North Island kokako recovery plan

1999 - 2009

THREATENED SPECIES RECOVERY PLAN 30

Department of Conservation
Te Papa Atawhai

Recovery plans

This is one of a series of recovery plans published by the Department of Conservation. Recovery plans are statements of the Department's intentions for the conservation of particular plants and animals for a defined period. In focusing on goals and objectives for management, recovery plans serve to guide the Department in its allocation of resources and to promote discussion amongst a wider section of the interested public.

The Department recognises the valuable contribution of all individuals, groups and organisations participating in this recovery programme. The Department recognises its obligation in terms of section 4 of the Conservation Act 1987 to give effect to the Principles of the Treaty of Waitangi in relation to its business, and the need to take account of the views of the tangata whenua and the application of their values in the conservation of natural resources. While the expression of these values may vary, the recovery planning process provides opportunities for consultation between the Department and the tangata whenua. Departmental Conservancy Kaupapa Atawhai Managers are available to facilitate this dialogue.

This plan reviews and updates the previous edition (Plan No. 1, 1991). Its content has been refined by scientists, managers and other interested parties, both within and outside the Department. A draft of this plan was sent to relevant Conservation Boards, tangata whenua, and other stakeholders for comment. After further refinement, this plan was formally approved by the Northern Regional General Manager in August 1999. A review of this plan is due after ten years (in 2009) or sooner if new information leads to proposals for a significant change in direction. This plan will remain operative until a reviewed plan is in place.

A recovery group consisting of people with knowledge of North Island kokako, and with an interest in their conservation, has been established. The purpose of the North Island Kokako Recovery Group is to review progress in the implementation of this plan and to provide advice to the Department. The Department of Conservation will consult with relevant Conservation Boards, tangata whenua and other stakeholders where such consultation will assist with implementation of this plan. Comments and suggestions relating to the conservation of North Island kokako are welcome and should be directed to the recovery group via any office of the Department or to the Biodiversity Recovery Unit.

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Cover photo: North Island kokako, Puketi Forest, Northland, 1981.
Photo by Rogan Colbourne.

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Vulnerable: a 3-day-old kokako nestling, Mapara, 1995. Photo: Ian Flux, DOC.

1. Abstract

This is the third edition of a recovery plan for North Island kokako (*Callaeas cinerea wilsoni*).

It has a 20-year vision or goal (To improve the status of North Island kokako from endangered, by restoring the national population to ca 1,000 pairs by the year 2020, in sustainable communities throughout the North Island) although the plan itself recommends actions for the next 10 years.

In many ways, this edition is a celebration of the success of kokako recovery planning so far. Since the 1980s, when the first plan was written, our knowledge of kokako ecology has grown enormously. We have now identified key threats and developed successful pest-management regimes to counter them. Kokako are declining on the New Zealand mainland primarily because ship rats (*Rattus rattus*) and brushtail possums (*Trichosurus vulpecula*) prey on kokako eggs, chicks and adults during nesting. Management to recover kokako populations should aim to reduce possums and ship rats to very low levels (<1% trap catch for possums; <1% tracking rate for ship rats, using particular indexing techniques) at the onset of the kokako nesting season, for several consecutive years. Most actions outlined in the previous Plan have been successfully completed and are reviewed here.

Like its predecessors, this plan has the twin approaches of applying existing knowledge to management as well as undertaking research to increase what we know about kokako recovery. Major new themes are to develop strategies for managing kokako in large (>10,000 ha) blocks; to improve the efficiency of management in small-medium sized forest blocks, and to re-introduce kokako to some mainland regions from where they disappeared decades ago.

In order to attain the stated goal of this plan, we list 23 key sites which represent the *necessary minimum* management sites required to improve the status of kokako by 2020. Increasing the number or area of sites is of course desirable.

Kokako management is mostly intensive pest-mammal control. As such, it is likely to benefit most indigenous components of their forest ecosystems. Similarly, intensive pest-mammal control conducted for other purposes within suitable kokako habitat may benefit kokako. The Kokako Recovery Group supports ecosystem management and will work with other groups, wherever appropriate, on projects of mutual benefit.

2. Recovery plan issues and actions

LONG TERM GOAL

To improve the status of North Island kokako from "endangered", by restoring the national population to ca 1,000 pairs by the year 2020, in sustainable communities throughout the North Island.
Separate populations shall average 50 pairs and shall be managed together with the diverse communities in which kokako were previously recorded.

1. Issue

Fewer than 400 pairs of kokako currently exist. Populations are small and isolated. Kokako occurred naturally throughout the North Island, and true recovery will involve their restoration to sites throughout this original range. Some populations have been reduced to such small numbers that harmful genetic bottlenecks may be occurring, and others have declined to extinction. Translocation of birds from elsewhere may be required in both cases. Nationally, recovery will be achieved most efficiently if key sites for kokako management are clearly identified.

Action
Choose key mainland sites as places to manage or establish populations. Planning must identify a source or sources of kokako to translocate to new sites, and must consider the conservation of all current kokako genetic lineages.

2. Issue

There are still many uncertainties about the most effective ways to manage kokako for the next 20 years, especially in very large (>10,000 ha) forest blocks, and regarding translocations. Kokako ecology at individual, population and community levels is not fully understood, nor are details of management techniques and strategies.

Action
Undertake key research to underpin sustainable management. Research topics are detailed in the work plans.

3. Issue

Offshore island populations are usually safe from the predatory mammals that make kokako recovery on the mainland so expensive, but some details of the number and origins of translocated kokako required for island populations to be successful are still uncertain.

Action
Monitor offshore island populations and be prepared to translocate further birds if necessary.

4. Issue

Some populations (e.g. Taranaki, western Waikato, Coromandel) are, or may be, reduced to one or two birds, usually males. Left alone, extinction of the populations and loss of their particular genetic lineages are certain.

5. Issue

It is difficult to advocate for kokako management in the wild because many populations are remote, which makes it difficult for the public to see or hear wild kokako.

Action

Hold kokako in captivity for breeding and reintroduction in an attempt to preserve some of the genetic variation held within the remnant populations. Hold kokako in appropriately constructed and vegetated aviaries and use them to support advocacy for active management of kokako in the wild.

6. Issue

Kokako conservation is everyone's responsibility. The New Zealand public have a right to full information about the kokako recovery programme, and many people (especially those living adjacent to management sites) wish to be actively involved in kokako projects. The long grind of pest control to achieve the 2020 vision of kokako restoration will only be sustainable if the interested public remain involved and informed about the kokako recovery programme.

Action

Promote public interest and involvement in kokako conservation, by ensuring good public access to populations and using media to assure a free flow of information about kokako projects. Support and encourage partnerships between DOC and other like-minded groups which are prepared to work for kokako conservation.

3. Recovery strategy

3.1 INTRODUCTION

We start this planning period (1999-2020) knowing:

1. that the immediate cause of mainland kokako decline is recruitment failure due to predation by ship rats and possums at kokako nests;
2. that this decline can be reversed by intensive and sustained pest control using existing technology.

These two findings of the last 10 years' research and management are the key to future recovery for the whole population. The vision of 1000 pairs by 2020 *can be achieved by methodical application of what we already know*.

The main strategy of this plan is to apply pest control to at least 20 mainland sites (Table 1) so that, on average, there will be 50 pairs in each. Some (Rotoehu, Otamatuna-Onepu) already have more than this but must be sustained or increased. Others (e.g. Trounson Kauri Park) are unlikely to ever reach 50 pairs, due to their smaller area. We hope that more sites than those listed in Table 1 *will* be managed, but the listed sites are the *required minimum* to be managed if the recovery vision is to be achieved. The sites are scattered evenly among DOC Conservancies, partly to spread the work load and partly because this reflects the natural range of the species.

Very large forest blocks such as Te Urewera National Park, the north block of Pureora Forest Park, and some forests in Northland are in some ways the 'final frontier' for kokako conservation. Recovery techniques for kokako were developed in small-medium sized blocks and their extension to very large areas is essentially experimental. However, large forests offer most to kokako conservation, in the long term, because the ecological community to which kokako belong is intrinsically large-scaled.

New populations, and the infusion of new genetic lineages to bottle-necked populations, can only be achieved by translocations (Table 2).

