Kiwi (Apteryx spp.)
Best Practice Manual

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This Kiwi Manual has been approved by

Conservator,

for use by the Department of Conservation and will come into effect on

There are sections of this document that detail capture methods of kiwi and this information should not be distributed indiscriminately.

Any recommended changes to the scope or contents of this document should be clearly described and sent to the National Kiwi Coordinator (Operations and Planning) Biodiversity Recovery Unit, Department of Conservation, PO Box 10-420, Wellington.

Authorisation Signatory

Date:
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1: INTRODUCTION

This module gives the main objectives of the best practice manual and briefly discusses its background. Accountability and review procedures are outlined. Kiwi biology and aspects of kiwi conservation management are introduced.

Contents:
1.1 Objectives
1.2 Accountabilities
1.3 DOC standards
1.4 Permits
1.5 Review
1.6 Procedures
1.7 Basic kiwi biology
1.8 History of kiwi conservation

Additional related documents for DOC staff1:
Sharing Best Practice (QD: C1329)
National Requirements for Trapping and Cyanide Use (QD: NH1170)
Prevention of Predator Invasion (QD: NH1262)
Animal Pests, Assessing Applications for DOC Consent (QD: NH3008)
Animal Pests, Accepting a New Toxin for Use by DOC (QD: NH3006)
Animal Pests, Obtaining Consents (QD: NH3003)

1.1 Objectives

The objectives of this manual are to:
∞ provide information and resources on the best techniques currently available to manage and research kiwi
∞ help DOC staff, external managers and researchers with techniques for the recovery and management of wild kiwi
∞ help formalise consistent management practices across kiwi taxa throughout the country
∞ provide a mechanism for advocating the continuous improvement of kiwi conservation management and research
∞ be a companion document to the Kiwi Recovery Plan and the Kiwi Captive Management Plan.

1.2 Accountabilities

People in the following positions are responsible for identifying and maintaining best practice techniques for working with all taxa of kiwi:
∞ Area Managers
∞ Kiwi Sanctuary Managers
∞ Conservation Officers
∞ Kiwi Recovery Group Members
∞ Technical Support Officers.

1 If you are not employed by DOC but would like to access these documents, please contact staff in your local DOC conservancy for copies.
1.3 DOC standards

The following documents form the basis for the Department of Conservation’s standards for management of kiwi. They are available on request from the National Kiwi Coordinator (Planning and Operations), Biodiversity Recovery Unit, Department of Conservation, PO Box 10-420, Wellington.

- The Department of Conservation Standard operating procedure for the Translocation of New Zealand’s indigenous terrestrial flora and fauna (QD: NH1042) should be referred to for the approval process required for the movement of kiwi to new release sites.
- The Department of Conservation wildlife health guidelines should be referred to for basic assistance in this area (QD: NH1176).
- The Department of Conservation Captive Management Guidelines apply to captive holding of kiwi, and a draft Captive Management Plan is being reviewed.

In addition, a legal authority under the Wildlife Act 1953 is required for any manipulation of wildlife. This includes collection of samples, banding, capture and translocations.

1.4 Permits

Various stages in the management of kiwi are not to be undertaken without having applied for and received specific permission. These permits are mentioned in the text. In brief, permits are needed for the following activities:

- monitoring kiwi using radio-telemetry
- undertaking projects using banded kiwi
- catching kiwi
- attaching transmitters to wild chicks
- taking blood samples from kiwi
- using dogs to locate kiwi.

Appendix 6.1 also has information on permits; see also Issue of Permits to Collect Flora / Fauna (QD: NH1167) and Injured Bird Permits (QD: NH1164)

1.5 Review

The National Kiwi Coordinators of Research and Monitoring, and Planning and Operations, are charged with the responsibility of reviewing and revising this document annually, and so ensuring that best current practices are promulgated within and outside of the Department of Conservation.

In some sections, several alternative approaches are offered, but further experience may reveal that one method is superior to the alternatives, and so become the single mandatory best practice.

There are also various methods under development, which have not yet been agreed upon as best practice but which are at present recommended good practice. These are listed in Sections 10 (dogs) and 11 (nets).

Changes from the stated best practice should be approved by the Kiwi Recovery Group and be carefully documented. Adherence to current best practice guidelines should not prevent
innovations which may result in improved performance, but it is important that such innovation be monitored.

1.6 Procedures

Mandatory procedures are those that must be followed because after many years of practice they have been identified as the best and most reliable methods. These procedures are indicated by the words ‘must’, ‘shall’, or ‘do not’.

Recommended procedures are those which to our current knowledge are best methods, but that may have good alternatives. These procedures are indicated by the word ‘should’.

1.7 Basic kiwi biology

All currently known taxa of kiwi share the following general characteristics:
∞ small eyes but good vision by night and day
∞ large ears – good hearing
∞ well-developed sense of smell – nostrils at tip of long sensitive bill
∞ feathers with unlinked barbs on a single rachis
∞ feathers easily shed – perhaps as a predator defence mechanism
∞ wings minute (vestigial)
∞ no external tail
∞ short legs finishing in three forward pointing toes equipped with sharp claws
∞ females 20-30% heavier and larger than males
∞ large egg in proportion to female body weight (eggs weigh around 15-20% of female weight)
∞ chicks are miniatures of adults.

Kiwi nest and shelter in burrows, under vegetation and in hollow logs. They are found from sea level to alpine tussock grasslands and herb-fields at about 1500 metres above sea level. Mostly forest inhabitants, they are now also present in scrubland, rough farmland, swamps and pine forests.

Kiwi mainly eat insect larvae, weta and crickets, centipedes, moths, earthworms, spiders, fruits and berries, but they have also been recorded occasionally feeding on leaves. Food is taken from soil, rotten logs or on the surface.

The main differences identified to date amongst the six kiwi taxa are summarised in Table 1.1.
### Table 1.1: Breeding and vocalisation distinctions among kiwi taxa

<table>
<thead>
<tr>
<th>Breeding</th>
<th>Vocalisation</th>
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<tr>
<td><strong>Egg laying</strong></td>
<td><strong>Incubation</strong></td>
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<tr>
<td>North Island Brown Kiwi</td>
<td>Male alone for 70 to 80 days.</td>
</tr>
<tr>
<td>June to January</td>
<td>Male and female for 65-75 days.</td>
</tr>
<tr>
<td>Haast Tokoeka</td>
<td>Unknown.</td>
</tr>
<tr>
<td>Southern Tokoeka</td>
<td>Male 2/3rds. female 1/3rd for 70 days.</td>
</tr>
<tr>
<td>Great Spotted Kiwi</td>
<td>Male and female, for 65-75 days.</td>
</tr>
<tr>
<td>Little Spotted Kiwi</td>
<td>Male alone for 65-70 days.</td>
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### Evolutionary and taxonomic history

Kiwi are thought to be an early offshoot from the evolutionary line of the primitive flightless ratites (e.g. moa, emu, cassowary, ostrich and rhea) but seem to be more closely related to the emu than the moa. They are one of the oldest members of the New Zealand avifauna and are unique in being our only endemic order of birds.

