RECOVERY PLAN FOR

NORTH ISLAND KOKAKO

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FOREWORD

This recovery plan is one of a series of threatened species unit publications produced by the Department of Conservation. Recovery plans are statements of the department's intentions for the conservation of plants and animals for a defined period. In focusing on goals and objectives for management, and the tasks by which these will be achieved, recovery plans serve to guide the department with it's allocation of resources.

Following the preparation of a technical report which was refined by scientists and managers within the department a draft of this plan was forwarded to the N.Z. Conservation Authority and relevant Conservation Boards for comment from land owners and other interested groups. After further refinement this plan was formally approved by the Director-General of Conservation on 8th of November 1991.

The department acknowledges the need to take into account the views of tangata whenua and the application of their values in the conservation of natural resources. As the expression of these values vary from iwi to iwi, it is therefore not possible to incorporate these variations within a general theme in each recovery plan. Recovery plans are to be refined and implemented in such a way as to ensure that consultation with tangata whenua of the areas in which species of interest are located has been carried out. Conservancy Kaupapa Atawhai managers are available to initiate this process. Without consultation, recovery programmes will remain incomplete.

A recovery group consisting of people with a knowledge of kokako, and an interest in their management has been established to review progress in it's implementation and to recommend to the department any changes which may be required as management proceeds. Comments and suggestions relating to the conservation of kokako, are welcome and should be directed to the recovery group via any office of the department.

CONTENTS Page No.

SUMMARY

The North Island kokako was distributed widely in many parts of the North Island in the 19th century, but is now found only in a fraction of the remaining areas of forest. The impacts of introduced mammals are limiting the prospects for the species' survival.

Existing kokako populations vary in size from several birds to about 300, but most have fewer than 100 birds. Major populations of 100 or more birds occur in Puketi forest, Mamaku Plateau forests, Pureora forests, Rotoehu forest, and Te Urewera National Park. Significant populations of 40-100 kokako are found in Mapara forest and the Hunua ranges, and kokako have been established recently on Little Barrier Island. A number of smaller populations are found from Wanganui northwards.

A number of features of the ecology of the kokako render it vulnerable to extinction. The birds maintain large territories year round, from which they must meet all food requirements. They tend to specialise on temporarily available foods. They are poor flyers and do not disperse easily. They have a low reproductive rate. As a result, they are susceptible to loss of habitat through forest felling, disturbance through logging, and predation and food competition from introduced mammals.

The conservation goal for North Island kokako is the recovery of the species to the numbers and state where it is no longer endangered. This will be achieved when at least two large populations of 400 birds and several moderate-sized (100 or more birds) are maintaining their numbers in well protected forest, free from the effects of introduced mammals. The immediate objectives for the term of this plan (1990-1995) include:

1. Research into the precise causes of kokako decline.

2. Research-by-management, in which management activity is planned and monitored in such a way as to continue to refine our knowledge of the causes of kokako decline and thereby improve future management.

3. The establishment of a self-sustaining population of kokako from remnant populations onto Kapiti Island.

4. Establishment of a self-sustaining captive population.

1. INTRODUCTION

The kokako is the only species in the wattlebird family Callaeidae still living on mainland New Zealand. The subject of this plan, the North Island subspecies, is classified as endangered - "in grave danger of extinction" (Bell 1986). Fewer than 1300 birds probably remain throughout the known range. Many of these populations are very small, numbering less than 20 birds. Without active management the species will eventually dwindle into extinction on the mainland. Protecting forest habitat for kokako means that the forest is made safe for many other species of native forest plants and animals.

Throughout this plan "kokako" will be taken to refer to the North Island subspecies *(Callaeas cinerea wilsoni).* The South Island kokako *(Callaeas cinerea cinerea)* is gravely endangered, limited to a few tiny elusive populations on Stewart Island (Buckingham 1987) and perhaps in the South Island (Nilsson 1988, McBride 1981). Its management will be the subject of a separate plan.

"Recovery" is defined here as the conditions under which the kokako is no longer considered endangered. The purpose of the recovery plan is to provide information and direction for programmes aimed at the protection of the kokako. To achieve this end, the plan briefly reviews the population status and biology of the species, and describes the adverse factors affecting the bird. This background information supports the main thrust of the plan: to outline all actions necessary for the protection and recovery of kokako, and to provide priorities and a schedule for these programmes. An integral part of the planning procedure is review. Annual evaluation of the plan and its programmes is necessary, and revision of the plan should be undertaken at five year intervals.

Public and official interest in kokako has been high since the 1970s when major efforts were made to protect and study the species in the central North Island. This plan had its first beginnings as a New Zealand Wildlife Service document in the early 1980s. It was in a draft stage at the time of the Kokako Research and Management Workshop held by the Department of Conservation (DOC) and the Forest Research Institute (Ministry of Forestry) in Rotorua on June 7-9, 1988. The enthusiasm shown at the workshop provided fresh impetus for the plan's completion. The preparation and content of this recovery plan has been overseen by the North Island Kokako Recovery Group, whose members are:

Shaarina Boyd (DOC Auckland Conservancy) (from 1/91)
Raewyn Empson (DOC Wellington Conservancy) (from 2/92)
Wayne Hutchinson (DOC Wanganui Conservancy)
John Innes (Forest Research Institute, Rotorua)
Paul Jansen (DOC Bay of Plenty Conservancy)
Richard Parrish (DOC Northland Conservancy)
Gretchen Rasch (DOC Threatened Species Unit, Wellington)
Kevin Smith (Royal Forest & Bird Protection Society, Wellington)
Phil Thomson (DOC Waikato Conservancy)
Chris Ward (DOC East Coast Conservancy)

2. PAST AND PRESENT DISTRIBUTION

2.1 Past Distribution

"According to Maori tradition (Reischek 1886) the kokako was common in all suitable forests of the North Island. Subfossil records tend to support this. Buller (1873) noted 'where the range of the huia ceases, that of the kokako begins' - thus confirming that huia were more abundant in the beech forests of the south of the North Island while the kokako preferred the floristically diverse forests further north..." (Hay 1984).

"Buller (1892) regarded the distribution as being somewhat eccentric in the late 1800s but there were dense populations occurring at scattered locations in the northern part of the North Island, through the Waikato, Rotorua, Urewera and Taranaki regions down into Wairarapa" (Hay 1984). This information is compared with the present known distribution of kokako on Map 1.

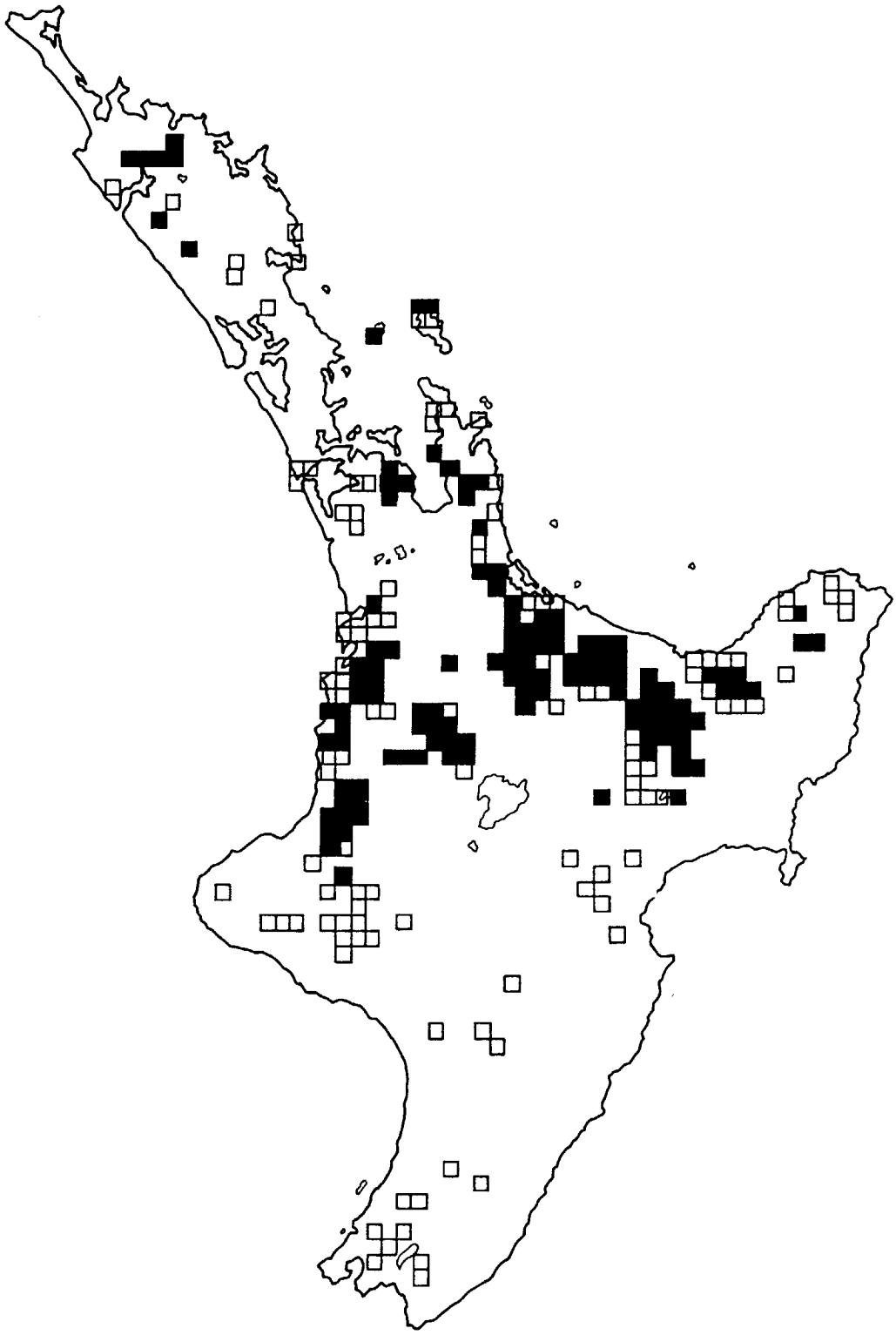
2.2 Decline

The kokako has suffered from a reduction in range and a decline in numbers within individual populations. Lavers (1978) summarised available information on past distribution for the four periods: pre-1900; 1900-1939; 1940-1959; and 1960-1970. Since the time of European colonisation of New Zealand, kokako have disappeared from the lower third of the North Island (Map 1). Other large scale disappearances have occurred in the Auckland, Northland, East Cape, and Hawke's Bay areas (Lavers 1978).