This plan is to be used by resource allocators and administrators, especially in DOC Regional Offices, to aid their decision-making processes. However, the Kokako Recovery Group acknowledges that not all recovery projects are government-funded, and that some projects will be solely or partially funded by other agencies or community groups.

3.2 BACKGROUND – TO THE SPECIES, TO THE PAST AND CURRENT APPROACH TO RECOVERY, TO PREVIOUS PLANS, TO THIS PLAN

"*The cry of the crow is indescribably mournful. The wail of the wind through a leafless forest is cheerful compared to it. Perhaps the whistling of the wind through the neck of an empty whiskey bottle is the nearest approach to it, and is sadly suggestive of departed spirits*" (sic)

Charles Douglas

The North Island kokako is a beautiful blue-grey forest bird with blue wattles and a black 'Lone Ranger' mask, but it is most famous for its haunting song. The song is long and very loud – it is flung by the birds from the tops of emergent trees at dawn; it fills the sky, and then settles like a huge blanket down through their forest territories.

According to Elsdon Best (1942), kokako were not prized by Maori as food supply but they ate them opportunistically, attracting them with a call-leaf. People were often compared to birds in Maori proverbs. Kokako were regarded as fleet of foot – "Hoki i kona, e kore e mau i a koe te kokako e Whareatua" (you can turn back, for you will never catch the crow of Whareatua). Early settlers called it the 'blue-wattled crow' because like English crows they were "inquisitive and crafty", but it is not a crow. The wattlebirds are an ancient family of unknown affinities, and these days its members are all but driven from the New Zealand mainland. The huia with its striking black and white plumage is now extinct; tieke (saddlebacks) are confined to islands where pest mammals are absent, and the South Island kokako is probably extinct since there have been no verified recent sightings.

Historically, the range of the North Island kokako has shrunk as its forest home has shrunk. Three-quarters of native forests present in 1000 AD have now gone, and many native birds, which evolved with kokako, have disappeared also. The small, tattered forests that remained were then overrun by introduced mammals, so that today key pest species, such as ship rats and possums, are firmly established in the very centres of our largest forests. Kokako are best understood with this history in mind. The mammalian predators which threaten kokako today are quite different to the avian predators that hunted their ancestors a thousand years ago.

The present recovery effort was late starting. Research in the 1970s – especially by Ian Crook of the former N.Z. Wildlife Service – focused on kokako distribution and the impacts of native forest logging. This habitat-use theme drove further research by Rod Hay, Ralph Powlesland, Hugh Best and Peter Bellingham during 1979-1984, and from these studies grew an understanding of the species' biology. Kokako eat a wide range of foods – fruits, leaves and insects. They defend 4-20 ha territories in which they obtain all their resources. They are poor fliers but are still superbly mobile, using their powerful legs to bound from branch to branch, and their short, rounded wings to glide from ridge tops to valley bottoms. Researchers found poor breeding success, with only one pair in ten producing a chick each season. The first draft of a recovery plan for kokako was prepared by the Wildlife Service in the early 1980s.

A workshop in Rotorua in 1988 led to new research and management targets (Innes, Owen & Smale, 1988), and eventually to a revised, published recovery plan (Rasch 1992). Intensive, imaginative and successful work has been undertaken on kokako since 1989. Large-scale surveys have verified the desperate plight of many remnant populations. Te Urewera National Park has the largest population, but even this is declining. The good news is that the key cause of decline has been diagnosed to be predation at nests, especially by ship rats and possums, and that intensive control of these pests is known to reverse declines within a few years. At issue now is whether these efforts are sustainable – financially, ecologically, and politically.

This plan summarises the achievements of the previous plan and presents objectives for the next 10-50 years of research and management. The technical Working Documents, which contain standard practices used by kokako managers, are listed in an appendix to this plan, but the Documents themselves are collated separately.

Kokako eggs preyed on by an unknown predator, probably a ship rat. Rotoehu Forest, Bay of Plenty, 1991. Photo: J. Innes

3.3 DISTRIBUTION AND DECLINE – CURRENT STATUS

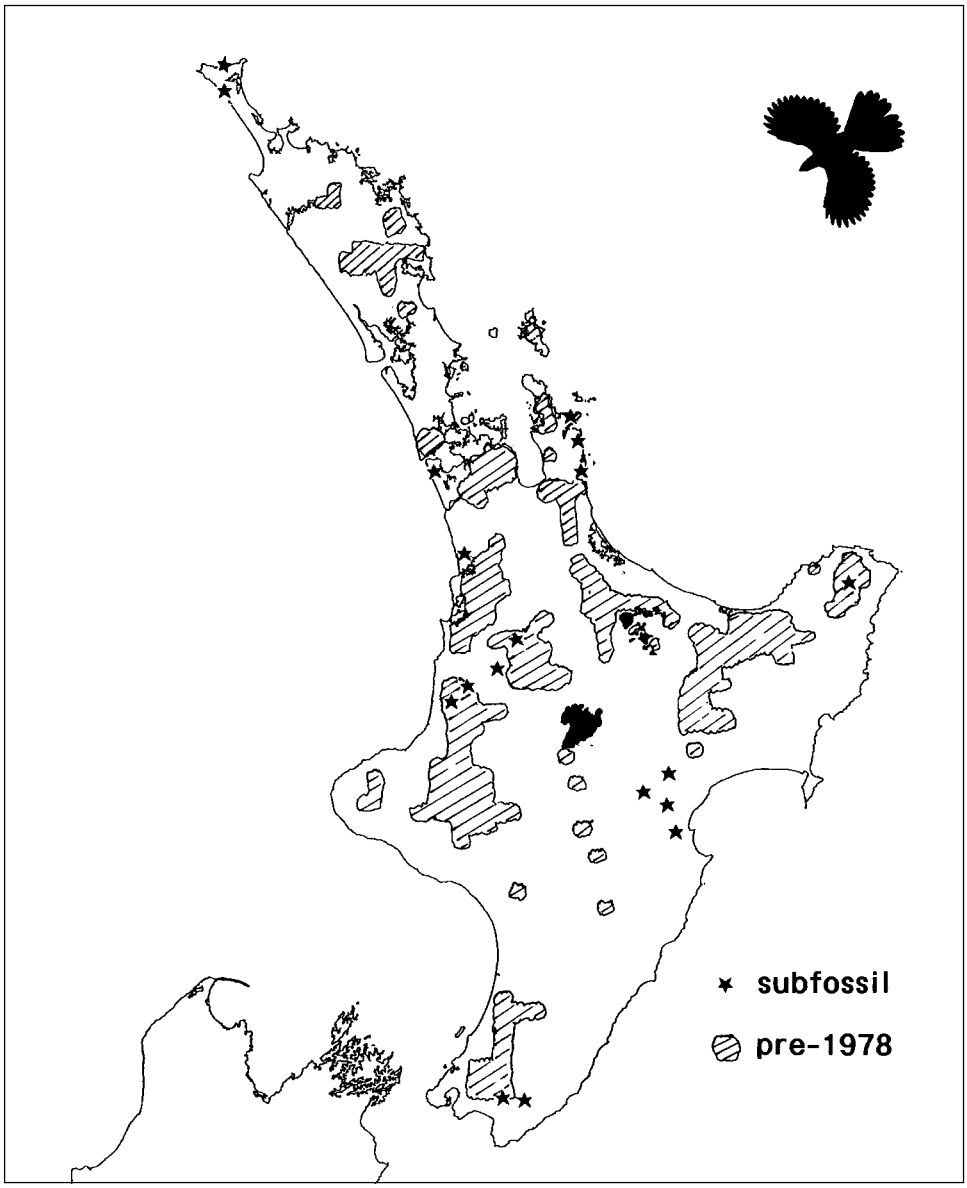
According to Maori tradition the kokako was once common "on all the ranges of the North Island forests", and sub-fossil remains indicate a widespread distribution before the arrival of European settlers.

The maps which follow show kokako distribution records as (Map A) subfossils and pre-1978, from Lavers (1978), and (Map B) populations under or proposed for management in this plan. Known remnant populations not shown on the map are Coromandel Peninsula (1 adult), Kaimai Range (20?), western Waikato (5), Pikiariki (Pureora; 3), Tihoi-Waimanoa (10) and Taranaki (5), bringing the known national total of adults to just over 1200.