Currently, we recognise six taxa of kiwi:

- **North Island Brown Kiwi** (*Apteryx mantelli*).
- **Rowi or Okarito Brown Kiwi** (*Apteryx mantelli* ‘Okarito’)
- **Haast Tokoeka** (*Apteryx australis* ‘Haast’)
- **Southern Tokoeka** (*Apteryx australis*)
- **Great Spotted Kiwi or Roroa** (*Apteryx haastii*)
1.8 History of kiwi conservation

**Kiwi decline**

Numbers and distribution of kiwi are in rapid decline on the two main islands of New Zealand. As populations decline, the rate of decline accelerates, and of the six taxa of kiwi, only the Little Spotted Kiwi and Rowi are increasing (in response to former management). For information on the decline of kiwi, see the Kiwi Recovery Plan.

**Role of predation in the decline of kiwi**

As little as a decade ago, some ecologists believed – wrongly – that predator impacts in New Zealand’s mainland forests were over, that after 100 years of coexistence, kiwi and other prey species had demonstrated both their resilience and ability to go on co-existing with mammalian predators indefinitely.

Ecologists were forced to change their view as the evidence for continuing declines mounted for a range of forest dwelling birds. The information for kiwi was particularly compelling. Accounts from early explorers indicated that kiwi were once far more abundant and widespread that they are now, though there were no actual measurements to facilitate comparisons. Farmers, trampers and iwi provided further evidence with accounts of local declines noticed within various individuals’ own lifetimes. Ecologists noticed that kiwi were generally more numerous on offshore islands than in mainland forests.

The first scientifically defensible hint that predators were involved (although dog kills had been well-documented) came from a comparative analysis of kiwi population structure in mainland forests (predators present) and offshore islands (predators absent). Despite similar reproductive rates, populations on offshore islands contained many more young birds than those on the mainland, implying that failure in recruitment (population replacement by the next generation) was a significant issue for mainland birds. Above all else, the analysis made it clear that the chick stage of the kiwi’s life cycle needed to be examined in detail.

Radio-tracking studies soon revealed that stoats were the primary cause of the recruitment problem. In most localities and years, stoats killed almost the entire annual crop of young kiwi, usually before the birds were 6 months old. Population models showed that too few young were surviving to replace the adults that eventually died of old age. On average, the losses exceeded the gains, resulting in a mean annual rate of decline of about 6%. This was the first time that a population model had been used in New Zealand to evaluate the significance of predation – and the results were unequivocal.

One further question still had to be answered: Were stoats preventing chicks from reaching adulthood, or were they merely killing chicks that would have otherwise died at some later time for some other reason? Large-scale field experiments in several areas showed that chick survival to adulthood increased markedly following stoat control, thereby confirming that predators were indeed regulating kiwi populations in mainland forests.

Some people would argue, after the fact, that it was not necessary to go to such lengths to prove the now-obvious connection between predators and decline of kiwi. But in many ways, kiwi had become a test case for all forest birds, a test of whether predators were continuing to have an impact on mainland forests. Indeed, one of the most significant outcomes of that first kiwi work was that it advanced our understanding of predation systems in New Zealand’s
forests, with benefits for all native forest species. Efforts to conserve kiwi have also driven the expansion of effort to develop and improve techniques to control stoats.

**History of conservation management**

Kiwi have attracted much interest since specimens were collected and described in the mid 1800s. Most of the early work was on the structure and physiology of kiwi, based on study of museum specimens or captive breeding birds. Because kiwi are nocturnal and secretive, little field research on kiwi was practical until the development of radio-transmitters in the early 1980s. Apart from a few transfers of kiwi to offshore islands in the early 1900s little conservation management was done, and most species were thought to be holding their own despite local losses due to habitat clearance. The field research in the 1980s provided important new insights into the biology of wild kiwi, and helped to alert conservation authorities to the difficulties that kiwi faced from predators. The main conservation management actions taken in the 1980s were to successfully transfer Little Spotted Kiwi, the rarest species, from Kapiti and D’Urville Islands to a number of predator-free offshore islands, and to ‘rescue’ kiwi from habitat clearance operations, and to establish some island populations of Brown Kiwi.

It was not until 1991, with the launch of the Kiwi Recovery Programme, that significant coordinated conservation management action was taken to prevent kiwi from becoming extinct. The first five-year phase of the programme, from 1991 to 1996, concentrated on gaining a better understanding of the status and trends of kiwi populations; identifying the key threats to kiwi populations, including assessing the impacts of toxins on kiwi; re-examining the genetics of kiwi to better understand their conservation management units, and starting research on the biology of some of the poorly known taxa (rowi and tokoeka).

The next five-year phase, from 1996 to 2001, concentrated on experimental management of predators, especially stoats, to see if managed kiwi populations would recover; developing and refining Operation Nest Egg as a tool for allowing kiwi chicks to get through the population bottleneck of the first six months of life, re-assessing the status of populations, and extending earlier genetic research with more samples and more powerful analytical tools.

The third phase, from 2001 onwards has moved to experimentally managing five key populations to see if in situ management of predators is effective at the scale of 10,000+ hectares, rather than at the 100s of hectare scale attempted previously, and empowering community groups to assist conservation management efforts to complement those of the Department of Conservation.
2: HEALTH AND SAFETY ISSUES

In this module you will find specific health and safety requirements for people that work with kiwi. Each person shall read the Department’s best-practice guide, *Health and Safety Manual* (available on the intranet, QD: HS1016) before they go into the field.

Contents:
2.1 Disease Risk to Human Health from Kiwi Handling
2.2 Best Practice

Additional related documents:
- Safe Handling of Pesticides (QD: NH3009)
- Hand Held Radios, User Guide Standard Operating Procedures (QD: C1046)
- Radio Communications User Guide (QD: C1239)
- Helicopter Safety (QD: HS1018)
- Safe Operation of All Terrain Vehicles (QD: HS1338)

Appendix 2.1 gives details of suppliers of field equipment.

2. Disease risk to human health from kiwi handling

Recommended contents for first-aid kits can be found in the *Health and Safety Manual*. In particular, the following items shall be part of the first-aid kit:
- eyewash, used a lot for pokes to the eyes from protruding vegetation and to wash soil from the eyes after digging out birds
- a small mirror (burrow mirror), useful for removing foreign objects from the eye.

**Scratches**

Perhaps the most common health hazard you will suffer from working with kiwi are infected scratches. Kiwi have very strong legs which they use for defence. Kiwi claws are covered with dirt and all sorts of micro-organisms, which can produce infections. Wash scratches thoroughly and scrub out using a brush.

**Kiwi faeces and blood**

Perhaps the most dangerous and contagious pathogen kiwi could infect you with is *Cryptococcus* spp. This pathogen affects the respiratory system and was found in a captive bird in Hawke’s Bay. If you dissect kiwi, it is important that you use a mask and gloves.

Kiwi, like most other birds, may carry *Salmonella* or *Yersinia*. These bacteria cause infections of the digestive system (dysentery) which vary in their seriousness. Both bacteria live in the bird’s digestive tract, and you are most likely to get in contact with them when the birds excrete on you during handling.

Kiwi also suffer from other diseases that affect their blood and digestive tract such as *Coccidia* and *Babesia*, but these parasites are not known to affect humans. However, there is always a first time, as not many humans come into contact with kiwi.

We do not think that kiwi carry psittacosis, which is caused by *Chlamydia* spp and which affects the respiratory tract. Although the disease does not kill people, it is serious and debilitating. Its symptoms are those of a very strong flu, and the disease may last for a long time (months).
**External parasites**
Kiwi can have fleas (particularly on Stewart Island), ticks (common in Northland) and featherlice. Some of these may bite and cause severe irritations to sensitive skins.

