conservancies (Kiwi Coordinator, Operations and Planning).	Priority 2

Topic 2 Communities

New Zealanders need to be encouraged to become actively involved in kiwi conservation. Effort will be concentrated on areas where many kiwi live on private land and will include advocating effective land-management practices and voluntary codes of conduct for landowners. Captive kiwi institutions will be assisted in presenting high-quality advocacy and educational material.

Issue

Many New Zealand communities are not actively involved in kiwi conservation because of a lack of information and resources, and lack of kiwi protection on private land.

Objective

Communities are empowered to protect kiwi by the sharing of knowledge and best management practices among all individuals and organisations concerned with this protection.

ACTIONS	ACCOUNTABILITY	PRIORITY
2.1 Reinforce messages about the threats to kiwi and actions people can take to enhance kiwi populations in their local areas.	External Relations Division (Conservancies).	Priority 1
2.2 Encourage and empower people to develop and carry out their own conservation projects, or to assist with other research and management.	External Relations Division, Kiwi Coordinator, Operations and Planning (Conservancies).	Priority 1
2.3 Advocate land management practices and voluntary codes of conduct for companies and private landowners that will help to maintain or enhance kiwi populations and their habitats.	Kiwi Coordinator, Operations and Planning (Conservancies, SRU, Kiwi Coordinator, Research and Monitoring).	Priority 1
2.4 Evaluate proposals to transfer kiwi to 'open sanctuaries', 'mainland islands' or other suitable sites where they can act as a resource for advocacy and education, as well as contributing to the conservation of kiwi.	Kiwi Coordinator, Operations and Planning (Conservancies, External Relations Division, SRU).	Priority 2
2.5 Encourage captive-breeding institutions to present accurate information on kiwi and their conservation.	External Relations Division (Conservancies).	Priority 2
2.6 Endeavour to secure kiwi habitat on private land.	Conservancies (Kiwi Coordinator, Operations and Planning).	Priority 2

Topic 3 Planning

Issue

In some instances, kiwi are threatened by activities that can be addressed by statutory authorities (by means of legislation, regulations, rules, and policies) and by other organisations.

Objective

Threats to kiwi and their habitat are reduced by promoting legislative and policy changes to statutory authorities.

ACTIONS	ACCOUNTABILITY	PRIORITY
3.1 Promote statutory and policy changes to assist with the conservation of kiwi and their habitats.	Kiwi Coordinator, Operations and Planning (Conservancies).	Priority 1
3.2 Minimise road deaths of kiwi.	Conservancies (External Relations Division).	Priority 2

F. MANAGEMENT

Topic 4 Threat management of agent(s) of decline (in situ pest animals or plants; climatic extremes, disease)

The Okarito brown kiwi/rowi in south Westland is the taxon in most urgent need of conservation management. An intensive predator control programme is required in order to boost the current population of 150 birds. Other wild populations also need suitable protection, to ensure that at least one population

of each taxon presently recognised (formally or informally) is secured in the wild in its natural range, and ultimately that at least two secure wild populations are established.

Issue

Mainland populations of kiwi are still under threat from introduced predators, and will decline without management.

Objective

Representative populations of mainland kiwi are stabilised or increasing.

ACTIONS	ACCOUNTABILITY	PRIORITY
4.1 Maintain intensive management of Okarito brown kiwi/ rowi in the wild and increase population to 200 birds or more by 2006.	Kiwi Coordinator, Operations and Planning (Area Manager Franz Josef, SRU).	Priority 1
4.2 Develop programmes to secure representative wild kiwi populations resulting in the IUCN and DOC threat classification status of all presently recognised kiwi taxa being either maintained or improved by 2006.	Kiwi Coordinator, Operations and Planning (Area Managers in relevant kiwi areas, SRU).	Priority 1

Topic 5 Restoration (translocation, ecosystem)

Although the recovery programme aims to manage mainland populations, to ensure the survival of some taxa it may be necessary to establish a self-sustaining population on an island or to use an island as temporary refuge for chicks.

Issue

Techniques to effectively manage kiwi predators over large areas are still under development, and some taxa may continue to decline unless moved to secure offshore islands.

Objective

Secure island locations are found for threatened taxa of kiwi.