Regional Maori names for kokako included hokako, honga, honge, onga, onge, pakara and werewere. It was named *Callaeas* (from the Greek kallaia, cock's wattles) by J. R. Forster in March 1788, and *cinerea* (from the Latin cinereus, ash-grey) by Gmelin 5 months later, and thus became known to western science. Forster was a naturalist with the voyaging Captain James Cook, and Gmelin was the editor of Carolus Linnaeus's classic 'Systema Naturae'.

The North Island subspecies *wilsoni* was named in 1851. By 1960 it was confined to the northern half of the North Island, and since then all unmanaged populations have declined, and many have disappeared. The declines are characteristically so

FIGURE 1: SUBFOSSIL AND PRE-1978 DISTRIBUTION OF NORTH ISLAND KOKAKO (FROM LAVERS 1978)



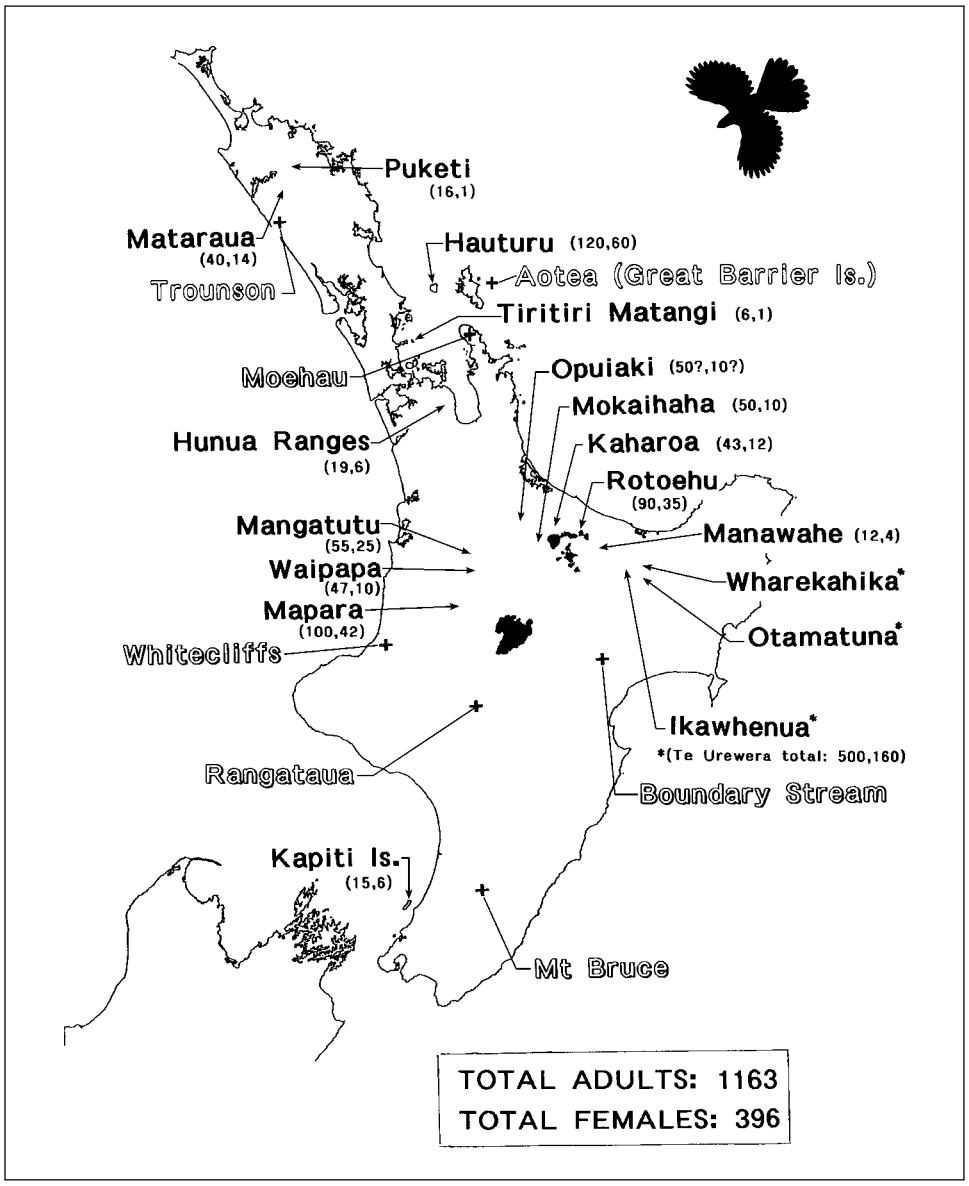
prolonged that a quick glance at the situation suggests peaceful co-existence between the bird and its agents of decline, but this is far from the truth. The protracted declines occur because a few nests are successful even when predators are abundant, and these lucky fledglings may live for 15-20 years, occasionally breeding themselves. It appears that predation of nesting females may accelerate the rate of decline in some areas. Fortunately, intensive pest control applied since 1989 has now reversed declines in many populations.

The only natural offshore island population, on Great Barrier Island, was lost in 1994 when the last two birds were transferred to Little Barrier Island. There they joined a thriving population, which originated from the translocation of 32 mainland kokako between 1980 and 1988. Kokako have also been translocated to Kapiti and Tiritiri Matangi Islands.

Kokako are listed as 'endangered' (20% chance of going extinct in 20 years; key problems are severe fragmentation; no population greater than 250) on the IUCN Red List (Collar *et al.*1994). They are in Category B (a second priority threatened species) for action by the New Zealand Department of Conservation (Tisdall 1994).

FIGURE 2: NORTH ISLAND KOKAKO POPULATIONS UNDER MANAGEMENT OR PROPOSED FOR MANAGEMENT IN THIS PLAN.

Sites with crosses and named with shadow print currently have no kokako, and require translocation. In some areas (e.g.Te Urewera), the names simplify more complex actual distributions. Numbers after place names show May 1999 estimates of the number of territorial adult kokako, and of the number which are female.



3.4 HISTORY OF KOKAKO CONSERVATION

As early as 1885, observers noted that kokako were ..."retreating before the advance of civilisation"... and they suggested that some should be preserved in island reserves. Early 20th century conservationists focused on reserving forest areas where possible, difficult in the pioneering climate of the times. In the ensuing decades, a handful of committed observers, such as H. Ross McKenzie and J.W. St Paul in the Hunua Range during 1944-1979, noted that kokako were continuing to decline. They suggested (1974) that the decline was ..."almost entirely due to predators"... but predator control on the mainland at that time was inconceivable. The modern era of intensive kokako management began in many ways with large-scale surveys of forest birds by the Fauna Survey Unit of the former New Zealand Wildlife Service. They refined the use of tape playback techniques to survey for kokako and published a series of Fauna Survey Unit reports (1971-1983) describing kokako distribution, abundance and habitat choice. Their determination was fuelled

by logging plans of the then New Zealand Forest Service, and difficult decisions were made about which forests survived and which were cleared for exotic afforestation. Kokako became the public symbol of what may be lost by logging the native forests, as conservationists joined the Wildlife Service in pushing for an end to logging. At Pureora, a 3-year logging moratorium during 1979-1981 allowed Rod Hay to undertake the first major intensive study of kokako diet, movements, habitat use and breeding success (Forest Bird Research Group report, 1981).

This was followed by another detailed study of habitat use by kokako in Northland during 1982-1984 by Hugh Best, Ralph Powlesland and Peter Bellingham. Logging of State-owned native forests was finally made illegal in most forests in 1987, with the formation of the Department of Conservation under the Conservation Act 1987. Kokako are likely to have a special place in the hearts of New Zealanders for many decades because of their role in these campaigns, and it is often used as a 'flagship species' by DOC.

Kokako first bred in captivity at the National Wildlife Centre at Mount Bruce in December 1986. Captive rearing has become a valuable source of birds for island translocations, and captive birds help advocacy for management of wild populations. The first population on an offshore island safe from key predatory mammals was established on Hauturu (Little Barrier Island) with the release of 32 birds during 1980-1988. Birds came from mainland forests threatened by logging, and, in retrospect, most were probably old males. Subsequent releases on Kapiti Island (1991-1996) and Tiritiri Matangi (1997-1998) included young females selected from the intensively managed population at Mapara (King Country), from Little Barrier Island, or reared at Mt Bruce.