2.2 Best practice

**Human health and safety**
To prevent being infected with kiwi pathogens you shall maintain the following standards:

When handling eggs, use thin sterile latex gloves (medical or food-industry–type), for safety in handling (yours and the egg’s) and for better touch.

When handling birds, use the most appropriate and most practicable methods available in the situation:
- Cover all your cuts and injuries with band-aids before handling birds, or nests.
- Wash your hands and forearms thoroughly with a disinfectant soap, such as Dettol®, after handling birds and/or nests.
- Do not touch your mouth and face after handling birds or nests.
- Carry alcohol swabs to clean scratches caused by the bird’s claws.
- Clean all wounds inflicted by kiwi thoroughly and apply antiseptic.
- Protect yourself from infections by wearing a mask and gloves when dissecting kiwi.

**Health and safety among kiwi populations**
Disinfect any gear used on the birds (including callipers and bird bags) every time you work with a different population (this will also ensure that you do not transmit disease between birds). More detailed information on preventing transfer of disease between kiwi populations is given in Section 7, which deals with translocations.
3: KIWI WORK PROGRAMMES

The tasks expected from managers working at various kiwi areas are listed, and information on experimental design, data handling and reporting is provided. Examples of the various types of field data sheets are given. All kiwi workers have a responsibility to the Bank of New Zealand for their sponsorship of kiwi projects; guidance is provided for appropriately recognising this responsibility, as well as our responsibility towards iwi and local communities.

Contents:
3.1 Varying management according to kiwi site
3.2 Experimental design
3.3 Data handling
3.4 Reporting
3.5 Public responsibilities

Contributors to this chapter:
Ian Flux, Rogan Colbourne and Hugh Robertson (all sections)

Additional related documents:
Guide to Staff on Maintaining Working Relationships with Iwi (QD: CR1158)
Guidelines for Community Relations in Conservation Projects (QD: CR1293)
Sponsorship Guidelines (QD: C1130)

3.1 Varying management according to kiwi site

Active management in areas where there is kiwi protection will include a combination of tasks as recommended by the Kiwi Recovery Group at annual meetings and identified through the Department’s business planning process.

Mainland populations of all taxa are declining without direct management intervention. Resources and technology available at present mean that we can not stop the decline nationwide, but we can attempt to maintain as much genetic diversity as possible by managing representative populations on the mainland.

Research and management of kiwi is very diverse, as it involves dealing with six taxa variously spread in the wild from near Kaitaia to Stewart Island, as well as a small captive population. Kiwi management varies according to the site and will be agreed upon in consultation between the site staff and advisors.

3.2 Experimental design

To undertake research on kiwi, talk to the local DOC Conservancy Advisory Scientist and the Kiwi Coordinator (Science and Monitoring); they will take your issues or requests to the Kiwi Recovery Group.

Before you start, have a clear idea what you expect the project to produce (e.g. patented device, technical reports, scientific papers, media articles). It is obviously impossible to know in advance precisely what results will occur. Remember that no news is still news, if it is reported accurately. It is tempting to report, and scientific journals tend to publish, only results from studies where significant effects are found, rather than those in which no
significant effect was observed. As long as the study is done rigorously, all results are of equal value to future managers.

You must make sure that your project is closely integrated with ongoing Department of Conservation and other projects in the same area, that it does not interfere with existing projects, and that it ties in with, or optimises, timing of planned pest control programmes in the study area.

Before you start, have a clear idea of when the project will terminate, and what criteria will be used to justify an extension beyond the due date. Allow ample time to analyse and write up the results, and, where appropriate, to restore the study area and study animals back to pre-study condition (e.g. remove tags marking tracks and study burrows; remove transmitters, but not leg bands as these may prove valuable at a much later date). Before you do this, check with the Kiwi Recovery Group, as members may be aware of another project that could usefully build on your project.

### 3.3 Data handling

It is very important that information on kiwi is collected systematically. However, anecdotal information can still be important and sometimes this is all we have. Although it is dealt with differently from systematically obtained data, it can become very useful over time and should be stored safely.

**Field recording**

For casual tasks you should enter field data in waterproof paper pocket notebooks. The notebooks should contain your name and address, and have blocks of reflective tape front and back, making it less easily lost at night. The field data **must** be transferred to electronic file as soon as possible or photocopied and the copy stored in a safe place away from where the field notebook is normally held.

For routine tasks, such as kiwi call monitoring or regular checks on radio-tagged birds, you **must** enter data onto pre-printed cards (e.g. Kiwi Call Scheme Cards), or on field data sheets, featuring block descriptors such as those given in Figure 3.1. This sheet was developed by Pat Miller, Northland Conservancy. The advantage of using such forms is that consistent data is recorded each time, and there is less chance of forgetting to record some variable. Pat’s A4 field sheets are held on a clipboard in the field, and then transferred to a ring-binder in the office, once the data has been entered into an electronic database.
Electronic databases
A variety of Excel databases should be created to keep track of individual birds, to store information recorded each time individuals are encountered, record nesting success and productivity, and keep track of transmitter lives and when transmitter tapes were last replaced. The following sections describe the standard databases you should maintain. As different projects develop, new data sheets or specific data sheets may also be necessary.

Individual file
This is a file containing basic information on each individual handled, which is useful for keeping track of individuals, filling in banding schedules, and keeping track of when transmitters and tapes were last replaced. Figure 3.2 describes and elaborates on the columns which should be included.
Figure 3.2: Base file columns and explanation

<table>
<thead>
<tr>
<th>Column</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locality</td>
<td>site name</td>
</tr>
<tr>
<td>Band</td>
<td>band number, wing-tag and/or transponder</td>
</tr>
<tr>
<td>Side</td>
<td>left/ right side the bird is banded, tagged or transponder inserted</td>
</tr>
<tr>
<td>Colour</td>
<td>combination on band</td>
</tr>
<tr>
<td>Nickname</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Mate</td>
<td>band number of mate (if known)</td>
</tr>
<tr>
<td>First Date</td>
<td>date when first found</td>
</tr>
<tr>
<td>Tx</td>
<td>transmitter frequency</td>
</tr>
<tr>
<td>Taped</td>
<td>date the transmitter was last taped</td>
</tr>
</tbody>
</table>

**Data file**
This is the master file recording all the information from each encounter with each bird, whether radio-tagged or not. This file can be sorted on a variety of variables for different purposes. Figure 3.3 illustrates and elaborates on the columns required for this file.