ACTIONS	ACCOUNTABILITY	PRIORITY
5.1 Evaluate islands that may be ecologically and culturally suitable for kiwi.	Kiwi Coordinator, Operations and Planning (SRU, Conservancies).	Priority 2

Topic 6 Maximising productivity of wild-laid eggs in captivity

The different social systems of various kiwi taxa include differing incubation practices, and possibly different post-nesting behaviour and survival of juveniles. Further improvement in hatching success, particularly of recently laid eggs, is also needed. Birds should be released back into the wild at the best time of the year and be monitored initially. Females whose eggs are taken may undergo additional stress from laying repeated clutches; if this is found to be so, it will be necessary to balance any resulting mortality against increases in

recruitment. Genetic diversity needs to be at optimal levels, and the risk of inbreeding arising from Operation Nest Egg (e.g. eggs from some pairs can be taken more easily than others) has to be monitored.

Issue

The lack of knowledge of kiwi social systems and incubation procedures is leading to reduced productivity of wild-laid kiwi eggs in captivity, and of captive-raised kiwi chicks when released to the wild.

Objective

Tools are developed to maximise productivity of wild-laid eggs in captivity.

ACTIONS	ACCOUNTABILITY	PRIORITY
6.1 Undertake research to identify the social systems of all kiwi, especially their incubation regimes.	Kiwi Coordinator, Research and Monitoring (SRU).	Priority 1
6.2 Develop ex situ egg and chick handling protocols to maximise productivity and minimise disease risk.	Kiwi Coordinator, Research and Monitoring (SRU, captive-rearing institutions, Conservancies).	Priority 1
6.3 Monitor the fate of captive-reared chicks released into the wild and establish locally appropriate protocols to maximise survivorship.	Kiwi Coordinator, Research and Monitoring (Conservancies).	Priority 1
6.4 Determine the average annual egg production, recruitment and survival of adult females with and without egg-cropping.	Kiwi Coordinator, Research and Monitoring (SRU).	Priority 3
6.5 Assess the genetic diversity of the captive-reared wild kiwi.	Kiwi Coordinator, Research and Monitoring (SRU).	Priority 3

Topic 7 Captive breeding

A captive management plan will help ensure that the captive population is self-sustaining, that inbreeding is minimal and genetic diversity is maintained. It will also need to declare whether a surplus of kiwi is available for release. Furthermore, it should ensure good practice in husbandry, record-keeping, and in display and advocacy matters. Husbandry techniques in special need of refinement are those to reduce female deaths from egg peritonitis and male deaths during re-pairing, to ensure chicks properly transfer to adequate artificial diets, and to improve chick survival upon transfer from brooders to outside pens. All birds should be released (or re-released) into the wild at genetically appropriate sites and meet specific health norms; information on these norms and on disease treatment should be stored appropriately. In addition, the captive management plan will declare what resources are required from the captive industry and under what conditions kiwi may be held.

Issue

The captive management of kiwi is not being managed sufficiently for the captive population to make a contribution to conservation of wild kiwi.

Objective

Captive institutions produce surplus kiwi progeny for release.

ACTIONS	ACCOUNTABILITY	PRIORITY
7.1 Develop and adopt a captive management plan for kiwi.	Kiwi Coordinator, Operations and Planning (captive-rearing institutions).	Priority 1
7.2 Refine kiwi husbandry techniques, especially to reduce mortality of adult females and chicks.	Kiwi Coordinator, Operations and Planning (Conservancies, SRU).	Priority 2
7.3 Assess health status of birds in captivity and in the wild to identify health normals and successful treatments for sublethal diseases.	Kiwi Coordinator, Research and Monitoring (SRU, captive-rearing institutions, Conservancies).	Priority 2
7.4 Bring further taxa into captivity to establish husbandry protocols for all taxa.	Kiwi Coordinator, Operations and Planning (SRU, captive-rearing institutions).	Priority 3
7.5 Determine what, if any, captive breeding programme is required for release into the wild, and identify kiwi captive breeding targets.	Kiwi Coordinator, Operations and Planning (SRU, captive-rearing institutions).	Priority 3

G. RESEARCH

Topic 8 Genetics and taxonomy

As we are committed to maintaining genetic diversity of kiwi, we need as much relevant data as possible. When integrated with morphological and behavioural characteristics, and distributional data, this will enable identification of appropriate management units. Furthermore, it will form the basis of a revision of the present taxonomic status of the kiwi (currently grouped informally into varieties/ populations, as well as formally described taxa).