A 1988 workshop at Rotorua reviewed achievements of the previous decade and identified gaps in existing knowledge. The key research question posed was how to untangle the relative roles of predators and competitors in mainland kokako decline. Two quite different investigations into this question were started by the Department of Conservation and Landcare Research one year later (Innes *et al.*, 1999). First, researchers discovered that many pairs of kokako were not attempting to breed and that many of those, which did attempt, were failing. Predation at nests, especially by ship rats and possums, was the main cause of nest loss in mainland sites whereas, on Little Barrier Island which lacked these pests, most kokako bred successfully. Second, managers started intensive pest control at Mapara (King Country) and Kaharoa (Bay of Plenty) and waited to see how the kokako would respond. The rest is now history. After 8 years of pest control at Mapara, the total population trebled, the number of breeding pairs increased eight-fold, and the composition of the population changed from predominantly old males to young birds with a near equal gender ratio. At Kaharoa, 85% of pairs fledged young after three managed years, but this figure plummeted to 0% two years after management stopped, and stayed there until management resumed. The programme of experimental pest control was initially called 'research-by-management', but the same approach was described in previous scientific literature (Walters,1986) as 'adaptive resource management'. This means:'Try things out in practice, and learn from what does and does not work'.

Knowing why kokako are declining and recognising that remnant populations may be predominantly composed of ageing males, allows us to boost key populations before they crash.They can also be supplemented with an injection of kokako from elsewhere, mimicking the historical juvenile dispersal that is now prevented by forest clearance.

Key challenges for this planning period are:

1. to improve the sustainability of recovery in small-medium sized blocks;
2. to extend the scale of recovery to include very large (>10,000 ha) blocks;
3. to return kokako to parts of their former range (Wellington, Hawkes Bay, Whanganui).

These aims form the main thrust of this plan. As groundwork, there have already been several trial translocations of birds between mainland sites, from Mataraua to Trounson (Northland), from Mapara to Pikiariki (King Country), and from Mapara to the Hunua Ranges (Auckland). Other long-standing conservation techniques – maintaining safe populations on offshore islands, and rearing birds in captivity – will also continue to be priorities in this plan.

3.5 SPECIES BIOLOGY AND ECOLOGY

Kokako are birds of forested areas. Today, most kokako occur in tawa-dominated, mixed podocarp-broadleaf forest but they are also found in shrublands and regenerating seral forest. Historic records show that kokako were once widely spread, in a variety of forest types throughout the North Island. They use their powerful legs to run and jump from tree to tree, assisted by short bursts of flight and glides (of up to about 100 metres) convey them from the tree tops to the valley bottoms.

Adults of both sexes average 230 g. Only nesting observations or DNA testing can distinguish males from females with certainty, although males tend to be a little larger.

The oldest known-age kokako is eleven years, but they may live for twenty years or more.

3.5.1 Reproduction

Kokako remain in territorial pair-bonds all year and pairs may stay together for many years. Breeding is usually from October to March, although – for reasons which are little understood – there are 'good' years when breeding may extend for up to 6 months, during which pairs make several nesting attempts. Until recently it was thought that kokako only bred once each year, but now pairs are known to have fledged three clutches in a single season.

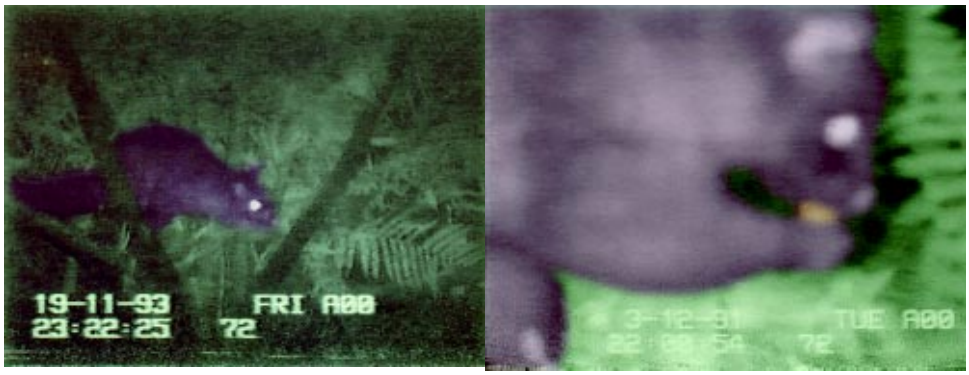
Kokako about two weeks of age, note bright pink wattles. Mapara, 1994. Photo: Ian Flux, DOC

The female builds the nest over several days, although the male may occasionally contribute materials. Nests have been found 2 to 32 metres above the ground, in dense foliage, well concealed from aerial predators. The nest generally has a twig base, with a woven mix of moss, lichen, dead wood, filmy ferns, epiphytic orchid, and finally treefern scales forming the bowl. The female lays one to three eggs, which are pinkish grey with brown and mauve spots and blotches, and these take about 18 days to hatch. Only the female incubates eggs and broods young, although the male feeds the female during incubation and also feeds the growing chicks. Fledging takes 30 to 35 days.

3.5.2 Predators and food competitors

Video cameras have shown that ship rats and possums are key predators at kokako nests. These introduced species are both abundant throughout mainland kokako habitat; both are arboreal omnivores which mainly eat plant matter or insects, but birds' eggs and chicks are taken when they can find them. Harriers are native predators which frequently take kokako eggs and chicks. They are incorrectly regarded as only open-country birds. In fact, they hunt native forests frequently and are a serious threat to very small kokako populations, such as on offshore islands in the early years of translocation. Stoats and feral cats also occasionally kill kokako, but they are less numerous than ship rats and possums and are not currently regarded as key predators.

Possums, ship rats, deer and goats are known to eat many of the same plant foods as kokako. Predation is now seen as a more immediate cause of kokako decline than food competition, but it is likely that long-term changes to forests caused by browsing will reduce the carrying capacity of forests for kokako. In this sense, food supply is a potential secondary limiting factor if the primary factor of predation is removed by pest control.



Infra-red video has proven to be a powerful tool in kokako research. Here, possums take kokako eggs from nests at Rotoehu Forest. Photo: Landcare Research.

3.5.3 Habitat use

Typically, kokako territories are located in dissected terrain and contain a great diversity of vegetation types and plant species. Kokako feed on leaves, fruits and insects according to what is available in different seasons. At times, they may concentrate on quite rare plants, but mostly their feeding probably reflects the energy and nutritional values of foods available at any point in time.

Singing is used to maintain their territories. They sing mostly at dawn, and usually from the tops of tall trees at higher altitudes in their territory.

3.5.4 Territoriality, sociality, dispersal

Territories range from 9 to14 ha at Rotoehu (Bay of Plenty) and 4 to 12 ha at Mapara (King Country). Territories may be held by male-female pairs, male-male pairs or single males, but only briefly by single females. The kokako is the only bird in the world known to form male-male pairs in the wild. This is possibly because there is an excess of males, perhaps because females are killed by predators while nesting, though we now know that some young kokako choose male-male pairings even in the presence of females.

Territories are occupied by pairs or single kokako all year, and so kokako can be heard singing in any month. Kokako will respond to tape recordings of their songs and this is the main technique for surveying and catching them.

Newly fledged subadults may be ejected immediately from their parents' territory or they may be permitted to stay and be fed by the parents for several months, sometimes until the following breeding season. Dispersing juveniles can cover many kilometres looking for a territory or mate. At Rotoehu Forest, the average distance between nest and final settlement for ten banded juveniles was 1450 m (North, 1997). At Mapara twenty juvenile females dispersed an average 2520 m whereas twelve juvenile males averaged only 1216 m. In Te Urewera National Park, a very large forest tract, banded juveniles dispersed 1.1 km on average (G. Jones, J. Hudson, S. Ferreira, unpub. data).

3.6 KOKAKO RECOVERY PLANNING

Dedicated individuals began some kokako conservation work in the 1940s, but co-ordinated planning for the recovery of the species as a whole was impossible without a recovery plan. The first draft Plan was written by Gretchen Rasch, Murray Potter and Shaarina Boyd in 1988. This was updated and refined after a workshop held at Rotorua in 1988 to discuss priorities for kokako research and management (Innes, Owen & Smale, 1988). The first formally accepted Kokako Recovery Plan was published in November 1991, and it was revised and republished (Rasch 1992) in June 1992.