While this initial decrease in the distribution of kokako can be attributed largely to forest clearance, declines have been documented within extant forests. Kokako were last found in the Tararuas up until the 1960s (Lavers 1978). Ogle (1987) found that of 21 distinct populations of kokako in the King Country, 12 have vanished in the past twenty years. In these surveys the loss appears to have been most rapid since the 1960s. Although many losses generally occurred from small forest blocks, O'Donnell (1982) reported that kokako had disappeared, or been markedly reduced in number, relatively recently from larger tracts of forest in south and inland Taranaki (Matemateonga Range, Mt Egmont) and from the northern King Country (Te Maika, Mt Karioi and Maungatautari). Programmes were begun in the 1980s to monitor kokako numbers in forests near the centre of their present range where their populations appeared to be the largest (Pureora, Kaharoa, Rotoehu, and Mapara). There are signs that some of these populations are also in decline. Not only are populations getting smaller, but a greater proportion of populations are made up of unmated birds. During intensive monitoring of kokako in Pureora State Forest, 10 territories were occupied by kokako pairs, while 23 territories contained single birds only (Rasch et al. 1986b, Speed et al. 1987b). This suggests an absence of one sex.

2.3 Present Distribution

From 1970-1986 the Fauna Survey Unit (Wildlife Service) conducted extensive surveys of most North Island forests. Although these surveys were not done exclusively for this species, kokako were looked for in all suitable habitat. Other survey work was done by the Forest Bird Research Group, NZ Forest Service and Forest Research Institute, the



Map 1 **North Island kokako distribution, pre- and post-1970.** Each square represents a 10 000 yard grid square in the New Zealand Map Series 1 from which kokako have been reported. Solid squares indicate records since 1970; open squares indicate areas where kokako were reported before 1970 but not since. From Lavers 1978 and C.R. Veitch, unpubl. data.

Department of Conservation, the Auckland Regional Authority, DSIR and members of the Ornithological Society of New Zealand.

In this brief description of kokako populations, the word 'population' is used loosely to mean the kokako inhabiting a continuous tract of indigenous forest, and where adjacent groups are less than five kilometres apart. Five kilometres is used because a juvenile kokako has been known to disperse roughly that distance (J. Innes, pers. comm.). This means that the potential for contact between individuals exists. In populations like those found in the Coromandel and Kaimai ranges, where a few birds are found in scattered pockets over a large tract of land, the real probability of exchange may be small.

Based on this definition, the distribution of kokako in the North Island consists of twenty-seven distinct populations. In conservation terms, this seemingly generous figure is misleading because the total number of birds is probably significantly less than the 1400 listed in Table 1, which is based largely on surveys from the early 1980s. Only six of these populations can be described as major, i.e. numbering between 100 and 300 birds. Two more populations can be called significant, consisting of 50-100 birds, while the other 20 small populations are made up of about 5-30 birds each. Detailed information on each population will be published elsewhere (Rasch, in prep.).

Seven geographic groups of kokako populations can be described.

Northland. Puketi forest contains the major population in this area. In 1984 Puketi contained 100 kokako, but a recent (1990) survey suggests that this population may be declining steeply (Walker 1990). This forest is contiguous with Omahuta forest, but there is only one recent record of a bird in Omahuta. Small numbers of kokako are found in Waipoua/Mataraua forests and in Raetea forest, although they are not well known (Ogle 1982). Current work in Waipoua found a small population of at least 15 birds there.

Hauraki Gulf. The small group of kokako on Great Barrier Island is important as it is the only naturally occurring offshore island population. A recent brief survey suggests that this population may be on the verge of extinction (Brown 1990). Little Barrier Island is important also, as it has the only artificially established population, stemming from birds removed from the Rotorua area in the 1980s. These are the only kokako whose habitat is free of mammalian predators and browsers. Recent work indicates that a large proportion of the present population is made up of island-bred birds (Brown 1989). The Hunua Ranges south of Auckland contain a moderate population of kokako (Macmillan and McClure 1990), and the Coromandel peninsula contains a few remnant groups of birds.

Waikato. Of seven kokako populations, four small populations are found in the Mt Pirongia forest, Rauamoa Block (formerly Pirongia South), Mt. Kokako, and Maungatautari (O'Donnell 1984). Three populations are found in larger forest tracts; Whareorino forest, Tawarau forest and the complex of forests between Kawhia and Waitomo (Miller 1984a, 1984b; Moynihan 1980). These populations are not well known but appear to be small as well.

King Country. One of the largest single populations (of roughly 300 kokako) is found in Pureora forest (North Block and including the adjacent Cowan Wildlife Management

Reserve, Meyers Block and Okahukura forest) (Hay 1981). The once abundant population in the South Block (Pikiariki Road) now numbers a few birds only. Another significant population is in Mapara Reserve (Bradfield et al. 1988).

Bay of Plenty. The greatest numbers of kokako are in this area. The Mamaku Plateau has a population of 300 birds (Saunders 1983). Rotoehu forest has another major population, and a significant number of kokako was found in Horohoro forest in the 1970s. Small populations are scattered in the Rotorua Lakes region, in the Kaimai Range and in Matahina forest (Wallace 1988).

East Cape . Less survey information is available from this area. A major population is found in northern Te Urewera National Park. Other kokako inhabit the Urutawa forest and Raukumara forest, but the number may be small (Wallace 1988).

Taranaki. Only small populations of kokako are left in this area, the southern limit for the present day range of the species. Waitaanga forest, Moki/Makino forests, the Mokau river forests and Whanganui National Park contain less than a dozen birds each (Molloy 1989).

National Wildlife Centre. Eleven birds have been taken into captivity at Mt Bruce since 1968 (M. Bell, pers. comm.). Three of these birds were sent to the Centre because of injuries. The maximum number held at any one time was 5 birds. Currently the Centre holds two birds: a female and her offspring. The young bird was bred at Mt Bruce in 1985.

TABLE 1. Estimated size of kokako populations. Numbers are based on most recent estimates. Surveys were the walk-through or territory mapping (see Appendix 1). * indicates population survey incomplete; ' indicates recent work suggests these populations have declined.

Forest	Area (ha)	Kokako	Year	Forest	Area(ha)	Kokako	Year
Waipoua	22 500	17	1990	Maungatautari	2 300	2 *	1980
Raetea	6 500	5 *	1979	Tawarau	4 700	5 *	1980
Puketi	19 400	100 [1]	1984	Mapara	1 300	70	1990
Hunua	20 000	40	1988	Pureora North	28 000	300	1988
Coromandel	71 700	25	1980	Pureora South	23 000	10	1990
Kaimai		20	1983	Mamaku	33 000	300	1982
Great Barrier Island	3 850	15 [1]	1985	Horohoro	8 600	60 [1]	1982
Little Barrier Island	3 076	22	1989	Rotoehu	8 000	150	1986
Mt Kokako	3 500	2 *	1979	Rotorua Lakes		10	1988
Pirongia	17 000	5	1989	Northern Urewera	212 700	150 *	1980
(Kawhia/ Hauturu	1 199	8	1981	Raukumara-Urutawa	150 000	15 *	1983
Waitomo) Te Rauamoa	2 157	7	1981	Mokau		4	
Mahoe	900	8	1984	Waitaanga	45 000	11	1989
Te Kauri	987	1	1986	Moki/Makino	25 600	23	1990
Whareorino	30 000	10 *	1981	Wanganui		3*	
				TOTAL		**1398**	

3. KOKAKO ECOLOGY

Detailed accounts of kokako ecology have been published elsewhere (Hay et al. 1985, Hay 1981, Best and Bellingham 1990) so it is necessary here to discuss only those factors which are causing the decline of the species.