Figure 3.3: Data file (master file)

<table>
<thead>
<tr>
<th>Column</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locality</td>
<td>site name</td>
</tr>
<tr>
<td>Record</td>
<td>number</td>
</tr>
<tr>
<td>Date</td>
<td>in YYYYMMDD order, for ease of sorting</td>
</tr>
<tr>
<td>Band</td>
<td>band transponder number</td>
</tr>
<tr>
<td>Colour</td>
<td>colour combination</td>
</tr>
<tr>
<td>Tx</td>
<td>transmitter number (also put r/ as a prefix before the current transmitter frequency to indicate that another transmitter was removed)</td>
</tr>
<tr>
<td>Age</td>
<td>chick/ juvenile/ sub-adult/ adult/ unknown</td>
</tr>
<tr>
<td>Sex</td>
<td>male/ female/ unknown</td>
</tr>
<tr>
<td>Mate</td>
<td>band number of mate</td>
</tr>
<tr>
<td>Bill</td>
<td>bill length (mm.x)</td>
</tr>
<tr>
<td>Width</td>
<td>tarsus width (mm.x) (optional)</td>
</tr>
<tr>
<td>Depth</td>
<td>tarsus depth (mm.x) (optional)</td>
</tr>
<tr>
<td>Length</td>
<td>tarsus length (mm.x) (optional)</td>
</tr>
<tr>
<td>Weight</td>
<td>weight (g)</td>
</tr>
<tr>
<td>Condition</td>
<td>poor to excellent; gravid; dead</td>
</tr>
<tr>
<td>Nest</td>
<td>contents information (possible nest/ probable nest/ on nest/ no. eggs or chicks)</td>
</tr>
<tr>
<td>Site</td>
<td>number – try to label daytime shelters with a permanent marker, but some (e.g. among rushes or gorse) are unlabelled (unl). Those used as a nest are given a suffix “N”.</td>
</tr>
<tr>
<td>Notes</td>
<td>include brief information on behaviour, appearance, cause and time of death, etc</td>
</tr>
</tbody>
</table>
**Nest file**
For each nest, maintain a more detailed Excel file (see Figure 3.4).

**Figure 3.4: Nest file**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nest</td>
<td>site number from Data file</td>
</tr>
<tr>
<td>Date</td>
<td>in YYYYMMDD order</td>
</tr>
<tr>
<td>Male</td>
<td>band number of male</td>
</tr>
<tr>
<td>Female</td>
<td>band number of female</td>
</tr>
<tr>
<td>Colour</td>
<td>colour combination of male</td>
</tr>
<tr>
<td>No. eggs</td>
<td></td>
</tr>
<tr>
<td>No. chicks</td>
<td></td>
</tr>
<tr>
<td>Record</td>
<td>record number from data file</td>
</tr>
<tr>
<td>Notes</td>
<td>include egg/chick measurements, and transponder numbers of chicks, or fate of nest</td>
</tr>
</tbody>
</table>

**Transmitter file**

For each transmitter, maintain an Excel file (see Figure 3.5). A template for a transmitter file with calculations embedded is given at WGNCR-25111. If you are working outside DOC, ask the Kiwi Coordinator (Research and Monitoring) to email or post you a copy of the template.

You should highlight in bold those rows containing information on transmitters currently in use, and highlight in italics those rows containing information about transmitters being re-potted.
### Figure 3.5: Transmitter file

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tx:</strong></td>
<td>Frequency and fine-tuning; you will need to add an initial blank space or a ‘ so that Excel doesn’t read this as a number or date!</td>
</tr>
<tr>
<td><strong>Location:</strong></td>
<td>Band of the bird (e.g. R 33333), or present location (e.g., Sirtrack, storage)</td>
</tr>
<tr>
<td><strong>Expected Life:</strong></td>
<td>Manufacturer’s stated life in days (or a conservative estimate of it, to be safe); this field can also be used to track repotting times by entering the estimated days for this procedure. Normally Sirtrack will give the estimated life of transmitters with each package they send.</td>
</tr>
<tr>
<td><strong>Elapsed:</strong></td>
<td>= 0 + Total Use; i.e. the time the transmitter has been running since new or since repotting.</td>
</tr>
<tr>
<td><strong>Date On:</strong></td>
<td>Date when tx turned on or when sent for repotting (<strong>NOTE make sure you are using DD/MM/YYYY format</strong> found by highlighting the cell, click ‘Format’, ‘Cells’, ‘Custom’, then choose this format.</td>
</tr>
<tr>
<td><strong>Julian On:</strong></td>
<td>= Date On as a number (create a column whose cells are numbers (highlight cells, click ‘Format’, ‘Cells’, ‘Number’, then in each cell type = the cell name which contains ‘Date On’ information, e.g. =E4). For example, 4/3/1999 (4 Mar 1999) will become 36223 – a ‘Julian date’, being the number of days elapsed since 1 January 1900).</td>
</tr>
<tr>
<td><strong>Date Off:</strong></td>
<td>Date tx removed and turned off (<strong>NOTE: DD/MM/YYYY format</strong>)</td>
</tr>
<tr>
<td><strong>Julian Off:</strong></td>
<td>= Date Off as a Julian date</td>
</tr>
<tr>
<td><strong>Session:</strong></td>
<td>= Julian Off - Julian On; i.e. the time running in each session</td>
</tr>
<tr>
<td><strong>Total Use:</strong></td>
<td>= Elapsed + Session; i.e. the total time used to the end of that session – this will become the figure for Elapsed on the next row.</td>
</tr>
<tr>
<td><strong>Julian Replace:</strong></td>
<td>= Julian On + Expected Life; i.e. the expected Julian date when the transmitter will have to be removed and replaced with another.</td>
</tr>
<tr>
<td><strong>Replace:</strong></td>
<td>= Julian Replace as a date format – of the Excel options available for date, only <strong>DD/MM/YYYY</strong> is sensible and not open to misunderstanding; don’t follow the American convention of <strong>MM/DD/YYYY</strong>. You can get the <strong>DD/MM/YYYY</strong> format from ‘Custom’ rather than ‘Date’. DD-MMM-YYYY is an alternative, e.g. 23-Jun-2002.</td>
</tr>
<tr>
<td><strong>From Today:</strong></td>
<td>= Julian Replace - Julian of current date (you will need to calculate this somewhere on your spreadsheet) for those transmitters in use, or being re-potted. This gives a clear indication of those transmitters getting close to having to be replaced.</td>
</tr>
</tbody>
</table>

## Data analysis

Science and Research Unit staff will assist with study design, data analysis and population modelling, and thus ensure that a nationally consistent and statistically robust approach is taken. The two main contacts are Hugh Robertson (SRU, Wellington) and Ian Westbrooke (SRU, Christchurch).

A practical guide to the management and analysis of survivorship data from radio-tracking studies is being prepared by Hugh Robertson and Ian Westbrooke (SRU, DOC). This guide will provide consistent rules for the handling and analysis of radio-telemetry data, so that results are comparable across studies. It will show how to analyse survival data held in Excel files in SPSS, and in specially prepared Excel spreadsheets for those who don't have ready access to SPSS or other major statistical packages. The draft guide and Excel spreadsheets are available from Hugh Robertson (SRU, Wellington), but the published guide should be available in late 2003.

Another Excel file is available from Hugh Robertson (SRU) for the analysis of breeding data, which calculates crude hatching, fledging and nesting success, and also daily nest survivorship, but supporting documentation is still under preparation.
3.4 Reporting

Department of Conservation staff who are working on kiwi need to be aware of and meet the following three reporting requirements as required:

- Monthly Operating Report
- End of Season Report
- Summary Report to the Kiwi Recovery Group.

Any external individual or group who receives funding from DOC or from the Kiwi Recovery Group sponsor must supply the Kiwi Recovery Group with an annual report.

3.5 Public responsibilities

Consultation with local communities and iwi

There should be adequate consultation with local communities and tangata whenua, so that affected locals and neighbours are fully able to contribute to the planning of your project. If possible, involve these stakeholders in physical help with the project. During transfers, recognise the spiritual significance of such events to tangata whenua. Keep stakeholders informed about the progress of projects, either through informal or formal communication channels, as appropriate.