Kokako Recovery Group Meeting, Tiritiri Matangi, May 1999. Photo: G. Moorcroft

This plan supercedes that document.
The Kokako Recovery Group is a team of DOC staff and other scientists and managers who work with kokako throughout its range. They meet annually to present progress reports and to plan the next year's actions. The recovery plan is the key document which provides the framework for all kokako recovery endeavours, although inevitably new initiatives may arise at any time. Any departures from this plan will be circulated in the minutes of the annual recovery group meetings. Recovery group leaders play an important role in co-ordinating and motivating the group, and in presenting the group to the rest of the Department of Conservation and to associates such as sponsors. Gretchen Rasch, Paul Jansen and Ian Flux undertook this during 1991 to 1998. Philip Bradfield will lead the group from 1998 to 2000.

3.7 PROGRESS ON OBJECTIVES IN THE PREVIOUS PLAN

Objectives from Rasch (1992)

Objective 1

Determine the relative importance of the causes of the current decline of North Island kokako.

Outcome
Predation is a more immediate cause of current kokako decline than competition. Possums and ship rats are the key predators of kokako at nests. Key reference: Innes *et al.*, 1999.

Objective 2

Determine successful management techniques and strategies for the conservation of North Island kokako.

Outcome
Managers wishing to recover kokako populations in small-medium sized forest blocks (<5000 ha) should aim at residual indices of one possum per 100 trap-nights and a 1% ship rat tracking index at 1 November each year, for several years. This action will also maximise food availability quickly, because possums and ship rats are simultaneously predators and potential competitors. Key reference: Innes *et al.*, 1999.

Objective 3

Establish viable kokako populations on islands.

Outcome
Kokako are now secure on Little Barrier Island, established but not yet secure on Kapiti Island, and newly translocated onto Tiritiri Matangi Island. Isolated kokako from remnant forests on the mainland are mostly old males and are poor candidates for island translocation compared to young birds of both sexes from healthy populations.

Objective 4

Develop rearing techniques for kokako in captivity.

Outcome

Kokako now breed in most years at Mount Bruce, and there are no technical impediments to this species being captive-bred elsewhere. Chicks raised there have contributed to establishing offshore island populations.

Objective 5

Determine gender of single birds holding territories.

Outcome

Body measurements, breeding behaviour (if/when they do pair) and DNA analysis all suggest that most single birds holding territories are males.

Objective 6

Survey potentially important but poorly known populations.

Outcome

Major survey effort in Te Urewera National Park confirmed that there are more kokako there than everywhere else put together, yet subsequent re-survey suggests that these populations are declining rapidly like all others. Surveys of other populations in the Kaimai-Mamaku Ranges and in Northland suggest that all major populations are now known.

Objective 7

Monitor critical populations.

Outcome

Most mainland populations are both managed and monitored, including some in large forest tracts in the Urewera, at Pureora, in the Hunua Range, and in Northland. Two study populations (Mapara and Rotoehu) contain many banded birds; at Mapara all kokako were colour-banded until 1996. New populations on Kapiti and Tiritiri Matangi Islands are closely monitored.

Objective 8

Monitor all kokako work and be prepared to respond to change.

Outcome

The Kokako Recovery Group has met annually since 1990 to review progress and make new plans. The group has maintained a long-term commitment to the scientific requirements of the recovery plan, while eagerly absorbing new techniques and approaches in research and management. The group has formalised procedures for monitoring kokako adults and juveniles, and its technique for monitoring ship rats has become the national standard. One example of change is using young kokako of both sexes to establish new island or mainland populations, rather than rescuing old (male) birds from isolated forest remnants.

Objective 9

Promote public interest and involvement in kokako conservation.

Outcome

There have been many media releases and feature articles on kokako management successes in newspapers and popular magazines. Kokako management has also become a major feature of the advocacy programme at the Mount Bruce National Wildlife Centre. Iwi involvement – especially with kokako translocations – is increasing and will continue to be encouraged. Many kokako management areas involve volunteers and local interest groups with close co-operation from local communities.

3.8 KOKAKO RECOVERY PLAN, GOAL AND STRATEGY

This plan is intended to guide the Kokako Recovery Group for the next ten years, and to outline a recovery vision to 2020, when the Long Term Goal (below) must be reviewed. The plan identifies research needs and provides an overall framework for kokako recovery. Recommendations from the Kokako Recovery Group effectively update the plan throughout its operating period.

Detailed research and work plans and operational procedures are listed but not detailed in this plan; they are in a separate loose-leaf folder for managers and will be updated irregularly, as need arises. Copies are held by those working on kokako projects and can be viewed at their respective conservancy offices.

The main achievements under the recently expired plan were the determination of the key cause of mainland population decline, and the demonstration, so convincingly, that the decline could be reversed by intensive pest control. The vision of this new plan is to widely apply the knowledge gained *to greatly increase most kokako populations*, and *to restore the species to most of its former range* – at least in managed forests throughout that previous range. While this plan advocates chiefly for kokako, it is clear that forest communities as a whole will benefit from the application of the intensive pest-mammal control advocated here. The interdependency of kokako with other elements of the native forest community is captured in the explanatory statement to the long term goal, below.

Long-term goal

To improve the status of North Island kokako from endangered, by restoring the national population to ca 1,000 pairs by the year 2020, in sustainable communities throughout the North Island.

Populations shall average 50 pairs and shall be managed together with the diverse communities in which kokako were previously recorded.

The figure of 1,000 pairs is an arbitrary total which was selected because it was far in excess of the current (July 1999) estimate of 270 pairs. If we can reach 1,000 pairs, then we have demonstrated that we understand the causes of decline and can reverse them on a large scale. If in the process, at least one population exceeds 250 mature individuals, then the status of kokako, according to I.U.C.N. criteria, will also improve from 'Endangered' to 'Vulnerable' (Collar *et al.*, 1994). We chose 50 pairs as a safe average population target because preliminary computer

modelling suggests that such populations will last many decades even if management ceases.

The option of managing many smaller populations rather than one or two large ones was selected because this preserves existing kokako genetic and behavioural diversity; because we now know that small populations (<10 pairs) can be recovered; because this spreads resource expenditure among several DOC conservancies, and because kokako were historically found throughout all of the North Island.

Three key uncertainties of this plan are:

1) whether current pest-mammal control practice, which we know can reverse kokako population-declines in small-medium blocks, is in fact sustainable for the next 20 to 50 years – financially, biologically and politically;
2) whether kokako recovery is practicable in very large (>10,000 ha) blocks using methods derived from small-medium blocks; and
3) whether new kokako populations can be established on the mainland by translocation. Conservation of kokako is more likely to be sustainable if we can manage them at the same sites as other species or alongside forest-community conservation projects. We also rely upon the continued involvement of other agencies and the public in kokako projects and the availability of effective pest control tools (currently we rely heavily on poisons). We suggest that pulsing pest control effort (e.g. five years on and five years off) directed at larger populations will assist sustainability by reducing the amount of toxin that goes into the environment, and by enabling managers to rotate effort between several management sites. Preliminary mathematical modelling of kokako populations which oscillate between managed and unmanaged states has been undertaken to clarify the most efficient duration of these two states, and more is required.

Offshore island 'insurance' populations and captive-rearing will continue to be important for the foreseeable future, to complement the primary recovery effort throughout the North Island mainland. Further research into many aspects of kokako biology and management is the final key element of the recovery strategy.

3.9 MANAGEMENT WORKPLAN FOR 1999 TO 2009

Four types of action are planned for kokako:

1. monitored intensive pest-mammal control at a range of mainland sites;
2. translocation to mainland sites with no or few kokako, to establish or boost populations;
3. translocation to offshore islands and ongoing protection there;
4. breeding in captivity for release into the wild, and for providing a focus for advocacy of kokako management to the public.

Of these, only mainland translocations are new; all other actions were prescribed in the previous recovery plan. Translocations, where required, will reintroduce kokako to parts of their former range, or boost a small existing population. Site management aims to increase kokako populations by maximising breeding success and minimising mortality; pest control is necessary to maintain kokako populations on the New Zealand mainland. Offshore island populations included in this plan require vigilance but no ongoing management.