3.1 Behaviour

The kokako has certain behaviours which make it less adaptable to the changed ecological conditions of New Zealand's environment. Adult birds maintain exclusive territories (held by individuals or mated pairs) throughout the year. The size of a territory is influenced by local conditions, but it varies from an average size of 6.5 ha in Puketi (H. Best, pers. comm.) and to 7-11 ha in King Country forests (Hay 1981), to as large as 80 ha in the highly modified Taranaki forests (Williams 1990). Hay (1981) concluded that the species requires large continuous tracts of forest to maintain population stability. Mobility is further limited by the birds' poor flying ability.

Kokako nest and lay clutches from September through February, with a peak laying time in November. This is much later in the season than most species. When combined with the fact that juvenile kokako are dependent on their parents for 10-12 weeks following fledging, it means that kokako produce only one brood per year. The number of young produced on average ranges from 0.2 to 1 young per pair per year in some study areas (J. Innes, in prep.). The behaviour of these young birds immediately after leaving the nest makes them vulnerable to predators. During at least the first few days they may spend a large proportion of their time on, or close to, the ground (B. Calder, pers. comm.).

3.2 Foods and feeding

Kokako are omnivores, feeding on fruit, flowers, foliage, and insects (Hay 1981). The foods which kokako eat vary according to location, season, and year. In his study sites in Pureora, Mapara, and Rotoehu, Hay found variation in all these factors, as did Powlesland (1987) and Best (Hay et al. 1985) in Puketi (Figure 1).

Hay (1981) described kokako as "sequential specialists", indicating that although the birds feed on many species, they concentrate on a few species as these become available. He reported kokako feeding on 77 species of plants and animals in Pureora while Powlesland (1987) noted 68 food species for the birds in Puketi. Both studies emphasised the importance of shrub hardwoods as a food source. This reliance on a few seasonally available species, and the fixed nature of kokako territories makes the species vulnerable to any loss of diversity.

3.3 Habitat selection and use

The predominant forest type found in the central and northern North Island is podocarp-hardwood, a broad category which includes the rata-tawa forests in which most kokako are found. There is great variation within the type, with taraire and kauri being important elements in the Northland forests, for example. Although kokako were once found in the mainly beech forests of the southern North Island, they had disappeared from this area by

the 1960s. The southern limit (today) of the kokako appears to correspond with the southern limit of taws as a major forest species (Imboden 1978).

Relating kokako distribution to more specific forest types is difficult. Detailed mapping shows that kokako tend not to be found in montane forest, in recently or heavily cutover forest, or in secondary types containing large amounts of species like kanuka and kamahi. Best (1988) summarised good kokako habitat as "diverse, mature, unlogged, non-beech forest".

The data from Pureora reported by Crook et al. (1971) roughly indicate that kokako are more numerous at lower altitudes and on gentle slopes, but these effects were not separated. However, in the Pureora North Block, Speed et al. (1987a) found kokako in concentrations along the deep gorges of rivers, which they suggested was due to the presence of shrub hardwoods (an important food source). These gorges are often less modified by logging and wild animals. In Puketi Forest, kokako are more plentiful in areas where the dissection of land produces a diverse array of vegetation types, e.g. ridgetops, valley sides, and valley bottoms (Best & Bellingham 1991).

The patchy distribution of kokako indicates that they have specific habitat requirements. An important conclusion by Hay (1981) Powlesland (1987) and Best & Bellingham (1991) is that kokako use their habitat selectively when feeding and moving about. Preference was shown, for example, for certain shrub hardwoods (e.g. pate, five-finger, and kaikomako), epiphytes and lianes. These featured in the diet more prominently than their relative abundance in the forest would indicate as being likely, if the birds were feeding randomly (Figure 2).

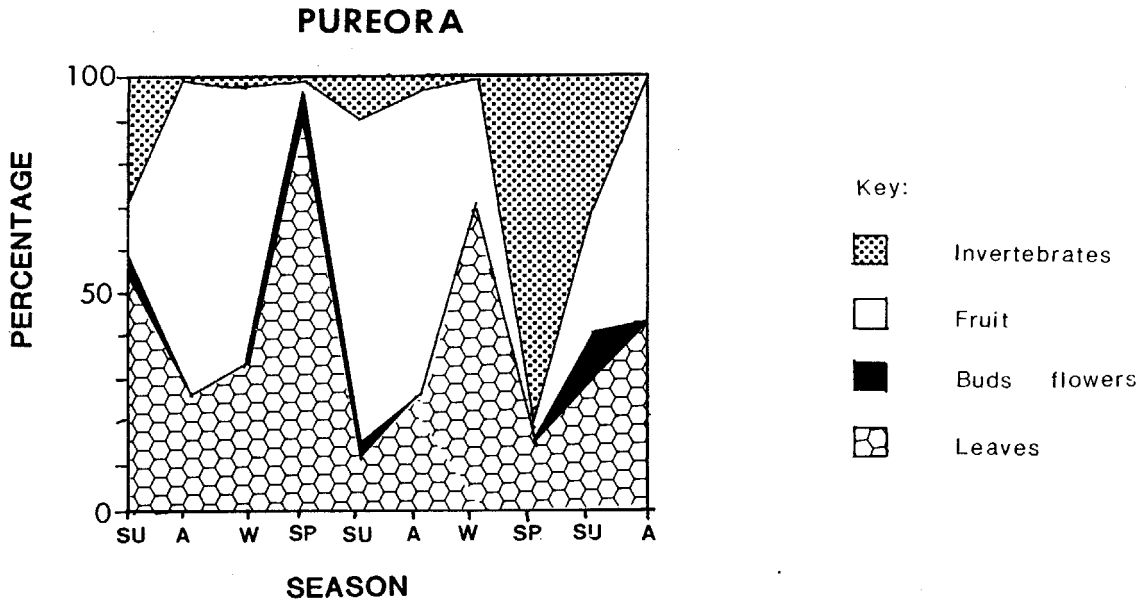


FIGURE 1 **Relative use of food types by kokako**. The percentage use of different types is shown for Pureora State Forest (1979-1981). From Hay et al. 1985.

The overall use of podocarps and tawa directly as food was lower than expected from their abundance, but use of these and other plant species was highly variable, differing considerably between and within years.

In both Pureora and Puketi there was a close association between the way kokako used various forest tiers and the amount of vegetation within those tiers, the only disparities being the disproportionately high use of the highest levels (as song posts for example) and avoidance of understorey with tree ferns and other (seemingly) unpalatable species. When kauri occurred in a kokako territory in Puketi forest, birds favoured these trees as song posts and breeding or territorial display points, but they did not feed in the kauri. In the absence of kauri the birds tend to display from emergent northern rata or podocarps (Best & Bellingham 1991).

In Rotoehu forest, kokako have been found in radiata pine stands adjacent to native forests. Calder and Innes (1987) suggest the birds may be feeding on insects in the exotic plantations. Kokako have been known also to feed extensively in manuka scrub in heavily modified areas (Williams 1990).