Issue

The lack of clarity about the genetic status of kiwi populations is leading to difficulty in identifying priority populations for management.

Objective

Kiwi populations with distinct genetic difference are identified.

ACTIONS	ACCOUNTABILITY	PRIORITY
8.1 Analyse further blood samples from Okarito and Haast populations to ascertain the taxonomic status of those populations.	Kiwi Coordinator, Research and Monitoring (SRU, Royal Ontario Museum).	Priority 1
8.2 Analyse blood samples from populations not sampled adequately to ascertain the taxonomic status of major (geographical) North Island kiwi populations.	Kiwi Coordinator, Research and Monitoring (SRU, Royal Ontario Museum).	Priority 1
8.3 Define appropriate management units, including identification of minimum founder population size, and genetically viable populations for all kiwi taxa.	Kiwi Coordinator, Research and Monitoring (SRU, Royal Ontario Museum).	Priority 2
8.4 Publish a new taxonomy of kiwi.	Kiwi Coordinator, Research and Monitoring (SRU, Royal Ontario Museum).	Priority 3

Topic 9 Monitoring

Monitoring of key populations is important to determine trends, to indicate where management effort is most needed, and to indicate long-term effects of management.

Issue

Lack of information on kiwi population dynamics is leading to difficulty in interpreting trends in kiwi recovery and identifying populations where management effort is most needed.

Objective

Population trends of all taxa are monitored.

ACTIONS	ACCOUNTABILITY	PRIORITY
9.1 Collate and publish the baseline data for nationwide kiwi monitoring.	Kiwi Coordinator, Research and Monitoring (SRU, Conservancies).	Priority 1
9.2 Repeat the nationwide kiwi monitoring scheme every five years to determine trends in nationwide kiwi monitoring and confirm variations by further monitoring the next year.	Kiwi Coordinator, Research and Monitoring (SRU).	Priority 1
9.3 Undertake intensive monitoring of banded populations of kiwi to identify population dynamics.	Kiwi Coordinator, Research and Monitoring (SRU, Conservancies).	Priority 1

Topic 10 Autecology and population dynamics (survival, productivity, dispersal, recruitment, modelling) and management

Information on productivity and survival of adults is now available, but there seem to be significant regional differences that need to be addressed. There are few data on juvenile dispersal (because of small sample sizes and difficulty following juveniles); the success of improving recruitment into a population may depend on identifying factors related to juvenile dispersal. Population models to support management decisions have to be examined. Future operations to control or eradicate pests need to assess and, if necessary, mitigate accidental deaths among kiwi. Detailed population work is needed for the Haast tokoeka (a small population with an unusual distribution) and the populations of great spotted kiwi/roroa on both sides of the Southern Alps (to examine the possibility that agents of decline might prove to be less of a problem in high-rainfall areas). There are various circumstances under which kiwi and humans regularly share habitat, and the kiwi-friendly management of these habitats (rough farmland, production forests, areas being cleared of scrub, and areas used for pig hunting) needs to be established.

Issues

Lack of knowledge about the population dynamics of some kiwi taxa is impeding recovery of those taxa.

Objective

The agents of decline for each taxon have been determined and the effectiveness of management assessed.

ACTIONS	ACCOUNTABILITY	PRIORITY
10.1 Undertake research on the productivity, survival, and dispersal of kiwi to ascertain factors affecting survival and productivity.	Kiwi Coordinator, Research and Monitoring (Contract research, Conservancies).	Priority 1
10.2 Develop population models to support management decisions.	Kiwi Coordinator, Research and Monitoring (Contract research, Conservancies).	Priority 1
10.3 Undertake research on the effects of pest management on kiwi to identify kiwi survivorship through pest control /eradications using new techniques and/or timing.	Kiwi Coordinator, Research and Monitoring (SRU).	Priority 1
10.4 Undertake research on the ecology of, and threats to, the Haast tokoeka.	Kiwi Coordinator, Research and Monitoring (Area Manager Haast, SRU).	Priority 1
10.5 Undertake research on the Southern Alps population of great spotted kiwi/rotoa to determine regional variation in population dynamics and management.	Kiwi Coordinator, Research and Monitoring (Canterbury and West Coast Conservancies).	Priority 2
10.6 Undertake research on the management of kiwi in rough farmland to determine the best practical land management to enhance/maintain kiwi populations in these areas.	Wanganui Conservancy (SRU).	Priority 2
10.7 Undertake research on the use of exotic forests by kiwi to determine the best practical land management to enhance/maintain kiwi populations in pine plantations.	Northland Conservancy (SRU).	Priority 2
10.8 Undertake research on the short-term and long-term impacts of land clearance to determine the best practical land clearance to maintain kiwi populations.	Northland Conservancy (SRU).	Priority 2
10.9 Undertake research on feral pigs and pig-hunting as a threat to kiwi to determine the best practical pig hunting methods to maintain kiwi in recreational hunting areas.	Kiwi Coordinator, Research and Monitoring (Conservancies).	Priority 3