We should work hard to truly try and reach agreement – consultation does not require agreement between parties, but we should aim for this whenever it is possible. On occasions, this could take a long time and a lot of energy, but if we can reach agreement, the effort and time are well worthwhile.

When consulting, you will need to allow for an effective lead-in time and you will need to set up – well ahead of time – the consultation protocols you intend to observe. The Department can help with already published advice (see QD1158, Guide to Staff on Maintaining Working Relationships with Iwi). As well, the Department’s community relations managers and kaupapa atawhai managers can help you. You will need to be aware of what local rules or processes need to be accommodated, but it is also important to let the iwi or hapu with whom you are dealing be aware that legislative or scientific issues can on occasion override immediate local concerns.

Bank of New Zealand Kiwi Recovery Trust

The Bank of New Zealand Kiwi Recovery Trust was established in November 2002 by the Department of Conservation and Bank of New Zealand. The Trust is the successor to the Kiwi Recovery Programme, a partnership established in 1991 between the Department of Conservation, Bank of New Zealand and the Royal New Zealand Forest & Bird Protection Society.

Bank of New Zealand Kiwi Recovery is the umbrella banner for all kiwi recovery work undertaken by the Department, the Bank, the Bank of New Zealand Kiwi Recovery Trust, as well as any community or other work that the Trust funds.

The establishment of a Trust is designed to facilitate additional sponsorship and fundraising opportunities, as well as to pave the way for greater community participation in kiwi recovery initiatives.
Bank of New Zealand Kiwi Recovery is the largest environmental sponsorship in New Zealand. The establishment of the Bank of New Zealand Kiwi Recovery Trust is a landmark in kiwi recovery funding and will be looked on as a model for future conservation sponsorships. The Department of Conservation has a service agreement with the Bank of New Zealand Kiwi Recovery Trust setting out its obligations to the Trust which in turn will support Bank of New Zealand’s ongoing commitment to sponsoring kiwi. These obligations are summarised below.

**Stakeholder and sponsor involvement**

Local stakeholders, the Bank of New Zealand Kiwi Recovery Trust and, at mutually agreed occasions, Bank of New Zealand should be involved in kiwi recovery projects. Indeed, the Trust’s involvement in your projects is encouraged as often as is practicable. Allow in your planning for events such as open days, or take stakeholders with you into the field when this can be done.

Bank of New Zealand is the principal sponsor of Bank of New Zealand Kiwi Recovery. This does not preclude other community groups (eg, Rotary, Lions, schools) from being involved with local DOC or community projects, or charitable trusts from supporting work that helps the local kiwi population. However, before you enter into an arrangement with a local sponsor or funding body, please refer to the sponsorship officer, External Relations Division, to ensure that conflicts with the principal sponsor do not arise.

Funding for Bank of New Zealand Kiwi Recovery comes from two sources:

- Crown revenue through the annual allocation to the Department of Conservation in the national budget, recently including a specific allocation from New Zealand Biodiversity Strategy funding
- revenue from the Bank of New Zealand Kiwi Recovery Trust, which currently comprises Bank of New Zealand sponsorship funds, income from Bank of New Zealand product-related campaigns such as kiwi pictorial cheque books, as well as donations and interest. In the future, additional sponsorships and fund raising will help increase Trust funds available to kiwi recovery.

**What we need to do**

The Department of Conservation has a contract with the Bank of New Zealand Kiwi Recovery Trust governing the conditions of the sponsorship arrangement with Bank of New Zealand. In summary, please ensure the following with respect to any kiwi recovery initiative:

1. Acknowledge Bank of New Zealand Kiwi Recovery Trust, whenever and wherever possible. This includes media releases, promotional materials and publications, and when being a spokesperson. More details are provided below.
2. Involve the Executive Director of the Bank of New Zealand Kiwi Recovery Trust, whenever and wherever possible. This includes open days, field trips, and other public awareness opportunities, as well as regular updates on the progress of your kiwi recovery project.
3. Refer any sponsorship, donation or funding enquiries to the Executive Director of the Bank of New Zealand Kiwi Recovery Trust, and copy to the sponsorship officer at Head Office. Refer general queries to the website, www.kiwirecovery.org.nz
4. Get approval from the Trust for all advertising or promotional material relating to kiwi recovery, e.g. display panels and fact sheets, and for any use of the Bank of
New Zealand Kiwi Recovery logo. Copy in the sponsorship officer at Head Office. Please also note that all media releases must be forwarded to the Trust and sponsorship officer prior to release for Trust and Head Office sign-off.

Contact details:

Kieron Goodwin, Executive Director, Bank of New Zealand Kiwi Recovery Trust
Tel: 09 375 1084, Email: kiwirecoverytrust@bnz.co.nz

Tim Amos, sponsorship officer, Conservation Awareness Unit, External Relations Division.
Tel: 04 471 3122, VPN 8122, Email: tamos@doc.govt.nz

Media Releases

All media releases written by the Department of Conservation about kiwi (even if no sponsorship dollars have been given directly to the project concerned) must use the media release template and mention Bank of New Zealand Kiwi Recovery, or the Bank of New Zealand Kiwi Recovery Trust. Guidelines are available on the DOC intranet at NPPM C1409.

As early as possible, your spokesperson or written release should refer to “Bank of New Zealand Kiwi Recovery”.

Before you issue a media release, you must send a draft for approval to the Head Office sponsorship officer and the Trust’s Executive Director. They will ensure suitable acknowledgement within the release and consider government sensitivities.

All press releases should inform journalists where they can find more detail, either in a sentence after the end of the press release or within the text. For example, “Bank of New Zealand Kiwi Recovery Trust was established in November 2002 by the Department of Conservation and Bank of New Zealand. The Trust is responsible for coordinating fundraising and funds allocation nationally, as well as public awareness and education. Further background information can be found on www.kiwirecovery.org.nz, or by contacting Kieron Goodwin, Executive Director, Bank of New Zealand Kiwi Recovery Trust on 09 375 1084. ”. This makes it easier for the journalist to get more background information.

At media events or in high public profile situations:

- one or two key DOC staff wear Bank of New Zealand Kiwi Recovery cap, shirt and/or sweatshirt and DOC name badge. They wear no other items of DOC uniform.
- other staff are present wearing DOC uniform. They wear no items of Bank of New Zealand Kiwi Recovery clothing.
- say “Bank of New Zealand Kiwi Recovery”, not “the kiwi recovery programme”.
- say “Bank of New Zealand Kiwi Recovery Trust”, not “the kiwi trust” or “the trust”
- say “Bank of New Zealand”, not “BNZ”.
- use the template for all media releases about kiwi (refer to NPPM C1409 for the template and other tips).

Items like transfer boxes should be labelled clearly on all sides with Bank of New Zealand Kiwi Recovery branding. Apparel and stickers are available from the sponsorship officer at Head Office.
When approached by the media, consider if the request is best dealt with nationally, especially if there are any potential political sensitivities, such as issues to do with funding and strategic directions. If in any doubt, pass the request on to the National Kiwi Recovery Coordinators or to External Relations Division. If dealt with at a local level, please alert the above as soon as possible, and let them know the questions and answers, and the likely time when the resultant article or item will appear.

If the media get in touch with you directly, contact your Conservancy community relations staff before you respond. In particular, do not be drawn into answering questions related to funding and strategic priorities. Do not be afraid to tell a journalist that you are busy, or want to check information with others, and that you will get back to them – but, do get back to them, even if to tell them to direct their questions to another spokesperson. Remember to check their deadline – it can be within minutes.