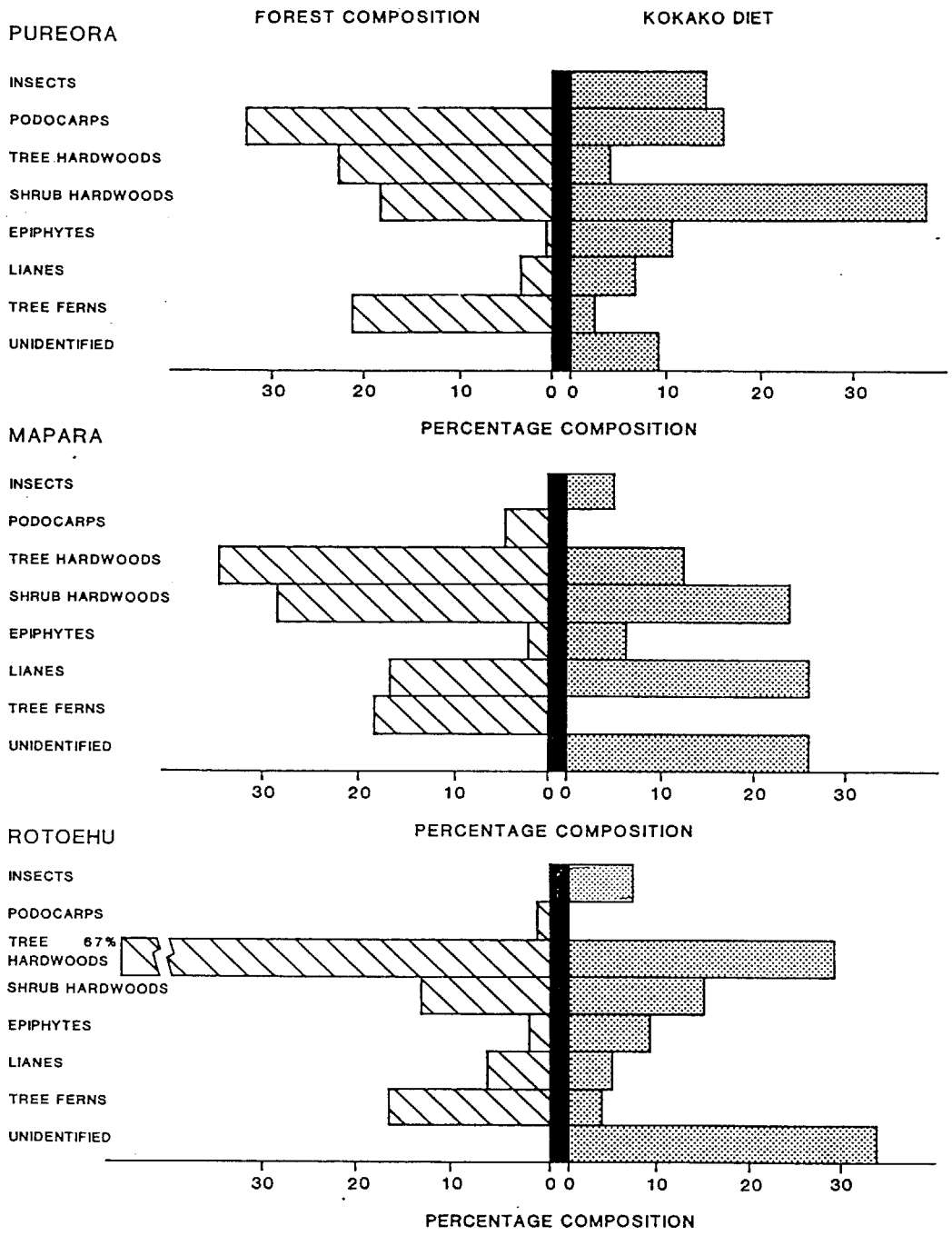


FIGURE 2 **Kokako diet in relation to forest structure.** The relative proportion of plant types used as food by kokako (right side) is contrasted with the actual proportion in which these types occur in the forest (left side). From Leathwick et al. 1983.

4. FACTORS LEADING TO DECLINE

4.1 Introduction

As for most New Zealand birds, the main factors contributing to the decline in kokako were loss of habitat and the introduction of mammalian predators and browsers. St Paul and McKenzie (1974) attributed the decline in the Hunua Ranges almost entirely to the effects of introduced predators, particularly the ship rat. In contrast Williams (1976) regarded destruction of habitat since European settlement as clearly being the main cause of population losses. Leathwick et al. (1983) pointed out that neither forest modification by humans nor predator introduction fully explain the decline of kokako in unlogged forest. Good populations of kokako coexisted with predators for up to eighty years before the birds vanished. These relatively recent losses have been attributed to the spread of browsing mammals during the present century.

4.2 Forest Clearance and Modification by Logging

The forested area of the North Island has been reduced from some 60% of the land area in pre-European times to less than 10% of the land area today. This change alone obviously decimated the kokako population. Data tabulated by Ogle (1987) for the King Country show that kokako have been disappearing from the smaller areas of forest (Figure 3). All existing populations are found in forests greater than 1000 ha in size. Half of these are more than 10 000 ha.

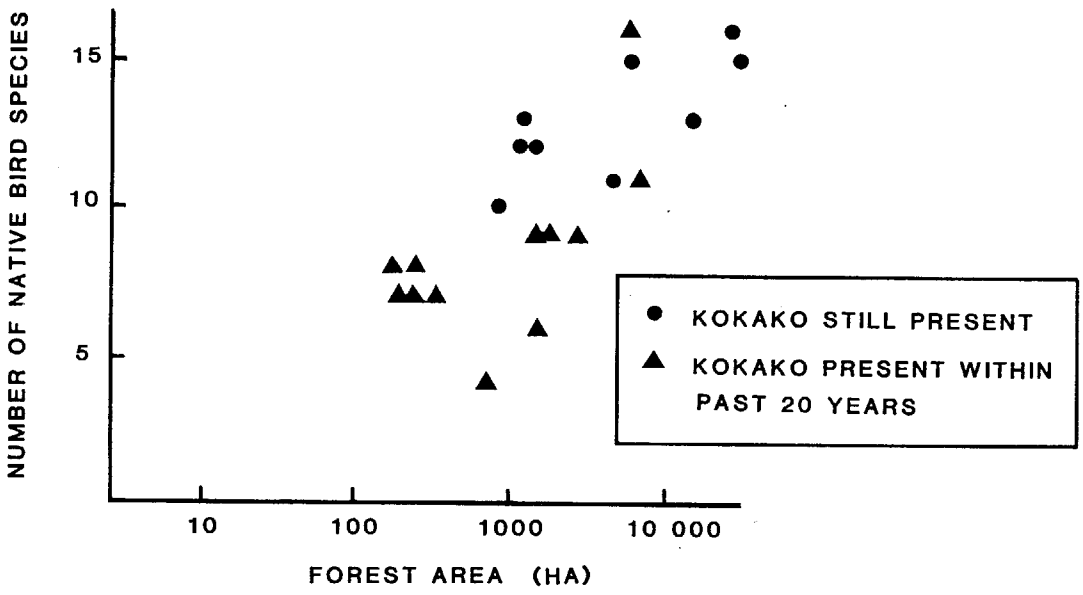


FIGURE 3 Kokako populations in King Country forests, 1960-1980. Each point represents the number of native bird species found in a forest. The number is shown relative to the size of the forest (semi-log scale). From Ogle 1987.

Several studies have indicated that modification within existing forest areas has an impact on the distribution of kokako. O'Donnell (1982) recorded habitat type for each of the 102 kokako found in the western King Country and Taranaki survey. The majority (91.2%) of these birds were found in unmodified forest. Nearly all kokako recorded in Puketi State Forest have been found in forest that has not obviously been modified (Anderson 1979). In this same survey it was found that where ridges have been modified, especially kauri ridges, these areas become "no birds land" for kokako and act as territorial boundaries. In Puketi no kokako have been found in heavily cutover areas.

Hay (1981) also found fewer kokako in recently selectively logged forest. His conclusions were:-

1. Logging reduces overall diversity and food availability for kokako.

2. Logging removes key elements in kokako habitat; the larger trees which support epiphytes and lianes, a major food source.

3. The forest species composition changes immediately after logging. Tracks and clearings are colonised initially by wineberry, tree ferns and other species not greatly used by kokako.

4. Although kokako do occur in cutover forest, this is usually in areas where logging ceased many years ago when conditions in the forest were different from today. Regeneration was faster because most browsers were absent or in low numbers. Kokako populations were probably larger and more productive, making recolonisation of logged areas easier.

4.3 Predation

Prior to European colonisation of New Zealand, the major predators affecting kokako were the morepork, the New Zealand falcon, and the Australasian harrier. The introduction of mammalian predators (Norway rats, ship rats, stoats, ferrets, weasels, and cats) into an ecosystem in which they were unknown meant that their colonisation could proceed in a rapid and explosive fashion. For bird species whose behaviour had evolved in an environment free from those animals the effect was severe. It may be surmised that kokako were reduced in number like other New Zealand birds. The fact that the invasion of predators paralleled the destruction of forests in the latter half of the nineteenth century makes it difficult to know how important predators were in the early decline of kokako.

Separate from the initial effect of predators on kokako is the ability of the species to cope with current levels of predation. While the continued presence of kokako in predator-infested forests indicates the birds have adapted to some extent to these animals, predators still probably influence population levels. Thirteen of 15 identified nest failures at Rotoehu Forest in the last two years' study were due to predation. The relatively low potential reproductive output for the species makes it less able to compensate for this loss of young compared to other commoner forest passerines.

4.4 Competition

Kokako persisted in the Tararuas, Ruahines and the southern Ureweras until the 1960s but have since disappeared (Lavers 1978). This abandonment of beech-dominated forest and the gradual decline of birds in podocarp-hardwood forests (O'Donnell 1982) is consistent with the spread of browsing mammals.

While there is no direct evidence of competition between kokako and browsing mammals, Leathwick et al. (1983) showed there was substantial overlap in their diets. Of thirty plant species commonly eaten by kokako in central North Island forests, possums and goats are known to eat 76% of these species, while deer feed on 36% of them. For example, leaves of raurekau, broadleaf, pigeonwood, mahoe, kaikomako, and supplejack are all eaten by kokako and two or more of the introduced mammals. Fruit of a large number of species are also eaten by both kokako and possums, including tawa, putaputaweta, kohekohe, hinau, pigeonwood, rewarewa, mahoe, kaikomako and supplejack. Possums also eat the foliage of many plants which kokako feed on.

Leathwick et al. (1983) noted that possums probably exert a greater effect on kokako because of their habit of feeding in the canopy and by their consumption of fruit. Deer and goats, on the other hand, eat understorey species and seedlings or saplings of canopy species. While the elimination of seedlings takes longer to influence species composition in the canopy, the effects of possum browse on the preferred understorey foods of the kokako are almost immediate.

The decline in habitat quality may affect reproduction in kokako. Hay (1981) observed that not all pairs in this study were observed attempting to nest every season, but insufficient data were available to indicate the reasons for this. One possible explanation was that this was nutritionally based - kokako did not reach breeding condition because of the lack of abundant, high quality food.

5. ABILITY OF KOKAKO TO RECOVER

Kokako will persist on the mainland only if concentrated efforts are made for their conservation in the next few years. Although the situation worsens each year, the greatest factor in the species' favour is its continued presence on the New Zealand mainland in an age when so many other species have been restricted to offshore islands for a century or more. There are still relatively high numbers of birds, which allows time to develop in situ management techniques. There is a strong background of information on the species - twenty years have already gone into learning about kokako, and while we need to know more we have good ideas about why kokako have declined and a general idea of what we need to do about it. We are now into 'second generation' research and management on this bird, and there is every chance that with the prope ~ support we can succeed. It must be accepted that unless methods are developed to sustain ably reduce predators and browsers, kokako will probably not survive on the mainland.