Topic 11 Distribution

To define management units properly, it is important to continue collating distribution records. Both the Kiwi Call Scheme and the Kiwi Reporting Scheme contribute valuable information and should be continued. Experienced observers should do follow-up work in areas outside of the known range for kiwi where there are apparently reliable reports of birds. Fiordland has not yet been surveyed, but as there are indications of a decline in tokoeka, it should be surveyed comprehensively.

Issue

Lack of information about kiwi distribution is leading to difficulty in identifying key populations for management.

Objective

Gaps in our knowledge of kiwi distribution have been identified and surveyed.

ACTIONS	ACCOUNTABILITY	PRIORITY
11.1 Continue the Kiwi Call Scheme to determine relative kiwi abundance (over time) from casual observation.	Kiwi Coordinator, Research and Monitoring (SRU, Conservancies).	Priority 1
11.2 Continue the Kiwi Reporting Scheme to identify kiwi distribution (and changes over time).	Conservancies (SRU).	Priority 2
11.3 Survey southern tokoeka in Fiordland to determine distribution, abundance and population trends.	Area Manager, Te Anau (Conservancies, SRU).	Priority 2
11.4 Survey specific sites for all species to gain an understanding of kiwi distribution to a level suitable for defining management units.	Conservancies (SRU, Kiwi Coordinator Operations and Planning).	Priority 2

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APPENDIX 1

RESULTS: THE KIWI RECOVERY PROGRAMME, 1991-96

This Appendix quotes the goal, aims and objectives of the kiwi recovery plan published in 1991, as listed in the plan (reformatted, with minor spelling changes). These are comparable to those in the present plan. The plans quoted below are comparable to tasks in the present plan; outcomes have the same meaning in both documents.

To avoid confusion with the new plan, the suffix /91 has been added to the Objective and Plan numbers in the 1991 recovery plan. In some cases, the original recovery plan did not number Plans; these have had numbers arbitrarily assigned and put in square brackets—for example, Plan [1a/91]. You can find them by looking in the printed 1991 plan under the original Objective numbers. An ellipsis (...) indicates that some text has been omitted.

Long-term goal

To maintain and, where possible, enhance the current abundance, distribution and genetic diversity of kiwi.

Aims

1. To identify the current distribution, abundance and genetic diversity of kiwis, the trends of their populations and the threats they face (OBJECTIVES 1-4).
2. To take action to remove the short-term risk of extinction of endangered kiwi taxa, prevent further declines and begin recovery of other kiwi populations (OBJECTIVES 5-9).

Objectives

OBJECTIVE 1/91: Identify Current Distribution and Abundance of Kiwi.
Undertake surveys of known range and areas where taxa are considered to have recently become extinct.

Plan [1a/91]: Continue the Kiwi Call Scheme (S&R, conservancies, general public).

Outcome [1a/91]: Regularly updated distribution maps of kiwi and measures of call rates in some areas.

Plan [1b/91]: Perform surveys in eight North Island conservancies.

Outcome [1b/91]: Identification on a conservancy basis of kiwi distribution, with an indication of the density in different areas. ...

Plan [1c/91]: Survey [South Island brown kiwi] population of Haast area and complete survey of Okarito ... Compare with previous surveys to evaluate current trend.

Outcome [1c/91]: Identification of the approximate number of kiwi ... and their distribution. ...

Plan [1d/91]: Survey [great spotted kiwi] population from NW Nelson to South Westland. ...

Outcome [1d/91]: Distribution ... and identification of current disjunct populations. Comparative densities ...