Whenever possible, mention Bank of New Zealand Kiwi Recovery at any interview with media representatives, and refer the journalist to the National Kiwi Recovery Coordinators or the Executive Director of the trust for a national perspective.

Record keeping and reporting

Provide the sponsorship officer with updates on the progress of kiwi recovery projects funded by the Bank of New Zealand Kiwi Recovery Trust in December and April/May.

Also briefly report on major media events or stories which have broken, especially where DOC media releases may not have been the main source of communication. Who was interviewed?, was BNZKR mentioned by DOC?, were those mentions of BNZKR in the resulting television/radio/print story? was BNZKR apparel worn? how did the story develop? Did we learn anything for next time? There might be about six of these stories per year in total.

These reports will be consolidated and forwarded to the BNZKRT.

The objective of this monitoring is to increase the number mentions of Bank of New Zealand Kiwi Recovery in media stories. The more profile BNZKR has, the better for kiwi and the easier it is to raise more funds.

All outgoing DOC media releases about kiwi go to the Trust before being made public so there is no need to collect and report on these. Bank of New Zealand clips all resulting print media stories about kiwi to monitor mentions of Bank of New Zealand Kiwi Recovery so there is no need to report on these.
4: SURVEYING AND MONITORING TECHNIQUES

This module sets out the methods that are used for surveying and monitoring kiwi.

Contents:
4.1 Determining kiwi presence, abundance and distribution
4.2 Monitoring kiwi populations

Contributors to this chapter (sections contributed):
Rogan Colbourne and Hugh Robertson (all sections)

Additional related documents:
Guidelines for Ecological Survey and Monitoring (QD: 1284)
For information on where to buy field equipment and supplies, see Appendix 2.1.
For use of dogs in monitoring and surveying kiwi populations, see Section 10, Methods under Development: Using Dogs in Kiwi Work.

4.1 Determining kiwi presence, abundance and distribution

The following techniques have been used by field personnel to find kiwi in areas where there was no previous information or where there was believed to be a small kiwi population. In addition, these techniques can provide information on the relative abundance of kiwi and their distribution over wide areas.

Because of the secretive behaviour of kiwi and the fact they are nocturnal it is very difficult to count all birds in a known area. For this reason, we use surveys to give us an indication of kiwi presence and activity in an area. To survey kiwi we make use of their calls because we know that most territorial kiwi call regularly and very loudly. Birds can be heard calling up to one and a half kilometres away in ideal listening conditions. Additionally, male and female kiwi produce different sounding (sexually dimorphic) calls allowing us to know of the possible presence of pairs in an area.

Survey techniques based on calls only allow estimation of relative abundance, due to the fact that not all kiwi call at the same frequency or volume. For example, males generally call about 2-3 times more frequently than females. In addition, the lower pitched calls of females don’t carry as far as the whistle-like calls of the males. Juveniles are usually silent in their first year and some non-territorial adult or sub-adult birds rarely call. During the breeding season many birds are on nests and so are not calling.

Since kiwi are territorial, if you can locate different calling birds you may be able to determine their distribution in a specific area. As with the estimation of the number of kiwi in an area, determining the distribution of kiwi has limitations in that it is based on calling birds. In the same way, to obtain the best and most reliable information you must follow the same steps in the same way each time you survey.

Kiwi Reporting Card

The Kiwi Reporting Card (Figure 4.1) is important in drawing attention to the possible presence of kiwi in an area. This scheme is aimed at the general public, especially hunters, trampers and climbers, but DOC field staff can help by recording the same observations whenever they are in the bush. This scheme solicits records of kiwi sightings, kiwi heard, feathers found, probe holes (feeding evidence), kiwi footprints or kiwi faeces. Although there
is often confusion between kiwi sign and that made by other animals, if there are enough reports from a given area, then you can organise a survey to verify these reports.

**Figure 4.1. Kiwi Reporting Card**

<table>
<thead>
<tr>
<th>DATE:</th>
<th>LOCATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAP SERIES</th>
<th>SHEET</th>
<th>GRID REFERENCE</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER OF KIWI SEEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Other, please specify)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER OF KIWI HEARD</th>
<th>SIGNS OF KIWI PRESENT</th>
<th>OBSERVER’S DETAILS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PHONE: Home/Work</td>
</tr>
</tbody>
</table>

| COMMENTS | |
|----------||
| (Vegetation, habitat, dogs or other predators seen) | |

Are you 100% sure that what you saw or heard was a kiwi? **YES/NO**

**Kiwi Call Scheme**

The Kiwi Call Scheme has three main aims:

∞ to determine the national distribution of kiwi
∞ to relate kiwi call rates to location and habitat
∞ to assign a kiwi call index at a known season to each listening station to enable the dynamics of the population to be determined with time. Repeated listening at these stations after 5, 10 or 20+ years may indicate whether a population is stable, increasing or declining.

The record card provided (see Figure 4.2) is intended for use by interested people whenever they are spending a night or nights in likely kiwi habitat. The Kiwi Call Scheme will allow only relative abundance of kiwi to be determined; it cannot be used to estimate absolute numbers because not all birds call. There is a good correlation between call rates and density in high-density populations, but the relationship is not so good at low densities.
Figure 4.2: Kiwi Call Scheme Card (front of card)

<table>
<thead>
<tr>
<th>CARD No.</th>
<th>KIWI CALL SCHEME</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBSERVER:</td>
<td>Date:</td>
</tr>
<tr>
<td>Address</td>
<td>Locality Name:</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Series</td>
</tr>
<tr>
<td>NOTES:</td>
<td>Grid Reference</td>
</tr>
</tbody>
</table>

**Tape or minidisc recordings of calls of both sexes of all species of kiwi are available from the Kiwi Call Scheme, SRU, and includes the other calls which could be confused with those of kiwi, e.g. weka, pukeko, possum, morepork and long-tailed cuckoo. Please send a blank cassette or minidisc and these calls will be recorded and your tape returned. DO NOT use this tape to stimulate kiwi to call before or during a listening period unless directed to. An example where a tape could be used is if a forest is to be logged and it is unknown if kiwi are present or not, or if the population is known to be very sparsely distributed. In those few situations, indicate that a tape was used by inserting an asterisk (*) at the end of the location field on the card and note the times the tape was played. This is to avoid confusion with other groups listening and to separate those solicited records from natural records.**
Figure 4.2 (continued): Back of card

<table>
<thead>
<tr>
<th>Start time:</th>
<th>Finish:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp</td>
<td>Sex</td>
</tr>
</tbody>
</table>

| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

<table>
<thead>
<tr>
<th>OTHER ANIMALS HEARD</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morepork</td>
<td>none</td>
<td>few</td>
<td>mod</td>
<td>many</td>
</tr>
<tr>
<td>Weka</td>
<td>none</td>
<td>few</td>
<td>mod</td>
<td>many</td>
</tr>
<tr>
<td>Possum</td>
<td>none</td>
<td>few</td>
<td>mod</td>
<td>many</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>few</td>
<td>mod</td>
<td>many</td>
<td></td>
</tr>
<tr>
<td></td>
<td>few</td>
<td>mod</td>
<td>many</td>
<td></td>
</tr>
</tbody>
</table>
**You will need:**
- Compass
- Watch (preferably digital)
- Kiwi Call Scheme Cards
- Hard folder
- Pencil (sharpener/pocket knife)
- Maps
- Warm clothing

**Method:**

1. Choose listening stations with a view to covering the widest listening area within the prevailing weather and topographical conditions. Best listening stations are situated on prominent knobs, hilltops, ridgelines, spurs, or river flats, away from loud river or sea noise. However, don’t be put off listening from a campsite in thick bush, so long as the listening category ‘narrow’, ‘medium’ or ‘wide’ is stated.