6. OPTIONS FOR RECOVERY

Devising a recovery strategy for the North island kokako is a complex problem with a range of possible options. The species is found in many locations, each of which has its own population size, habitat size and condition, and adverse factors to be dealt with. Furthermore, although it is believed that management of predators and browsers is the correct approach, it is not known if the kokako are benefiting from present management levels. The strategy also depends on some educated guesswork - what is believed to be the long term fate of mainland forests in view of the problems of introduced mammals and limited funds for management.

The different viewpoints and options include:

1. Kokako will not survive on the mainland, due to the effects of introduced mammals and the enormous cost of controlling these animals. Therefore concentrate on establishing island and captive populations while monitoring the demise of mainland populations.

   This is seen as unduly pessimistic, and does not address the question of whether there are enough islands of sufficient size to support kokako.

2. The kokako can be protected on the mainland, and all habitat with kokako should be intensively managed.

   This would be ideal, but not realistic given the level of funding available.

3. Intensively manage as many populations as possible, giving priority to the largest populations of kokako, as those will contribute the most to the survival of the species. Island and captive populations should be established from populations with a low priority for management.

This last option has been chosen, based on expert evaluation of available information. The

following recovery strategy has been developed over a 2 year period. It was designed in recognition of these factors which limit the options for conserving kokako;

1. Limited funds available for management and research

2. Lack of knowledge of the effectiveness of management

3. Lack of precise knowledge of the impact of predators and browsers on kokako.

7. RECOVERY STRATEGY: GOAL AND OBJECTIVES

LONG-TERM GOAL: To improve the status of North Island kokako from endangered by restoring the total, primarily mainland population of North Island kokako to a level (circa 2500 birds) by the year 2020.

Recovery will mean the maintenance of at least two secure populations of roughly 400 birds or more each and several other smaller populations of over 100 birds apiece. Recovery will be achieved when there is evidence that populations are stable at target levels or increasing in numbers; that is, reproduction and recruitment are shown to be keeping pace with natural losses.

OBJECTIVES:

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

   Compare nesting attempts and successes of kokako in modified habitat (mammalian predators and browsers abundant) and managed or unmodified habitat (predators and browsers reduced or absent).

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

   Implement research-by-management programme to conserve kokako populations and develop effective management techniques.

3. **Establish viable kokako populations on islands.**

   Use pairs from mainland remnant kokako populations to try to establish a self-sustaining population on Kapiti Island.

4. **Develop rearing techniques for kokako in captivity.**

   Increase the number of birds held in captivity so that a self-sustaining population is established.

5. **Determine gender of single birds holding territories.**

   Use appropriate techniques to determine the gender of single birds which occupy territories.

6. **Survey potentially important but poorly known populations.**

   Survey kokako populations for which little information is available and which may contain significant numbers of birds.

7. Monitor critical populations.

Territory-map those populations which contain large numbers of kokako and which are therefore critical to the survival of the species, in order to accurately monitor changes in kokako populations.

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

Maintain the North Island kokako recovery group to monitor all kokako problems, to liaise with the public, to respond to problems as they arise, and to revise the Recovery Plan.

9. Promote public interest and involvement in kokako conservation.

Keep the public fully informed of conservation work relating to kokako, and involve interested groups and individuals infield work when appropriate. Each conservancy should promote the work they are doing following departmental media guidelines.

8. RECOVERY STRATEGY : WORK PLAN

Actions necessary to meet each objective and to fulfil the goal of recovery are as follows:

OBJECTIVE 1: DETERMINE THE RELATIVE IMPORTANCE OF THE CAUSES OF THE CURRENT DECLINE OF NORTH ISLAND KOKAKO.

Explanation

The decline of kokako in extant forests is probably due primarily to mammalian browsers and predators. However, the relative importance of the animals responsible has not been established. This could mean that management programmes are targeting the wrong pest species. A key step in determining WHICH mammal pest species limit kokako populations - and checking whether in fact mammal pests are the most important factor - is to look at kokako populations with regard to breeding attempts and outcomes. If kokako are not attempting to breed, then habitat quality (and therefore browsers) may be responsible. If kokako make many breeding attempts but the eggs, chicks or adults themselves are preyed on, then predators may be the major culprits.

It is important to realise that both predation and competition may be happening, perhaps of different importance in different populations or territories, and perhaps their relative importance as limiting factors varies from year to year with, for example, seed supply. The picture is likely to be very complex.

Plan

This objective can be achieved by close study of the breeding and mortality of as many kokako populations as possible. Especially, we should compare kokako populations in communities with high numbers of browsing and predatory mammals (e.g. on the North Island mainland) with those in communities with low numbers (e.g. on Little Barrier Island or in a managed area such as at Mapara). Parameters needing study are the usual ones required to determine population health - adult density, number of paired adults and single adults, chick output, breeding attempts, breeding failures, age at first breeding, longevity, mortality rate and causes for chicks, subadults and adults. Most of these parameters are difficult and expensive to estimate accurately.

Currently, four populations are being studied in detail:

1. Little Barrier Island:

No mammalian browsers or predators except kiore.
Parameters measured : chick output (% of pairs' territories fledging chicks), measured annually.

2. **Rotoehu, Bay of Plenty:** (No management)

Many species of mammalian browsers and predators present. Past logging.
Parameters measured : adult kokako density; ratio pairs to singles; number breeding attempts; number and cause of breeding failures, all annually.
Best attempts are also made at gathering data on subadults such as dispersal distances and age at first breeding.

3. **Mapara, King Country**

Best practicable control of mammalian browsers and predators undertaken since 1989/90.
A forest remnant, with extensive past logging.
Parameters measured : as for Rotoehu.

4. **Kaharoa, Bay of Plenty**

Best practicable control of mammalian browsers and predators undertaken since 1990/91.
A forest remnant with extensive past logging.
Parameters measured : chick output (% of pairs' territories fledging chicks); adult density; ratio pairs to singles, measured annually.

The location of nests at Rotoehu and at Mapara is assisted by using radio transmitters on kokako. An initial plan to use radio transmitters on Little Barrier Island was abandoned since the scheme was impractical. Remote, 24-hour, time-lapse video cameras are in use at Rotoehu to identify nest predators.

It is likely that a detailed study will start on a large, unlogged mainland forest - Te Urewera.

Interpretation

1. Compare kokako population parameters - especially chick output - from different communities with different abundances of mammalian browsers and predators. This will need to be done very carefully with regard to the many climatic and ecological differences between regions and to the past differing human impacts on forests (browser control, logging, fire, roading, etc.).

The initiative of treating mammal control at Mapara and Rotoehu as a hypothesis (i.e. that it will cause kokako chick output to increase) rather than a dogma (we undertake mammal control and hope/presume that it helps kokako) is called "Research-by-Management" (RbM). In these blocks, increasing chick output and adult density from the beginning to end of the management programme (5 years) will be taken as the key indicator of management success.

Clues to the relative importance of browsing and predatory mammals will come from basic studies of kokako breeding in unmanaged blocks; from the rate of population recovery (faster if predators are key factor) in managed blocks; from comparing chick outputs on

Little Barrier Island with those from mainland sites with differing mammal abundances; and from other research such as reversing managed and non-managed blocks, pulsing predator control, or food addition experiments in territories of persistently non-breeding kokako after the initial five years of research is over (see also Objective 5). It is likely to take ten years to fulfil this objective.

Key Personnel

John Innes	:	FRI, Rotorua
Paul Jansen	:	DOC Bay of Plenty Conservancy, Rotorua
Hazel Speed	:	C/- DOC Bay of Plenty Conservancy, Rotorua
Philip Bradfield	:	Reserve Manager, Mapara (via Te Kuiti DOC)
Greg Sherley/Ian Flux	:	DOC Science and Research, Wellington
Chris Ward	:	DOC East Coast Conservancy, Gisborne.

OBJECTIVE 2: DETERMINE SUCCESSFUL MANAGEMENT TECHNIQUES FOR THE CONSERVATION OF NORTH ISLAND KOKAKO

Explanation:

This objective is ambiguous in the well-known way: it means successful in terms of increasing some parameters of kokako well being (chick output, density) as well as in terms of reducing target pest populations, improving vegetation condition, and so on. The first meaning is the more important.

The Research-by-Management (RbM) programme (see objective 1) has been developed to determine the effectiveness of management techniques by both criteria above. It is a management programme with a research component, in which introduced mammals are intensively controlled in two forests, while at the same time monitoring measures the abundance of mammal pests, the improvements in forest condition and the effects of these changes on the kokako population.

Major problems with RbM have forced continued changes in the programme since 1988 when it was first suggested.

On the ecological side of things these included:

- There were too few available study populations to allow as many treatments or replicates as some initially attractive scientific designs required.

- It was technically impossible to kill individuals of one of the problem pest groups (e.g. browsers) without killing individuals of one of the other group (predators), and some species such as ship rats and possums have been described by some to be in both groups.