Summary of 1991–96 results

1000 record cards were added to the Kiwi Call Scheme; Kiwi Reporting Cards have been distributed and are being used.

Great spotted kiwi: Extensive survey work has identified three discrete populations (North-west Nelson, Paparoas, and Southern Alps meeting between Harper Pass and Arthur's Pass). The study area population (Saxon Hut, Heaphy Track) is stable, but others may be declining. (Priority 1)

South Island brown kiwi: More precise population estimates have been made, and a study population has been banded at Okarito. (Priority 1)

Little spotted kiwi (D'Urville): None have been reported. (Priority 1)

North Island brown kiwi: More than a dozen surveys show a patchy distribution across the island, ranging from locally common in Northland to virtual disappearance from the Kaimanawas. (Priority 2)

Other surveys: A search for the 'little spotted kiwi' in south Westland found no further birds. A survey of Deep Cove/Wilmot Pass showed moderate numbers of southern tokoeka west of the divide but few to the east.

OBJECTIVE 2/91: Identify Genetic Diversity of Kiwi. *Investigate the genetic variation within kiwi across their geographic distribution using a combination of morphological and molecular techniques. Identify potential management options based on these analyses. (Priority 1)*

Plan [2a/91]: Complete analyses of blood samples currently held, using blood protein and mitochondrial DNA techniques. Collect further samples from Haast and Kapiti populations ... Compare ... with morphological data.

Outcome [2a/91]: A revised taxonomy for brown kiwi. ...

Plan [2b/91]: Collect blood and morphometric data from great spotted kiwi throughout their range. Analyse blood ...

Outcome [2b/91]: Identification of variation ... and possibly revision of taxonomy. ...

Plan [2c/91]: Collect blood and morphometric data from the D'Urville bird now on Long Island. ... Collect similar data from any birds remaining on D'Urville. ...

Outcome [2c/91]: Identification of any differences ... and a recommendation on ... maintain[ing] the two as separate genetic lines.

Summary of 1991–96 results

Two independent genetic investigations were made. Both found that there were four groups of kiwi distinct at the species level. The brown kiwi is two species—the brown kiwi and the tokoeka. The Okarito population is genetically distinct and may also represent a separate species; likewise, the Haast birds.

North Island brown kiwis have strong regional differences, and captive stock should be kept separate.

Great spotted kiwi populations have some variation but have probably not been isolated for long. No obvious differences between Kapiti and D'Urville Island little spotted kiwi were noted.

A 'great spotted kiwi' from Franz Josef was in fact a hybrid little spotted kiwi x Okarito brown kiwi. It is now on Mana Island.

OBJECTIVE 3/91: Determine Kiwi Population Trends Through Monitoring. *Develop a technique to index the abundance of kiwi in an area. Identify key populations for each taxon, and monitor these at regular intervals to establish trends. (Priority 1)*

Plan 3a/91: Develop a monitoring strategy to be applied to all kiwi taxa. Develop a reliable method for indexing abundance using call counts and apply this technique together with the banding of samples of territory holders.

Plan 3b/91: Identify key populations for each taxon.

Plan 3c/91: Establish regular monitoring on a regional basis.

Outcomes 3a-3c: A reliable indexing technique and key populations identified by end of 1992/93. Monitoring programme established for all kiwi taxa following this.

Summary of 1991-96 results

Nineteen baseline monitoring sites were chosen (see Table A1), to include all taxa and subpopulations. The monitoring method is based on call rates.

The call-rate method was not suitable for sites with very low call rates (under 2/ hour), and so Okarito was dropped. No adequate sites were established in East Coast/Hawke's Bay or Fiordland.

There are now 12 populations which have been banded (see Table A1). These provide an independent method for monitoring population trends.

OBJECTIVE 4/91: Determine Threats to Wild Populations and Develop Management Techniques for Population Maintenance and Recovery. *Undertake research to determine the causes of mortality in the wild. Develop management techniques to tackle those causes that we can influence directly.*

Plan 4a/91: Undertake research on the survival and dispersal of juveniles.

Plan 4b/91: Undertake research on the effects of possum control operations on kiwi.

Plan 4c/91: Undertake research on South Island kiwi and evaluate options for the management of small populations.

Plan 4d/91: Undertake research on the management of kiwi in rough farmland.