This work plan consists of a common prescription for management of sites together with two timetables (Tables 1 and 2). They also detail the sites selected for management and, where transfers are programmed, the sources from which kokako will be taken. The kokako management folder (to be published by DOC shortly after this plan) contains detailed technical information and management practices which have been refined over the last decade. It is intended primarily for use by kokako managers and will be updated sporadically; copies are available in DOC conservancy offices.

Most remaining viable kokako populations are currently managed in some form or other, so a lot is already known about how to make projects successful. A degree of innovation is always healthy, but any departure from the given prescriptions should be fully discussed with the Kokako Recovery Group before it is implemented.

3.9.1 Choice of management sites

Table 1 presents 23 locations which the recovery group recommends as key sites for kokako management and dates by which they are to be managed. The overall strategy of the recovery group in selecting these sites is:

1) to consolidate and sustain the kokako recovery successes which characterised the 1990s in small-medium sized blocks and on offshore islands;
2) to develop strategies to manage kokako throughout larger forest blocks; and
3) to reintroduce kokako to parts of their former range.

Management in large forest areas may be by increasing the area to which current pest control techniques can be applied cost-effectively, or by embedding small areas of conventional management within large unmanaged areas.

The 23 sites are diverse, being located throughout the North Island, of varying sizes (hundreds to thousands of hectares), and varying histories of management. Eight sites (Rotoehu, Kaharoa/Onaia, Mapara, Mangatutu, Otamatuna/Onepu, Hunua, Tutamoe/Mataraua, Puketi) have received intensive pest control targeted specifically for kokako during the last decade, while some others (Waipapa/Pikiariki) received more ecosystem-oriented management which nevertheless benefited kokako.

Pest control regimes to recover mainland kokako populations were proven in the last decade's research and management in small-medium sized blocks (to 3,000 ha). Continued effort at these sites and others of the same size is probably a sure formula for success, especially (and perhaps ironically) if blocks are isolated so that juvenile kokako cannot emigrate. Application of this management approach to very large forest areas such as Te Urewera National Park has demanded new thinking and is essentially experimental. However, the rewards are potentially huge, because in Te Urewera the initial population is still large compared to all other sites, and because the avian community is more intact there than in small isolated blocks. Urewera staff have developed an alternative pest control system ('A lines') which focuses on ridge tops rather than grids. Another local variation is the successful recovery of Mataraua (Northland) kokako by protecting individual nests rather than whole territories.

Three offshore islands currently have kokako; all were established by translocation. Little Barrier Island has a self-sustaining kokako population (32 kokako released 1980-1988; 120+ territorial adults present in 1994-95). The Kapiti Island population (32 released 1991-1997) is not yet regarded as secure (self-sustaining) but no further releases are planned until the success of current releases is assessed. Tiritiri Matangi (six kokako, 1997-1998) will receive further kokako originating from the Taranaki region when these are available. A fourth island, Great Barrier Island, had a natural

TABLE 1: KEY SITES WHICH ARE REQUIRED TO BE MANAGED SO THAT THE GOAL OF THE KOKAKO RECOVERY GROUP CAN BE MET BY 2020

CONSERVANCY	SITE	ECOSYSTEM RESTORATION PROJECT	RECENT OR CURRENT KOKAKO MGMT	REQUIRES TRANSLOCATION (SOURCE)	NEW	PEST TARGET INDICES MET BY
Wellington	Kapiti Island	•				ongoing
	Mt Bruce Forest	•		• (central NI)	•	2002
Wanganui	Whitecliffs			•	•	2005
East Coast/Hawkes Bay	Otamatuna/Mangaone	•	•			ongoing
	Onepu	•	•		•	ongoing
	Ikawhenua	•				ongoing
	Boundary Stream	•		• (Nth. Urewera)	•	2001
Bay of Plenty	Rotoehu		•			2010
	Kaharoa/Onaia		•			2000
	Mokaihaha				•	2001
	Opuiaki				•	2005
Waikato	Mapara		•			2002
	Mangatutu	•	•			ongoing
	Waipapa/P' ariki	•				ongoing
	Moehau	•		• (Waikato/Coromandel)	•	2005
Tongariro/Taupo	Rangataua?	•		• (Waikato/Coromandel)	•	2010
Auckland	Hunua	•	•			ongoing
	Hauturu (LBI)					ongoing
	Tiritiri-matangi			• (Taranaki; captive bred)		ongoing
	Great Barrier Island	•		• (Little Barrier)	•	2005
Northland	Tutamoe/Mataraua		•			ongoing
	Trounson	•		• (Northland)		2010
	Puketi		Small scale	• (Tutamoe)	•	ongoing

TABLE 2: PLANNED KOKAKO TRANSLOCATIONS, 1999-2010

FROM	TO	BY	NUMBER
Taranaki/Coromandel	captivity	1999	3 adults
Mapara	captivity	2000	3 eggs/ch.
Taranaki, via Mt Bruce, Otorohanga	Tiritiri Matangi Is.	As available	subad./ad.
Captivity, or central N.I.	Mt Bruce Forest	2002	5 prs - subad./ad.
Nth Urewera	Boundary Stream	2001	5 prs
Northland	Trounson	2010	5 prs
Tutamoe	Puketi	2000	4 fem. ch.
Tiritiri Matangi Is.	Taranaki	2005	5 prs
Little Barrier Is.	Great Barrier Is.	2005	5 prs
Waikato/C'mandel	Moehau	2005	5 prs
Waikato/Taranaki	Rangataua	2010	5 prs

Ian Flux and Phil Bradfield feed a kokako prior to transfer from Mapara to Kapiti Island, 1997. Photo: M. Park

population which is now extinct. Kokako will be returned to a managed location there from Little Barrier Island if intensive pest control is undertaken.

Besides Great Barrier Island, five mainland sites have been suggested as locations for reintroduction of kokako to parts of their former range throughout the North Island. These are Mount Bruce Forest (Wairarapa), Boundary Stream Scenic Reserve (Hawkes Bay), Whitecliffs Conservation Area (North Taranaki), Rangataua Forest (Tongariro-Taupo), and Moehau Forest and Ecological Area (Coromandel). They have been selected because they are, or will be, subjected to pest-mammal control at the intensity which is necessary for kokako population establishment and expansion. Kokako will not be released at these sites unless a long-term commitment exists for intensive pest mammal control at a sufficiently large scale

Grant Jones preparing to mist-net kokako. Te Urewera, 1993. Photo: Ian Flux, DOC

(initially, at least 500 ha) to defend a breeding population. A "long-term commitment" means that there is a declared intention by DOC to maintain pest control at the site for as long as DOC's planning procedures allow.

Dates by which sites should be managed given in Table 1 are guidelines for managers. Management can start earlier and run for longer if resources allow, or if new survey data indicate unforeseen urgency.

3.9.2 Pest control for kokako

Possums and ship rats are key predators of kokako, although other pest mammals and native predators also cause some deaths. Pest control operations to protect kokako should be done during August to October (the later the better), so that ship rat populations are lowest at the time of kokako breeding from October onwards. Large-scale aerial poisoning operations which target possums may not benefit kokako if they are done earlier than August, because ship rat populations can return to pre-poison levels within 3-5 months (Innes *et al.*, 1999). Much benefit may be possible for kokako and other forest birds if aerial operations for, say, Tb control can be conducted inside the August to October period. The best available and sustainable pest control methods should be used by kokako managers.

Target post-control pest indices are 1% trap catch for possums (using the national standard trapping protocol) and 1% tracking frequency for ship rats (using the standard kokako RbM, system, which is apparently destined to be the DOC national system anyway) at 1 November. Post-control indices of less than 5% for each species are acceptable and greater values for either species mean an operation failure in this context.

Control of kahu (harriers), a native predator, may be justified while kokako populations are very small. Harriers are common and removed individuals are readily replaced.

A ship-rat drives a Mapara female from her nest then devours her 10 day old chicks. Photo: DOC

Goats, deer and other browsing mammals are likely to damage kokako habitat in the long term. Their numbers should be kept low in important kokako habitats. The spread of new browsing mammal species to kokako habitats should be prevented whenever possible.