- Analysis of community structures showed that unexpected outcomes for kokako after pest control - resulting from indirect ecological linkages (via predation and competition) - were possible.

- Verified, efficient population monitoring techniques were unavailable for most animal species.

Accordingly by 1991/92 the RbM Workplan (Hay, 1991) supported a design of matched study area pairs in only two regions. However, in early 1992 the control (non-treatment) blocks were abandoned, since although the pairs concept is highly desirable, the differences within the pairs actually available were widely held to be too great to justify a useful comparison of kokako chick outputs.

Despite these changes, the RbM programme is an important and valuable one, both for seeing if current mammal control efforts increase kokako numbers and for improving mammal control and monitoring systems.

This programme has wide-reaching implications for many other forest species affected by the same factors as kokako: kaka, kakariki and kereru are other birds which will benefit from successful management techniques. It is also valuable since it requires close working contact between research and management personnel.

Plan

- **MAPARA (1989 - 1994) : FUNDED BY DOC**

Target	Control Method	Monitoring Method
rats	Talon, 1080	tracking tunnels
mustelids	Fenn traps	catch per unit effort
goats	DOC hunters	kill rate
possums	trapping, 1080	modified removal method
vegetation		remeasurement of point-height-intercept plots est. by Leathwick 1979-1981.
kokako		adult density; chick output; ratio pairs to singles; no. breeding attempts and their outcomes.

- **KAHAROA (1990 - 1995) : FUNDED BY TASMAN FORESTRY LIMITED AND DOC**

Target	Control Method	Monitoring Methods
rats	1080, Pindone	tracking tunnels
mustelids	Fenn traps	catch per unit effort
goats, deer	DOC hunters	kill rate
possums	1080, trapping, Pindone	modified removal method
cats	restraint traps	catch per unit effort
kokako		adult density; chick output; ratio pairs to singles

- Reverse or pulse treatments, or another such as supplementary feeding are likely for the RbM blocks after the first five-year period ends.

- More deliberate effort to experiment in a formal way with control and monitoring techniques is required.

Evaluation

At the end of the five year management period for each block, successful results will show:

1. An increase in kokako adult density, chick output and the ratio of pairs to singles in territories.

2. Improved, verified and accepted techniques for controlling and monitoring numbers of mammal browsers and predators.

If very successful, management may then be applied to kokako populations requiring it. Research will continue meanwhile to see which populations require management.

If control programmes are unsuccessful there will be continuing decline in kokako adult density, and chick output will remain low; satisfactory methods for controlling or monitoring mammals may not be found. In this situation we will have to consider all evidence to induce if introduced mammals do not in fact limit kokako populations, or rather if our present control methods cannot get numbers low enough for long enough to make any difference to kokako.

Key Personnel

John Innes	:	FRI, Rotorua
Paul Jansen	:	DOC Bay of Plenty Conservancy, Rotorua
Hazel Speed	:	C/- DOC Bay of Plenty Conservancy, Rotorua
Philip Bradfield	:	Reserve Manager, Mapara (via Te Kuiti DOC)
Greg Sherley/Ian Flux	:	DOC Science and Research, Wellington
Chris Ward	:	DOC East Coast Conservancy, Gisborne.

OBJECTIVE 3. ESTABLISH VIABLE KOKAKO POPULATIONS ON ISLANDS.

Explanation

Transferring birds to protected, offshore islands is a frequently used 'insurance policy' for establishing new populations of rare or endangered species. Species on islands free of browsing and predatory mammals require little management. Because the habitat conditions on islands are usually superior to the mainland, increased productivity can provide birds for enhancing other populations. Kokako have been established successfully on Little Barrier Island, using birds salvaged from Bay of Plenty logging operations. However, islands which

are suitable for kokako are few in number, due to the requirement for large areas of suitably mature forest with no or few potential predators or browsers (islands greater than 1000 ha and free of ship rats, mustelids and browsers are preferred) (see Table 2). It would be preferable to avoid putting North Island kokako on islands within the South Island kokako range, as these islands may be needed for the conservation of the South Island subspecies. With the removal of possums from Kapiti Island, this island now appears to be the most suitable for a release of kokako. Because kokako populations are not threatened by logging operations at this time, a suitable source for transfer would appear to be the small remnant populations which are steadily disappearing from around the country, and where management is unlikely to occur.

Plan

A number of remnant kokako populations have been identified by the North Island kokako recovery group as potential sources of birds for Kapiti Island. Evaluation was made on the basis of: habitat size (removing birds from small remnants is preferable to removing birds from large forest tracts), good survey knowledge (there is no 'hidden' population), remote possibility that the forest would be intensively managed to protect kokako, accessibility, three or fewer pairs in the forest, and low potential for public conflict if the birds were to be removed.

TABLE 2 Islands which are possible release sites for kokako.

Island (hectares)	Forest	Predators/Browsers	Comments
Raoul (2941 ha)	extensive	cats, Norway rats, kiore	goats eradicated, considerable distance from North Island
Hen (500 ha)	extensive	kiore	good habitat but may be small
Little Barrier (3083 ha)	extensive	kiore	kokako established in 1980s
Great Barrier (28 500 ha)	extensive	ship rats, kiore, goats, pigs	remnant population of kokako present
Great Mercury (1860 ha)	limited	cats, ship rats, goats,livestock	privately owned not enough habitat
Mayor (1280 ha)	extensive	Norway rats, kiore, pigs, cats	Maori tenure
Kapiti (2023 ha)	extensive	Norway rats, kiore	possums eradicated in 1980s
D'Urville (16 800 ha)	extensive	stoats, pigs	within South Island kokako range
Arapawa (7780 ha)	limited	stoats, goats, sheep, pigs	within South Island kokako range

Codfish (1336 ha)	extensive	kiore	possums eradicated, within South Island kokako range

The most suitable areas appear to be:

1. Rotorua lakes remnants - this includes the Rotoma Scenic Reserve, bush remnants north of Lake Rotoma (Manawahe Road) and the Matawahaura area between Lake Rotoiti and Lake Rotoehu. One or two pairs and some single remain in the area.

2. Pureora northwest outlier - a large block which lies to the northwest but is separate from the Pureora north block. About 4 kokako were located here in 1987.

3. Mt Pirongia - a 13 000 ha block in the Waikato in which kokako have been declining for many years.

4. Kawhia-Waitomo - a complex of private land, scenic reserves and Department of Conservation administered forests stretching from Kawhia Harbour to the Waitomo caves. O'Donnell (1984) has documented the decline of kokako in these forests.

Less suitable areas which should be considered next are:

5. Otanewainuku-Otawa forests - a series of forested areas containing some 17 birds in the early 1980s, to the northeast of the Mamaku Plateau and Papamoa Ranges. Two pairs of kokako from this area were released on Little Barrier.

6. Horohoro - An extensively logged area south of the Mamaku Plateau which contained a large number of kokako in the 1970s. A brief survey suggests that few birds remain (P. Montgomery, pers. comm.).

7. Whareorino - a large forest block in the western Waikato which undergoes sporadic management. Less than a dozen birds were found here in the early 1980s.

8. Mt Kokako - a small block of forest west of Hamilton. One or two birds were found here in the late 1970s, but kokako are likely extinct from this area now.

Birds would be removed from several of these forests to make up the total transfer.

Translocation procedures are:

* Submit transfer proposal to Director, Protected Species Policy Division for approval.

* Survey and location of suitable birds from the above-mentioned forests

  The first transfer should be of at least three pairs (to establish a social structure). The five-year goal is to move 10-15 pairs of birds. Single birds will contribute to the social system and may eventually pair, but numbers of singles should not exceed 1/3 the number of pairs transferred.

* Capture and transfer of the birds to Kapiti.

  Any person handling kokako should have extensive previous experience of handling this species or be supervised by someone with that experience.

* Monitoring of kokako on Kapiti to determine survival, habitat use and reproductive rate.

Outcome

As at February 1992, five kokako have been successfully transferred to Kapiti Island, where the movements of four (two bonded pairs) are being monitored by radio telemetry. If successful, this project will see the establishment of a self-sustaining population of kokako on Kapiti Island. If the transfer of 15 pairs is insufficient to establish such a population, the project should be abandoned.

Key Personnel

Raewyn Empson - Wellington Conservancy
Colin Miskelly - Wellington Conservancy
Phil Thomson - Waikato Conservancy
Paul Jansen - Bay of Plenty Conservancy
Kerry Brown - c/- Bay of Plenty Conservancy

OBJECTIVE 4. DEVELOP REARING TECHNIQUES FOR KOKAKO IN CAPTIVITY.

Explanation

Captive populations can serve a number of functions. They provide an insurance policy against extinction in the wild, and can provide a source of birds for release back into the wild at some future date. They provide the opportunity for developing handling and egg manipulation techniques. More information on breeding biology can be obtained. Developing these techniques with the North Island kokako now could be crucial to the survival of the South Island subspecies in the future. Captive kokako have been useful already on a number of projects, for example testing bait acceptance in non-toxic trials relating to 1080 poison operations (Appendix 2), and the testing of radio transmitter packages. Finally, captive birds provide another opportunity for the general public to see kokako.