Plan 4e/91: Undertake research on the social systems of kiwi.

Plan 4f/91: Undertake research on the use of exotic forests by kiwi.

No outcomes listed.

Summary of 1991-96 results

Work has been undertaken as part of research-by-management programmes, primarily those in central Northland and at Waikaremoana, but also in the Tongariro forest.

Main threats were identified as:

- to adults—dogs, ferrets, possum traps and cyanide, cars;
- to chicks—stoats, cats, harriers (*Circus approximans*), ferrets;
- to eggs—possums (*Trichosurus vulpecula*), microbes, mustelids, kea (*Nestor notabilis*). (Other threats exist.)

The main bottleneck is the young juvenile stage, when 95% die, mainly killed by mustelids and cats, within 6–9 months of leaving the nest.

Juvenile survival (Priority 1): Four sites are being used for DOC research, and Landcare have a study site at Lake Waikaremoana. Control of possums and stoats has been carried out at Okarito, and valuable infrared video footage for nests has been obtained.

Research on pest control (Priority 1): The original objective concerned only possums; it has been widened to cover pest control operations, such as rat eradication. Studies have concentrated on the effects of 1080 and brodifacoum operations; data indicates minimal risk to kiwi populations during both types of operation.

Research on South Island kiwi and management of small operations (Priority 2): Much data on Okarito brown kiwi/rowi has been gathered, and there has been

TABLE A1: CURRENT KIWI TAXA, INDICATING SITES CHOSEN FOR MONITORING AND NUMBERS OF BIRDS BANDED.

TAXON	MONITORING SITES	POPULATIONS WHERE SAMPLES OF TERRITORIAL KIWI ARE BANDED
North Island brown kiwi	Northern Northland Western Northland* Eastern Northland Central Northland* Little Barrier Island† Coromandel PeninsulaTongariro* Taranaki East Coast/Hawke's Bay¶‡	Trounson, Northland Purua, Northland§ Lake Waikaremoana§ Tongariro Forest, Volcanic Plateau
Okarito brown kiwi	Okarito *‡	Okarito, South Westland
Haast tokoeka	Haast Range	Haast Range, South Westland
Southern tokoeka	Stewart Island/Rakiura	Mason Bay, Stewart Island/Rakiura
Great spotted kiwi/rooa	Goulard Downs Heaphy River Denniston Taramakau River Eastern Southern Alps*	Saxon, NW Nelson
Little spotted kiwi	Kapiti Island†	Kapiti Island, Wellington Red Mercury Island, Coromandel Tiritiri Matangi Island, Auckland Long Island, Marlborough Sounds

* Includes stations covering areas where intensive protection of kiwi is under way as part of the Kiwi Recovery Programme.

† Sites already free of mammalian kiwi predators (i.e. excluding rats).

‡ Because insufficient calls have been detected from the first two years of monitoring, a different technique (based on banding and territory mapping) will be used instead.

§ Populations where intensive protection of kiwi is under way as part of the Kiwi Recovery Programme.

¶ Suitable baseline monitoring was not conducted.

some collection of data on Haast tokoeka. Observation of Okarito brown kiwi/rowi and southern tokoeka on Stewart Island shows that both parents incubate the egg, occasionally with additional help. ONE (Operation Nest Egg) is a major programme to develop techniques for removing eggs from the wild, hatching them in captivity, and then returning the subadults to the wild. Some eggs have been hatched successfully, and some chicks have been released. Some of these are alive and breeding. The regime for handling of eggs is being further refined.

Research on kiwi in rough farmland (Priority 3): This has recently begun in Aotuhia, Taranaki.

Research on social systems (Priority 3): Much new information on all taxa of brown kiwi and tokoeka has been gathered.

Research on the use of exotic forests (Priority 3): No new research has been done.

OBJECTIVE 5/91: Ensure Survival of Little Spotted Kiwi. *Establish little spotted kiwi on one additional island capable of supporting a large, self-sustaining population and ensure their survival on the islands they currently occupy.*

Plan 5a/91: Establish whether the population on Kapiti Island is self-sustaining.

Plan 5b/91: Establish whether the Hen Island population is self-sustaining without further intervention.

Plan 5c/91: Establish whether the Red Mercury population is self-sustaining without further intervention.

Plan 5d/91: Establish a self-sustaining population on a further island capable of supporting a large population.