2. The stations should preferably be situated at least 1 km apart to reduce the coverage overlap between adjacent listening stations.

3. On a topographical map, estimate the listening range available from each listening station – at many places a ridge or spur will cut out distant calls in certain directions, giving a less than circular listening range.

4. Go though the Call Scheme Card methods before you go out. You may want to practice your skills using other animal calls at night. Make sure that you remember how to use a compass and that you know how other nocturnal animals sound including kiwi (male and female).

5. Before leaving to go to the listening stations remember to synchronise watches with any other personnel listening in the same area.

6. Arrive at the listening station with enough time to get ready for recording. Remember that if the station is on a hill you will be hot and sweaty and will require some time to cool off, then pile some clothing on and get your forms ready before you will be ready to listen. Make sure that you have all the clothing and gear you will need through the survey handy, so that you do not make unnecessary noise during the survey.

7. Start your listening period no earlier than 45 minutes after sunset. It is a good idea to make notes on the timing of the sunsets at the time of year when you are planning to do call counts.

8. Preferably, do your listening within the first four hours of darkness. Listening conditions are best on a dark night, away from excessive river and wind noise.
   - Preferably limit yourself to recording the birds that called during a two hour period; however, listening periods of other lengths are acceptable. Avoid starting or finishing a count just because you heard a bird, otherwise the call rate will be artificially high. Do record any birds that called outside the listening period in the Notes section, making sure it is clear that they did not call while you were surveying.

9. Fill out the card using the guide provided.

10. Do not solicit calls from kiwi using tapes, unless you have been asked to. If you do use tapes, make sure this is clear from your notes.

11. After the survey, total up the number of calls at the completion of listening and try to make an estimate of the number of individuals you heard during the listening period.

12. Describe listening stations well. You should do this during daylight hours.

13. A copy of all data collected should be sent to the Coordinator of the Kiwi Call Scheme (presently Rogan Colbourne SRU, DOC, PO Box 10-420, Wellington).
Filling in Kiwi Call Scheme Cards (Figure 4.2)
The information we require from the surveys must be written down in a Kiwi Call Scheme Card.

Card number
The top right-hand space is to remain blank. If you wish to link the number of a listening station in the area surveyed, use the Notes section on the card.

Observer
If more than one person listens from a listening station give the name of the most experienced observer first. This simplifies computer processing. For each new observer give address and affiliation (e.g. DOC) on the first card only. This information is not required on subsequent cards unless addresses or affiliations change.

Location
Give in order, the name of the Department of Conservation Conservancy, the province, the forest or reserve etc. and the nearest named locality or feature (such as river, stream, trig etc.). Finally, give a brief description of the exact location of the listening station (use the notes section if you run out of space). For example Southland, Stewart Island, Mason Bay, mound 100 m to east of Island Hill Homestead. This location will be further verified by the grid reference. This enables all records from Southland to be sorted or all records from Stewart Island (via Southland) to be accessed. If possible include a photocopy of the NZMS 260 series map of the area with the listening stations and listening area marked.

Grid reference
Wherever possible, use maps of the metric NZMS 260 series; these now cover the entire country. The metric 260 series map number is coded with a letter followed by two numerals. The grid reference consists of two five-digit numbers. Include the smaller figures of the grid number at the corners of the map in these spaces. A sample reference for Mt Robertson on Picton NZMS 260 sheet P27 would be: Series 260 sheet P27 grid ref. 25955 59838. If using a GPS, give full 14-digit location (and error) in the Notes section.

The N, S, X on the card refers to the old NZMS 1: 63,360 series.

Notes
If kiwi are heard in the area but do not call during the listening period, please note this fact. This information is important for distribution analysis. If more space is required for notes, continue writing under the entry of the last call heard on the back of the card (at the completion of the listening period).

Noise
This is a subjective score of interference to listening caused by wind, river, waterfall or sea noise, talking by non-listening members of the party or noise from other animals. Avoid noisy conditions wherever possible.

Moonlight
A subjective score of how bright the moonlight was, averaged over the listening period. Some taxa of kiwi have been shown to call less often on bright moonlight nights.
Listening coverage
When listening from a ridge on a calm night choose ‘wide’. When listening from a campsite in a gully underline ‘narrow’. Listening in a gully with a noisy creek and pouring rain... forget it!

Major habitat types
Mark a maximum of three categories of vegetation found within the zone of listening. If other habitat types than those listed are present, ring 17 and explain in Notes. Developed farmland is typical New Zealand pasture, well fenced, intensively grazed, and with few trees. Undeveloped farmland has rank grasses, perhaps interspersed with manuka and other scrub throughout and may include extensively grazed river flats or frost flats.

Minutes listened
Give the total the time listened in minutes. The number of calls will eventually be expressed as number of calls per hour.

Calls
Record the calls according to species calling, sex (M/F), time called, compass bearing (degrees) called from, and distance (m) of the calling bird. If unsure about estimating distances, write down ‘close’, ‘moderate’ or ‘distant’. If the same individual calls twice more than a minute apart, write these calls on separate lines. If a pair duets (male or female responds quickly to the call of its partner), show that these calls are linked, and the order that the calls were initiated, e.g. M + F or F + M

Other animals heard
Refer to the tape if any calls heard are unfamiliar to you. Two spaces are available for noting calls from animals other than morepork, weka, or possums, e.g. kaka, crickets, frogs, cattle.

With a wide listening coverage, use the following criteria:
- Few 1-2 individuals in listening area
- Moderate number 3-5 individuals
- Many 6+ individuals

Accessing Kiwi Call Scheme data
The information you give to the Coordinator of the Kiwi Call Scheme on the cards is stored on a computer file (presently in Access). Printouts from given areas together with a map of the up-to-date national distribution are produced for conservancies annually.

While information as to the presence of kiwi in 10 km grid squares can be made available to the general public, the precise locations may be of a more sensitive nature, particularly regarding the most endangered taxa. This database could be used as a guide to potential kiwi poachers or “twitchers” who could disturb the birds. Therefore, access to the Kiwi Call Scheme data is available only to the relevant DOC officer in each Conservancy or to others on application. All data collected is checked by the Coordinator of the Kiwi Call Scheme (presently Rogan Colbourne SRU) to make sure the records are suitable. Once checked, the data is entered either by the Coordinator or in the Conservancy.

Walk-through survey
In well-tracked areas where kiwi density is low or their presence is unknown, walk-through surveys can provide valuable site records while covering a large area relatively quickly. They can be done at any time of night in any month of the year, preferably along a well-formed
track, or on river flats where you are unlikely to get lost or suffer mishaps at night. Note that different kiwi taxa have peaks in their calling at different times of the year (see Table 4.1), so it may be worth returning to a site on a number of occasions during the year.