Previously, kokako have been supplied to Mt Bruce on random occasions, with never more than 2 well-established pairs being held. Captive breeding should be given the same opportunity to succeed as island translocations - the input of 10-15 pairs over a 7 year period. The Mt Bruce programme has a high priority because techniques will be developed which could be needed for intensive management of South Island kokako.

Three kokako currently held at National Wildlife Centre include a known female, her offspring, presumed to be female and a recently captured male.

Plan

* A captive breeding plan will be prepared

* Two pairs of kokako will be established in captivity. One further male is required, using the same sources and procedures as Objective (3)

* Construction of two additional aviaries at Mt Bruce for the purpose of breeding kokako

* Selection of suitable institutions for breeding kokako following a surplus of birds at Mt Bruce

Outcome

If this programme is successful, a self-sustaining population of kokako in captivity. The development of reliable breeding techniques could aid in the conservation of South Island kokako. Surplus birds could be released on islands. If reproductive rates of captive birds do not supply replacement or excess birds, the project should be abandoned.

Key Personnel

Martin Bell (captive breeding coordinator)- National Wildlife Centre, Mt Bruce
David Butler - Threatened Species Unit
Raewyn Empson - Wellington Conservancy
Phil Thomson - Waikato Conservancy
Paul Jansen - Bay of Plenty Conservancy

OBJECTIVE 5. DETERMINE GENDER OF SINGLE BIRDS HOLDING TERRITORIES.

Explanation

Many populations of kokako contain a high proportion of single birds holding territories. It has been assumed that 1) these birds are all of the same sex, otherwise they would form pairs; and 2) these birds are male, as females are more vulnerable to death during the breeding season. There is a possibility that these birds are not of one sex, but do not pair

up for unknown reasons. If this is true, it would have a major impact on management because the potential breeding population would be greatly increased. Determining the sex of kokako is difficult as both male and female birds appear almost identical. Females can be identified during nesting, and reasonably reliably through tarsus measurement, but the only other available and reliable method is laparoscopy. Other techniques such as blood testing and feather pulp analysis are not 100% dependable. Laparoscopy has been used successfully to determine gender of birds in captivity and tuatara in the wild (A. Cree, pers. comm.) and has been tested on a fat male kokako at the National Wildlife Centre.

The Taranaki population may be suitable for this purpose.

Plan

* Investigate suitability of laparoscopy (or other techniques) for use on kokako in the wild.

* Select wild population suitable for investigation

* Carry out investigation on wild population

* All kokako sampled will be released leg-banded.

Outcome

The outcome will be valuable information relevant to kokako decline and appropriate management.

Key Personnel

Wayne Hutchinson - Wanganui Conservancy
Gretchen Rasch - Threatened Species Unit
Martin Bell - National Wildlife Centre, Mt Bruce
Sherri Huntress - Wellington Zoo

OBJECTIVE 6. SURVEY POTENTIALLY IMPORTANT BUT POORLY KNOWN POPULATIONS.

Explanation

Accurate knowledge of the range and size of kokako populations is the basis for assigning conservation status to the species. However, survey is time - and resource-consuming, and the information gathered dates rapidly with time. Therefore, while a number of kokako populations have not had comprehensive survey, or have not been surveyed within the last 5-10 years, new survey should be aimed at those areas where little information exists but the population may contain substantial (> 30) numbers of kokako. These are forests of extensive area in which previous, brief surveys have shown kokako to be present (see Table

1, p 7).

Plan

* Populations in order of priority for survey (priority determined from existing information):

Northland, Whareorino, Whanganui National Park

* Survey

Techniques must follow well established methods (Appendix 1)

Outcome

Improved knowledge of kokako distribution, density, and thus status.

Key Personnel

Richard Parrish - Northland Conservancy
Phil Thomson - Waikato Conservancy
Wayne Hutchinson - Wanganui Conservancy

OBJECTIVE 7. MONITOR CRITICAL POPULATIONS.

Monitoring population trends in unmanaged areas will clarify the status of the species and help interpretation of management outcomes elsewhere. Monitoring should concentrate on those populations most critical to the long-term survival of the species, and which are most likely to receive management. These populations are outstanding because of their size, density, and/or favourable habitat conditions. Populations which are part of the research-by-management and the Rotoehu/Little Barrier programmes are already part of the monitoring programme, but others should be added. Other populations which should be monitored are listed below. Monitoring thirty birds in each of these forests at five yearly intervals would give a robust data base on the condition of the species throughout its range.

Monitoring techniques are distinctly different from survey techniques and must be carried out thoroughly and carefully (Appendix 1).

Plan

* Areas being monitored as part of Objectives 1 and 2:

Unmanaged: Rotoehu, Urewera

Managed : Kaharoa, Mapara

* Establish monitoring areas in

    State Forest 3 (Mamaku) - major population

* Revisit (5 yearly interval)

    Great Barrier Island - only naturally occurring island population; no mustelids
    Hunua - significant population
    Pureora - major population

Outcome:

Necessary knowledge of population trends, and background against which we must assess management success.

Key Personnel

All Recovery Group members
Phil Bradfield - Reserve Manager, Mapara
Hazel Speed - Kaharoa (via DOC Rotorua)

OBJECTIVE 8. MONITOR ALL KOKAKO WORK AND BE PREPARED TO RESPOND TO CHANGE.

Explanation

The North Island kokako recovery group was established to oversee the development of the recovery plan, and to act as a source of expertise in all matters relating to North Island kokako. The recovery group also acts as an information and advice liaison with other DOC staff, agencies, the media, and the public at large. The group monitors recovery work annually and revises the recovery plan. It is also available to respond to important matters arising unforeseen by the recovery plan.

Plan

* Annual meetings to review progress of recovery plan programmes.

* Available for decision-making on new matters.

* Available as liaison for advice and information on all matters relating to North Island kokako.

* Revision of the recovery plan in 1995.

Outcome

The successful implementation of the recovery plan will be enhanced by the functioning of this group. Field situations often change and the support of the group is needed for decision-making. This complex recovery strategy could falter and lose momentum without consultation and review.

OBJECTIVE 9. PROMOTE PUBLIC INTEREST AND INVOLVEMENT IN KOKAKO CONSERVATION.

Explanation

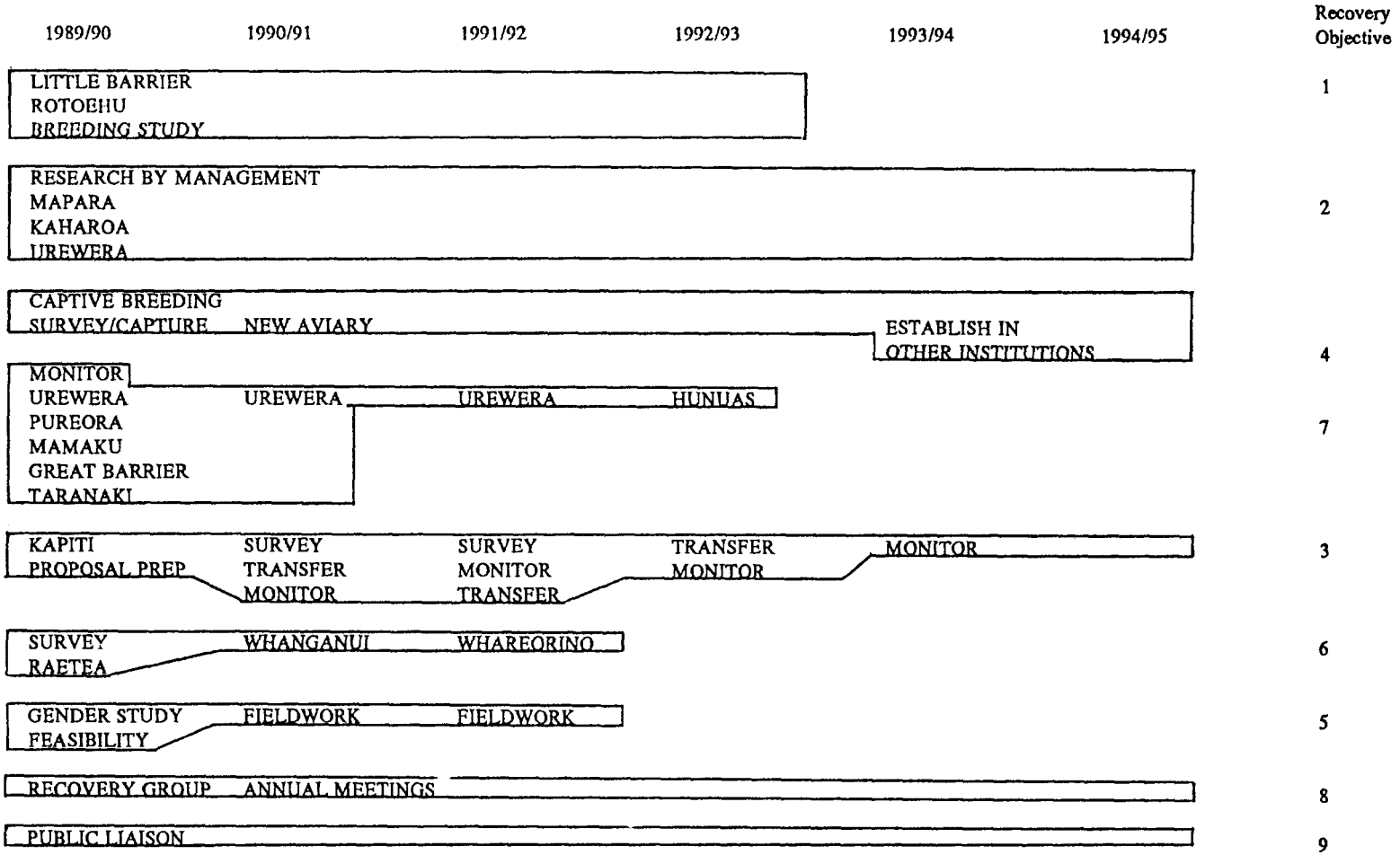
The public has invested heavily in kokako both in time and money in the past, and much of the current knowledge on the species arose from that investment. For example, the Hunua survey was carried out successfully with help mainly by volunteers. It is the responsibility of those people working with kokako to make certain that the public are repaid by keeping them informed, and involved when possible.