Plan 5e/91: Transfer any birds remaining on D'Urville Island to Long Island.

Plan 5f/91: Determine the current Long Island population and take steps to ensure its survival.

Plan 5g/91: Select another island for possible transfer of birds from Long Island.

Outcomes: Little spotted kiwi's future secure in the medium term. The island populations can be seen as holding measures until ... re-introduction to the mainland is a possibility.

Summary of 1991–96 results

Establish if the Kapiti population is self-sustaining (Priority 1): It is, and the Kapiti population is probably at carrying capacity.

Establish if the Hen Island population is self-sustaining (Priority 1): In 1988/89, 38 birds were released; the 1996 population is probably more than 50.

Transfer birds on D'Urville Island to Long Island (Priority 1): No new birds have been reported.

Establish if the Red Mercury population is self-sustaining (Priority 2): In 1983, 12 birds were released; the 1993 population was estimated at 30.

Establish a population on a further large island (Priority 2): A new population of little spotted kiwi has been established on Tiritiri Matangi. The birds have bred successfully and have all gained weight.

Determine Long Island population and safeguard it (Priority 2): The Long Island population has grown from five birds in 1990 to at least 10 in 1995; this includes the last of the D'Urville Island birds.

Select an island for transfer of birds from Long Island (Priority 3): There is no need to establish a second population in the near future; there is plenty of unused territory on Long Island, and other suitable islands exist in the Sounds.

OBJECTIVE 6/91: Identify and Evaluate Islands Available for Brown or Great Spotted Kiwi. *Preliminary work should be undertaken to identify islands for these kiwi, in case they are required in the short term for an endangered population. (Priority 1: South Island and 2: great spotted)*

Plan [6a/91]: Evaluate all islands that may be suitable for [South Island brown and great spotted kiwi].

Outcome [6a/91]: Islands provisionally identified as available for kiwi translocations

Summary of 1991–96 results

The Kiwi Recovery Group is awaiting formulation of a DOC islands policy.

OBJECTIVE 7/91: Manage Mainland Populations to Reduce Their Rate of Decline. *Endeavour to protect and enhance kiwi habitat and reduce impacts of dogs, pigs, possum trapping and poisoning, and road kills.*

Plan 7a/91: Endeavour to prevent further loss of kiwi habitat.

Plan 7b/91: Encourage the safer use of leg-hold traps and cyanide baits for possums.

Plan 7c/91: Develop 1080 and cyanide baits that are unattractive to kiwi.

Plan 7d/91: Minimise impacts of dogs on kiwis.

Plan 7e/91: Advocate management practices that are compatible with kiwi conservation to the owners of exotic forests.

Plan 7f/91: Minimise road deaths of kiwis. ...

No outcomes listed.

Summary of 1991–96 results

Efforts have been concentrated in Northland, as many kiwi are on private land in this area. Various techniques are being used to reach the community; parts of the Northland model are being used elsewhere (e.g. Coromandel Peninsula).

Habitat protection (Priority 1): A thousand hectares at Aotuhia, inland Taranaki, was allocated to DOC, and research is under way to see how birds use the various habitat types in the block. In Northland, some private landowners and communities are safeguarding kiwi. The Department is trying to make scrub clearance a notifiable activity.

Minimise the effect of possum trapping and poisoning (Priority 1): A leaflet has been produced to recommend ways to set possum traps and baits to minimise risk to kiwi. The Department now requires that leg-hold traps and cyanide must be at least 70 cm above the ground in areas occupied by kiwi.

Minimise impact of dogs (Priority 1): There have been major door-knocking campaigns, signage, and pamphlets to raise dog owners' awareness of risks to kiwi. Changes have been made in the Dog Control and Hydatids Act, allowing the Department to destroy or exclude dogs under certain circumstances.

Develop new baits and poisons (Priority 2): Research in progress.

Advocate exotic forest management (Priority 2): Forest & Bird have been conducting a public awareness campaign. The Principles for Commercial Plantation Forest Management in New Zealand were signed in 1992 by conservation and farm forestry organisations.

Minimise road deaths of kiwi (Priority 3): Road signs are being posted where appropriate.

OBJECTIVE 8/91: Manage Recovery of Key Mainland Populations. *Take action to reduce mortality and/or increase productivity of key mainland populations.*

Plan 8a/91: Initiate a programme to manage a large area of Crown-owned native forest to directly benefit its kiwi population.