Kahu (Australasian harrier) is a "natural predator" of kokako. Here the kahu was feeding on a Mapara kokako's eggs. Photo: DOC

3.9.3 Translocations

Translocations of kokako are currently necessary to establish new populations, and to rapidly boost small populations to a safe level. In the long term, translocations should also occur to add new genetic lineages to an inbred population – this should be considered in the next plan. In the past, adult kokako for translocation were taken from isolated forest remnants, but these kokako were mostly old males. More recently, subadult or young kokako from thriving populations were selected. Also, molecular genetics has provided scientists with techniques for accurately sexing kokako for the first time. These advances and ongoing research with translocating younger birds (including chicks which are temporarily hand-fed) will increasingly remove uncertainties of translocation outcomes.

3.9.4 Captive rearing

The recovery group supports captive-rearing to produce birds for translocation, to preserve genetic lineages from threatened regional populations by selective mating, and to enable the public to easily see a kokako and learn about management of wild populations. Kokako have bred regularly in captivity at Mount Bruce National Wildlife Centre since 1986, and captive-reared kokako released onto Kapiti Island and Tiritiri Matangi Island nested successfully in the 1998-99 season.

3.10 RESEARCH PRIORITIES

Below are listed, in priority order, the research topics which have been identified (January 1999) as being critical if we are to improve the efficiency of kokako management and achieve the goal of this plan. It is envisaged that these will be addressed by research investigations currently underway (DOC, SRU and Landcare Research) or be submitted as research requirements by affected conservancies. Some topics may suit university researchers. We have not listed improvement to mammal pest control technologies, despite its crucial importance for kokako

Researchers band and measure a kokako nestling, 1994. Photo: Ian Flux, DOC

recovery, because it has generic importance for DOC and is dealt with elsewhere by the department.

Research is needed on:

a. Juvenile dispersal in relation to managed areas within large forest blocks.
   Kokako populations in large forests will recover more slowly if juveniles disperse from safe ('source') managed areas to surrounding unsafe ('sink') unmanaged areas.

b. Differential male versus female loss rates at unmanaged sites.
   Female kokako are probably more vulnerable to predation because they alone incubate. Naïve young females fledged in managed periods may be vulnerable to predation when management subsequently ceases.

c. Population modelling to support sustainable kokako conservation. Determining efficient and effective pest control pulse intervals, and identifying population parameters for which we need better field data.
   We now have eight years' data from both managed and unmanaged kokako populations. Computer modelling can use these data to examine the 50-year outcomes of different pest control strategies.

d. Mainland translocation procedures. This includes translocation of subadults to locations with and without kokako currently, and translocation of eggs and/or nestlings for genetic reasons.
   Translocations are necesssary to establish new populations and to maintain genetic diversity. We need to find the most effective translocation techniques.

e. Genetic research to identify differences between populations, and the possible impact of inbreeding.
   Should populations be mixed by translocation? On the other hand, is translocation necessary to avoid deleterious inbreeding? Preliminary studies completed; require publication.

f. 'Mixed marriages' – what is the influence of dialect on post-translocation mate choice?
   On Kapiti Island, kokako which were translocated from the same place (with the same song) became paired. But what will be the song and mate choice of their offspring?

g. Impact of female age and experience on predation outcomes and chick provisioning.
In theory, older females should escape predation more and feed chicks more efficiently than younger females. These outcomes will infuence female mortality rates in managed populations.

h. Sex of kokako in wild populations.
Present evidence suggests that there is an excess of males in wild populations, perhaps because females have greater risks when incubating. However, this should be verified by DNA analysis, a new sexing technique.

i. The relationship between ship rat and possum indices, and kokako chick output. These data must be collected in the formats prescribed for the 'Research-by-Management' research.
Current kokako management consists of possum and ship rat control to particular residual abundances, known to correlate with kokako nesting success. Further replication from other study sites is needed to strengthen general application of the targets.

k. How 'good' and 'bad' years for kokako breeding attempts work, and their impact on the timing of pest-control pulses.
Kokako make many more breeding attempts in some years than others. Is this climate or phenology, both or something else? Should-pest control be confined to just 'good' years?

l. Diseases of wild populations and how these might affect established and new populations of kokako.
Nothing is currently known about diseases of wild kokako populations. Could serious diseases be spread by translocating kokako between populations?

m. How management designed for kokako affects other components of the forest community.
There is some tension between objectives of managing for single species, versus managing for the forest community or ecosystem. How much community benefit derives from management for kokako?

n. Determining habitat quality – are quality habitats easier to manage?
What does 'habitat' mean?
What is 'good kokako habitat'?
Can kokako be maintained today in some habitats, such as beech forest, where they occurred historically?

3.11 COMMITMENTS AND RESPONSIBILITIES

Over the past 20 years about 60 kokako were translocated, to enhance their breeding prospects, from remnant populations, or from forests destined for logging. At the time that these transfers took place, these kokako populations were under threat of immediate annihilation or were too small to be considered as viable. Most of the captured birds were released directly onto predator-free islands to establish new breeding populations. A few kokako taken to the Mount Bruce National Wildlife Centre have subsequently contributed to these island populations through a successful captive rearing and release programme.

Prior to or during some of these operations, the Kokako Recovery Group gave commitments to tangata whenua and other local people that, if possible, kokako

would eventually be returned to areas from whence they had come. These commitments were made on the understanding that suitable intensive pest control would be carried out in the forests before kokako were replaced there. The returning kokako will not be 'pure original stock' but, provided the transferred individuals will breed, we can at least return their direct descendants.

Tangata whenua or local communities to whom commitments were made include:

1. **Ngati Wai**, of Great Barrier Island, from where the last two kokako were captured in 1994 and transferred to Little Barrier Island. Staff at the Auckland Conservancy of the Department of Conservation are currently (February 1999) investigating the possibility of implementing intensive pest control in the 'Northern Bush' (Te Paparaki) of Great Barrier Island (Aotea). Such management would make the re-introduction of kokako an imminent possibility.
2. **Ngati Tama** and other iwi of the north Taranaki community. They have a reasonable expectation that kokako will one day be returned to their area. Two kokako were captured in Makino Forest in 1993, and another two were captured in Moki Forest in 1998 and 1999. None has shown inclination to breed, although efforts to encourage breeding are continuing.
3. **Western King Country locals**. Six kokako were captured in 1991-92 from the western King Country, and taken to Kapiti and Mount Bruce. Local landowners took much interest in the operation and expressed a desire to be updated on the fate of the transferred kokako and to receive kokako back in the future if possible.

Local communities and iwi from other areas from which kokako have been transferred (or will be taken from in the future) may have expectations, promised or implied, for information on the fate of those birds.

In some cases current beliefs or expectations amongst local communities may be based on erroneous or outdated information. The Manawahe community, for example, were in 1993 informed that kokako were being removed because they could not be managed *in situ*, but now they are managing those birds remaining. We must be sensitive in how we approach new initiatives and be careful to explain to communities any changes in our approach where new knowledge has given rise to new prospects (or problems) for management.

Ngati Maniopoto bless and farewell a kokako before it journeys from Mapara to Kapiti Island, 1997.
Photo: Ian Flux, DOC

3.12 ACKNOWLEDGEMENTS

The individuals who have contributed to the success of the past plan and to the development of this current plan are too numerous to identify. The tremendous dedication and enthusiasm of those people has maintained a strong and dynamic kokako recovery group over the past years. Their hard work is being rewarded by increasing kokako populations in managed reserves and by an advanced state of ecological and management knowledge which, we are confident, will be the long-term saviour of the kokako.

Through the term of the previous plan, kokako recovery has benefited from the generosity of several groups and institutions. We extend particular thanks to:

- **Tasman Forestry** – who supported initial research and management at Kaharoa, Bay of Plenty from 1990 to 1993.
- **State Insurance and Norwich Union Group** – who have generously sponsored the kokako recovery programme nationally from 1993 to 1999.
- **Auckland Regional Council** – a dedicated partner in the management of kokako in the Hunua Ranges, Auckland, as well as being a regular contributor as part of the kokako recovery group. The Hunua project is particularly special because this kokako population is on Regional Park land, within easy reach of our largest metropolitan area.
- The former **Forest Research Institute** (Rotorua); **Landcare Research Ltd**; Waikato, Auckland and the **Australian National Universities**, and the **Foundation for Science, Research and Technology**, who have supported or currently fund important kokako research.
- **Kaharoa Community Trust** – who have worked hard to maintain a growing kokako population in their Bay of Plenty neighbourhood.
- **Manawahe Community Trust**, a recently established group dedicated to conserving kokako in Manawahe Forest, Bay of Plenty.
- **Supporters of Tiritiri Matangi Incorporated** have provided support at all stages of the successful transfer of kokako to that island.