Plan

* The recovery plan is available for public comment
* News releases should be made whenever any significant or interesting events happen with kokako
* News releases should be conservancy initiated but following DoC proceedure on media releases.
* Volunteer participation in survey/monitoring should be used when appropriate
* Kokako visits should be part of conservancy/field station summer programmes

Outcome

The continued public support for kokako conservation and understanding of its programmes is vital to the recovery of the species.



CRITICAL PATH

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APPENDIX 1 SURVEY AND MONITORING TECHNIQUES

Survey is taken to mean a 'walk-through' survey, in which usually large areas are gone through rapidly in order to gain general information on the kokako population present. Monitoring is done to acquire precise knowledge of kokako territories, and involves 'territory mapping', i.e. following of kokako until their territories are familiar to the observer. The procedure described for each method is from King Country work in the period 1986-1988.

Survey

Survey techniques for kokako have been developed over a 15 year period. Birds are located by song or calls, which can be stimulated by the playing of taped calls. The following technique was found most effective in the King Country and Taranaki work.

Methods

Surveys have been conducted from September - May, but are probably most effective during September - early December. Singing by kokako and tape response drops sharply in the December - April period (when birds are nesting and moulting). Survey is done most effectively from ridges, and people working in parallel are more effective than a person working alone. Results from survey work indicate that coverage (time spent per unit area) declines as the total area covered increases (Figure 1).

Listening was done every 200-300 m., beginning at first light. If birds were not heard singing on their own, the following sequence was used:

1. 3 mew calls, followed by a 5 minute listening period.
2. 3 mew calls, followed by a 5 minute listening period.
3. 30 seconds of local song, followed by a 5 minute listening period.

Local song is considered imperative, and it has been suggested that local mew calls (generally considered not to have local dialects) may be necessary as well.

Interpretation

This method was found to locate 64 - 75% of the resident territorial birds (confirmed afterwards by territory mapping). Often one bird or pair is mistaken for two territories, or territories are overlooked. Birds may be called off territory by the use of tapes. Even when the kokako in an area are well known, they are located on only 52 - 82% of visits to their territories (results from Rasch et al. 1986b). Survey results give general figures on bird numbers and location, but cannot be used to interpret anything but gross population trends.

Territory mapping

This method was developed for situations where more precise information is needed on kokako numbers. It takes advantage of the fact that kokako are resident on territories year round and from year to year.
Method

Birds located in the walk through survey are found and followed until a clear picture is gained of the extent of the territory. All neighbouring birds have to be clearly identified. More than one person is usually necessary to identify neighbours, the number of people depends on the number of kokako with adjacent territories. While birds can be located by playing taped calls, they quickly become habituated to tapes and stop responding. Therefore playing tapes should be kept to a minimum. It usually takes 1-5 visits of nearly 3 hours apiece to identify a territory. This will increase where territories are very large or high numbers of birds are tightly packed. It took 1-12 visits per territory (average 4 visits) to map the dense kokako population at Mapara. The calendar time taken to accurately map birds varies from 1 to 5 weeks per territory (Table 1).

Interpretation

This method gives reasonably precise estimates of population change, and can record ratios of pair: single territory holders. If time is limited, or identification of individual birds is needed, then banding (with its associated costs and risks) may be necessary.

References

Molloy 1989
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TABLE 1 Time needed for territory mapping

Number of Territories	Person Weeks	Study	
18		24	Rasch *et al.* 1986
14		28	Speed *et al.* 1987
9		21	Speed *et al.* 1988
45		60	Bradfield *et al.* 1988
11		52	Williams 1990

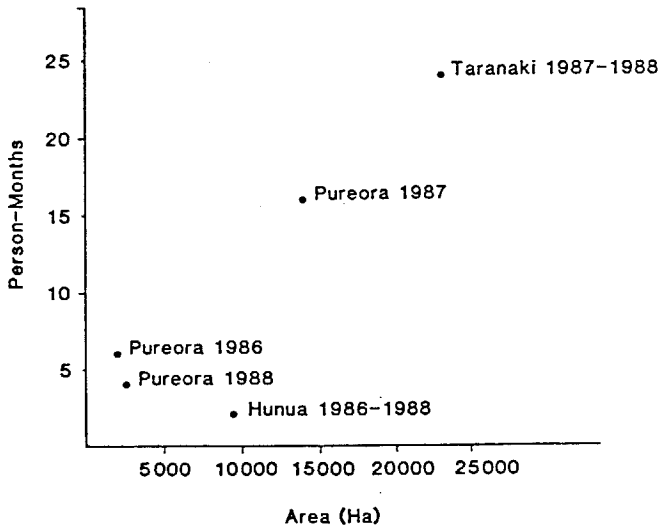

FIGURE 1 Time needed for survey

APPENDIX 2 USE OF 1080 POISON IN FORESTS CONTAINING KOKAKO

Large scale aerial drops of 1080 poison were carried out in the King Country in the years 1985-1988 as part of a programme aimed at controlling brush-tailed possums (carriers of bovine tuberculosis). Although drops of 1080-laden carrots had been made over kokako habitat in the Bay of Plenty in the 1960s and 1970s, losses of common forest birds during 1080 drops in the 1970s sounded a cautionary note. Therefore the agencies concerned in the King Country work (MAF, NZ Forest Service, Wildlife Service, and Department of Conservation) chose to test baits and monitor drops of 1080 over kokako. Non-toxic baits were tested on captive kokako at Mt Bruce and with wild birds in Pureora (Pikiariki Road) and at Rotoehu.

The results were sufficiently encouraging to allow drops to proceed over various parts of the Pureora North Block and environs from 1986-1988. Kokako were carefully monitored using the territory mapping method and roll-calling (the repeated locating of identifiable territory holders before and after poison drops) (see references for details). The forest type was cutover tawa, with regenerating podocarps. The baits used were green-dyed Wanganui No. 7 or Mapua pollard pellets with a toxic loading of 0.15 %. In six 1080 operations, 83 adult and 6 juvenile kokako were monitored. Two adult kokako disappeared during the operations. Both disappearances may have been due to 1080 poisoning, but only one was probably due to 1080. No dead kokako were found. From these results, the rate of adult mortality in future operations may be 1.2%, with a 5 % probability that mortality could exceed 7%.

While dependent juveniles are known to have survived operations, there is no information on non-territorial subadults.

Kokako are known to have been killed by gin-traps. However, 41 kokako were monitored and survived a gin trap/cyanide operation at Mapara in 1988.

Policy

1. Aerial 1080 operations over tawa-dominated North Island forest containing kokako need not be monitored if Wanganui No. 7 or Mapua baits are used; if the baits are cinnamon-lured; and if the operation is conducted between April and August.

2 The effects on kokako populations should be monitored if baits or lures different to those in past trials are used; if operations are in forests containing tree species (e.g. kohekohe) whose fruits resemble bait pellets and are fed on by kokako; if operations are conducted outside the April-August period.

   Monitoring would consist of located as many kokako territories as possible before and after the operation.

   In time, monitoring of kokako should cease to be required for any kind of 1080 operation.

3. If operations are small, then consideration should be given to replacing the aerial

operation with a ground-based cyanide and/or gin trapping operation. This can be as effective as aerial poisoning if good operators are used.

4. Work should be done on the effects of 1080 operations on juvenile kokako. This could involve putting radio-transmitters on fledglings.

References

Innes & Williams 1990
Innes et al. 1988
Speed et al. 1988b
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Rasch et al. 1986b

KOKAKO RECOVERY PLAN OPERATING BUDGET

1989/90	1990/91	1991/92	1992193	1993/94	1994/95	Recovery Objective
RESEARCH						
Cause of decline		$140,000	$140,000	$140,000		1
Gender study			$ 4,200			5
RESEARCH BY MANAGEMENT						
Kaharoa Mapara Urewera		$180,000	$258,000	$258,000	$258,000	2
CAPTIVE BREEDING						
National Wildlife Centre		$65,000	$ 2,000	$ 2,000	$ 2,000	4
SURVEY AND MOITORING						
All areas		$30,000	$36,000	$20,000	$20,000	6-7
ISLAND TRANSFERS						
Kapiti Island		$ 10,000	$ 15,000	$ 15,000	$ 15,000	3
TOTAL		$425,000	$455,200	$435,000	$435,000	