Plan 8b/91: Develop through research and then advocate management practices that are compatible with kiwi conservation to farmers whose land includes kiwi habitat.

No outcomes listed.

Summary of 1991–96 results

Initiate management of a large forest population (Priority 1): This has been done in Okarito. After continued breeding failure, for a variety of reasons, emphasis has shifted to concentrating on Operation Nest Egg.

Develop and advocate management practices for rough farmland (Priority 2): Research has begun on this.

OBJECTIVE 9/91: Develop Techniques to Breed Kiwi in Captivity. *Undertake captive breeding research to ensure we have the expertise to take birds or eggs from any kiwi taxon and to rear and breed these.*

Plan 9a/91: Develop a captive management plan for kiwi and appoint co-ordinators to manage the captive programmes of each species.

Plan 9b/91: Bring further great spotted, little spotted and South Island (or Stewart Island brown kiwi) into captivity to facilitate research on husbandry of these taxa.

Plan 9c/91: Develop better artificial diets for all species.

Plan 9d/91: Investigate means of reducing death rates of captive adults, particularly females.

Plan 93/91: Develop better techniques for incubating eggs artificially, especially those of little spotted kiwi.

Outcome [9/91]: Knowledge that will allow us to take any kiwi taxon into captivity, either as eggs or adults, and breed it successfully.

Summary of 1991–96 results

Develop captive management plans and appoint co-ordinators (Priority 1): Management and husbandry plans are still being developed, as the role of captive breeding institutions is changing quickly. Co-ordinators have been appointed for the brown kiwi and the spotted kiwi programmes.

Bring further species into captivity (Priority 1): Ongoing—little spotted and Okarito brown kiwi. Trial releases of North Island brown kiwi are to be assessed.

Develop better artificial diets (Priority 2): Literature review suggests that egg peritonitis in captive females may be linked to dietary deficiency. Further investigation is under way.

Reduce deaths of captive adults (Priority 2): This is related to the deaths from egg peritonitis. Research is under way.

Develop artificial incubation techniques (Priority 2): Field research with dummy eggs has recorded the incubation pattern of male brown kiwi and has contradicted results of earlier work. Further research on incubation temperatures and egg-turning is under way.

OBJECTIVE 10/91: Promote Public Interest and Involvement in Kiwi Conservation. *Keep the public informed of conservation work relating to kiwi. Educate the public to reduce losses of kiwis during hunting and trapping activities. Involve interested groups and individuals in field work where appropriate.*

Plan 10a/91: Evaluate proposals to transfer kiwi to open sanctuary islands where they can act as a resource for advocacy and education (e.g. Tiritiri Matangi).

Plan 10b/91: Encourage the display of North Island brown kiwi at suitable zoological gardens here and overseas. Work with these institutions to present accurate information on kiwi conservation.

Plan 10c/91: Produce a revised information leaflet to replace that produced by the New Zealand Wildlife Service in 1986. ...

Plan 10d/91: Produce a leaflet for those involved in trapping and poisoning possums, identifying techniques that will minimise risks to kiwi. ...

Plan 10e/91: Encourage the involvement of volunteers in kiwi surveys so that they can develop the expertise to assist in continuing monitoring of populations.

Summary of 1991–96 results

There has been good coverage from the media, in a variety of programmes.

Evaluate transfer to Tiritiri Matangi Island (Priority 1): Little spotted kiwi from Kapiti have been transferred successfully.

Produce leaflet for trappers (Priority 1): Done by Northland Conservancy. Another one is being prepared by the Department.

Develop volunteer programmes (Priority 1): The main groups involved have been BNZ staff, tangata whenua, trappers, hunters, Forest & Bird, and Ornithological Society members.

Produce a revised information leaflet (Priority 2): Two brochures and a booklet have been produced nationally, and the booklet has been updated. Northland Conservancy has produced a set of booklets for a variety of audiences.

Display of kiwi in captivity with appropriate information (Priority 2): Material has been assessed, and captive breeding institutions are being encouraged to provide up-to-date material.

Kiwi in schools (new priority): A bilingual kit, encouraging schools study and adopt their local kiwi population, has been developed in Northland. It was successful and has been distributed to more than 70 Northland schools and many other schools nationwide.