Tangata whenua – as the guardians of our natural taonga, Maori have played a very special role. The encouragement and support for kokako conservation efforts from iwi has been unfaltering. Traditional blessing of conservation projects, assistance with kokako transfers and the warmth of welcome offered by receiving iwi have afforded a special spiritual quality to this work. We look forward to further developing this partnership in coming years.

Lastly, thanks to the numerous landowners and local communities who have contributed in various ways, from simply allowing access across private land to giving generously of their time to help out in particular projects. Kokako recovery belongs to you, the people of Aotearoa.

4. References and further reading

Best, Elsdon 1942: Forest Lore of the Maori. *Dominion Museum Bulletin* 14: 378-379.

Best, H.A. and Bellingham, P.J. 1990: A habitat survey of North Island kokako in Puketi Forest, Northland. *Science and Research Series* 17, N.Z. Dept Conservation, Wellington.

Bradfield, P. and Flux I. 1996: The Mapara kokako project 1989-1996, a summary report. N. Z. Dept Conservation, Hamilton. (Unpublished report).

Brown, K., Innes, J., Shorten, R. 1993: Evidence that possums prey on and scavenge birds' eggs, birds and mammals. *Notornis* 40: 169-178.

Clout, M.N. and Saunders, A. 1995: Conservation and ecological restoration in New Zealand. *Pacific Conservation Biology* 2, 91-98.

Collar, N.J., Crosby, M.J., Stattersfield, A.J. 1994: Birds to watch 2. The world list of threatened birds. *BirdLife Conservation Series* 4. Cambridge, U.K. 407 pp.

Greene, B.S. 1995: Kokako (*Callaeas cinerea*) in the Hunua Range, Auckland, 1992-94. *Notornis* 42, 11-16.

Hay, J.R. 1984: The kokako – perspective and prospect. *Forest and Bird* 15, 6-11.

Innes, J., Hay, J.R. 1995: The nesting of North Island kokako (Callaeas cinerea wilsoni) – review of accounts from 1880 to 1989. *Notornis* 42: 79-93.

Innes, J., Brown, K., Jansen, P., Shorten, R., Williams, D. 1996: Kokako population studies at Rotoehu Forest and on Little Barrier Island. *Science for Conservation Series* 30: 39 pp.

Innes, J., Hay, J.R., Flux, I., Bradfield, P., Speed, H., Jansen, P. 1999: Successful recovery of North Island kokako *Callaeas cinerea wilsoni* populations, by adaptive management. *Biological Conservation* 87*:* 201-214.

Innes, J., Owen, K., Smale, S. 1988: Proceedings of the kokako research and management workshop, FRI Rotorua, June 7-9, 1988. *Forest Research Institute Project Record* 1960, 30 pp.

Lavers, R. 1978: Distribution of the North Island kokako (*Callaeas cinerea wilsoni*): a review. *Notornis* 25, 165-185.

Leathwick, J.R., Hay, J.R. and Fitzgerald, A.E. 1983: The influence of browsing by introduced mammals on the decline of the North Island kokako. *N. Z. Journal of Ecology* 6, 55-70.

Marsh, S. 1995: *Kokako lost. The last days of the Great Barrier and Coromandel crow*. Sid Marsh, 15 Dobson St, Waihi.

Meenken, D., Fechney, T. and Innes, J. 1994: Population size and breeding success of North Island kokako in the Waipapa Ecological Area, Pureora Forest Park. *Notornis* 41, 109-115.

McKenzie, H.R. 1951: Breeding of kokako. *Notornis* 4, 70-76.

Moore, S., Innes, J. 1996: North Island kokako – the cutting edge. *Forest and Bird* 282: 12-20.

North, M. 1997: Kokako research by management programme, Rotoehu Forest. 1996-97 report. N. Z. Dept Conservation, Rotorua (Unpublished report). 47 pp.

O'Donnell, C.F.J. 1984: The North Island kokako (*Callaeas cinerea wilsoni*) in the western King Country and Taranaki. *Notornis* 31, 131-144.

Powlesland, R.G. 1987: The foods, foraging behaviour and habitat use of North Island kokako in Puketi State Forest, Northland. *N. Z. Journal of Ecology* 10, 117-128.

Rasch, G. 1992: Recovery plan for North Island kokako. *Threatened Species Recovery Plan* 1. N. Z. Dept Conservation, Wellington.

Richardson, C.M. and Williams, D.S. 1999: 199 survey for juvenile kokako at Kaharoa Forest, Bay of Plenty. Unpublished report, Department of Conservation, Rotorua.

Speed, H.J. 1991-1997: Research-by-mamanagement at Kaharoa, Bay of Plenty. Annual reports to Tasman Forestry Ltd and Department of Conservation.

St Paul, J.W. and McKenzie, H.R. 1974: The kokako in the Hunua Range. *Notornis* 21, 205-218.

Tisdall, C. 1994: Setting priorities for the conservation of New Zealand's threatened plants and animals. Department of Conservation, Wellington. 64 pp.

Walters, C.J. 1986: Adaptive management of renewable resources. International Institute for Applied Systems Analysis, MacMillan, New York.

Appendix 1:
List of working documents

The documents listed here are contained in the kokako management folder (to be published by BRU shortly after this plan). They provide detailed technical information and management practices which have been refined overthe last decade.

1. BIRDS

a. Kokako surveys – walk-through survey, territory mapping, roll-calling, annual adult census, juvenile survey.
b. How to find and monitor nests.
c. How to age chicks.
d. Catching, banding, and other handling procedures.
e. Nest-climbing and filming guidelines.
f. Nest protection guidelines – ex-RbM for large-scale pest control, and at single nests.
g. Predation sign – examining and interpreting failed nests.
h. Policies for acceptable poison bait types and for allowable poison by-kill.
i. Kokako transfers.
j. Dealing with dead or injured kokako.
k. Project design – consultation, experimental framework, sponsors, pest control, monitoring.
l. Captive management plan.

Appendix 2: Published recovery plans

RECOVERY PLAN	#	COST	YEAR APPROVED
Weka	29	($15)	Approved 1999
Pittosporum patulum	28	($15)	Approved 1999
Cyclodina skinks	27	($15)	Approved 1999
Coastal cress	26	($15)	Approved 1999
Threatened weta	25	($15)	Approved 1998
Striped skink	24	($15)	Approved 1998
Fairy tern	23	($15)	Approved 1997
Blue duck	22	($15)	Approved 1997
Kakapo	21	($15)	Approved 1996
Stitchbird	20	($15)	Approved 1996
Brown teal	19	($15)	Approved 1996
Native frogs	18	($15)	Approved 1996
New Zealand (Hooker's) Sea Lion	17	($15)	Approved 1995
Dactylanthus taylorii	16	($15)	Approved 1995
Bat (Peka peka)	15	($15)	Approved 1995
Otago and grand skinks	14	($15)	Approved 1995
Giant land snail	13	($15)	Approved 1995
Takahe	12	($15)	Approved 1994
South Island saddleback	11	($15)	Approved 1994
New Zealand Dotterel	10	($15)	Approved 1993
Tuatara	9	($15)	Approved 1993
Kowhai ngutukaka	8	($15)	Approved 1993
Subantarctic teal	7	($15)	Approved 1993
Mohua (yellowhead)	6	($15)	Approved 1993
Chevron skink	5	($15)	Approved 1993

Black stilt	4	($15)	Approved 1993
Whitaker's and robust skinks	3	($15)	Approved 1992
Kiwi	2	($15)	Approved 1991
North Island kokako	1	($15)	Approved 1991
Yellow-eyed penguin*	–	*–	Approved 1991
Kakapo		Out of print	Approved 1989

* *Available: from Otago Conservancy, Department of Conservation, Dunedin*

Copies may be ordered from:

DOC Science Publications
Science & Research Division
P.O. Box 10420
WELLINGTON, N.Z.