**Table 4.1. Guide to peak in calling activity by various kiwi taxa (calling can be different according to sites or sub-populations, so this needs on-site truthing.)**

<table>
<thead>
<tr>
<th>Kiwi Taxa</th>
<th>Peak Calling</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Island Brown Kiwi</td>
<td>April to June and September to November</td>
</tr>
<tr>
<td>Rowi or Okarito Brown Kiwi</td>
<td>May to June</td>
</tr>
<tr>
<td>Haast Tokoeka</td>
<td>February to June</td>
</tr>
<tr>
<td>Southern Tokoeka (Fiordland and Stewart Island)</td>
<td>November to February</td>
</tr>
<tr>
<td>Great Spotted Kiwi or Roroa</td>
<td>November to March</td>
</tr>
<tr>
<td>Little Spotted Kiwi</td>
<td>February to August</td>
</tr>
</tbody>
</table>

**You will need:**
- Watch (preferably digital)
- Notebook and pencil
- Compass
- Torches
- NZMS 260 topographic map
- Tape with kiwi calls
- Cassette or minidisc player with amplifying speakers
- Extra batteries for cassette player and speakers
- GPS
- Flagging tape

**Method:**
1. Record the start time, the prevailing weather, moonlight conditions, and habitats.
2. Listen for kiwi as you walk, and record the sex, time, distance and compass bearing of the calling birds. It is possible that you may need to use flagging tape to mark the spot on the track (with the time) where you were when you heard a call, and return in daylight to more accurately assess where a bird called from.
3. Stop every 250 paces (200 m), or 500 paces (400 m) if you especially want to cover more ground in low density populations and play a burst of male calls from a tape, minidisc, or mimicked on a shepherd’s whistle. If there is no response after 1 minute, play a female call on tape or minidisc, or again imitate a male call on a shepherd’s whistle (female calls can’t be done on a whistle). Complete a full 5 minutes of listening at each site before moving on.
4. As accurately as you can, plot the location of any calling birds on a copy of a NZMS 260 topo map. Also mark your monitoring sites and the route you followed.
5. Record your finish time.
6. Summarise the number of times you stopped to play tapes and the number of individual kiwi heard on your survey sheet. Record the total time spent listening (subtract the time not spent actively listening).
7. Send the survey information together with the NZMS 260 topo maps to the Kiwi Reporting Scheme, Science & Research Unit, Department of Conservation, PO Box 10420, Wellington.
This survey will not give you accurate records of kiwi density, but it will let you know about kiwi presence and relative location. To obtain a more accurate picture of the distribution and abundance of kiwi in your area you must carry out a kiwi call scheme survey or a distribution survey.

**Distribution survey**

Kiwi distribution surveys are useful:

- where you are attempting to estimate the relative density of birds before commencing a more detailed study
- where the distribution and abundance of kiwi is poorly known
- when surveying an area for resource consent purposes (normally at the developer’s cost).

Note that surveys of this type are resource-intensive, and remember that failure to detect kiwi does not mean that they are absent from the area. Distribution surveys are two hours long, with no tapes used in the first hour, and preferably with calls broadcast in the second hour to solicit calls.

**You will need:**

- Compass
- Watch (preferably digital)
- Kiwi Call Scheme Cards
- Hard folder
- Pencil (sharpener/pocket knife)
- Warm clothing
- Maps
- Tapes etc

**Methods:**

Follow general instructions given for the Kiwi Call Scheme, and follow these steps as well:

1. During the first hour of the survey record on a Kiwi Call Scheme Card each time you hear a bird calling and at the end of the hour make an estimate of the number of individual kiwi you heard in the first hour.
2. You should continue with the second hour of the survey even if you did not hear any kiwi calls during the first hour.
3. In the second hour, use a separate Kiwi Call Scheme Card from that used in the first hour, and clearly mark this “Second Hour”.
4. During the second hour, preferably broadcast kiwi calls from an amplifying speaker. The calls should be played in the following manner:
   - At the start of the hour broadcast male calls for c.20 seconds.
   - After 15 minutes broadcast c.20 seconds of female calls.
   - After another 15 minutes interval broadcast c.20 seconds of male calls.
   - Finally after another 15 minutes interval broadcast c.20 seconds of female calls.

   If you don’t have suitable equipment, listen for unsolicited calls in the second hour as for the first hour and estimate the number of individuals heard in the second hour and in the whole 2 hour period.
5. Note on your “Second Hour” call card the times that tapes are played, and record every time a kiwi is heard calling.
6. If you can hear other teams playing tapes from another station, record this information on your card.
7. If kiwi approach you in response to the tapes, resist the temptation to chase after them and catch them, but by all means quietly shine your torch above them to verify the sighting.

8. After the survey, summarise your data:
   - Total up the number of calls heard during the first hour of the Survey and make an estimate of the number of individuals you heard during the listening period.
   - Make an estimate of the number of birds you have heard in the second hour.
   - Calculate the total number of birds heard in the two-hour period.

9. A copy of all data collected in Conservancies should be sent to the Coordinator of the Kiwi Call Scheme (presently Rogan Colbourne SRU).

As with the Kiwi Call Scheme, for rapid surveys, it is probably best to cover more listening stations than to make repeat counts at each station. However, for more detailed surveys where you plan to repeat the listening at these stations in the future, you should visit each station on at least three (not necessarily consecutive) nights. These six hours of listening at a station should reveal the presence of most (c90%) resident males and many (c70%) resident females.

4.2 Monitoring kiwi populations

Once you have an idea of the status of your kiwi population you can develop a monitoring programme to track changes in the population caused by natural events (increase or decrease in predator numbers, changes in sex and age ratios) or as a consequence of your management.

The best monitoring programme for your population will depend on time and resources available, and should consider the estimated density and distribution of your population as well as other factors such as other research being carried out at the time. Before you decide to use a particular method you must consult the Kiwi Recovery Group for advice and approval. In addition to the approved methods below, there is a monitoring method under development: walk through surveys with dogs. This is discussed in the development section.

Nationwide Call Count Monitoring Scheme

In the early phase of the Kiwi Recovery Programme, a standardised national scheme was established to monitor changes in kiwi call rates as a surrogate measure of the changes to their populations. The Kiwi Recovery Programme commissioned a report (McLennan 1992) recommending a standardised procedure for monitoring kiwi populations, based on counts of their calls at night. McLennan (1992) developed a sampling procedure capable of detecting a 25% difference between mean call counts. Some minor amendments to the proposed procedure were made by the Kiwi Recovery Group, and outlined in a memo sent to all DOC Conservancies by Hugh Robertson in September 1993.

In 1993, twenty sites were selected throughout the country that covered all populations of kiwi known or suspected to be genetically distinct, and covered a variety of habitat types, and areas with positive or negative population pressures (e.g. predator-free islands, and areas in which management of kiwi will take place). The monitoring procedure at these sites requires the establishment of 3-6 permanently marked listening stations at each site, and for 2 hours of listening to be done for 4-8 nights (i.e., 3 stations x 8 nights, 4 stations x 6 nights, 5 stations x 5 nights, or 6 stations x 4 nights) at each listening station. This gives 48-50 hours of listening at each site each year. This procedure should be repeated at each station for three consecutive years, at the same time of year, to establish a firm baseline in call counts to then measure changes over time. After the baseline has been established, call counts are repeated at 5-
yearly intervals at the same listening stations at the same time of year. If significant changes are detected, counts are repeated the following year to verify the initial results.

**You will need:**
- Compass
- Watch (preferably digital)
- Kiwi Call Scheme Cards
- Hard folder
- Pencil (sharpener/pocket knife)
- Warm clothing
- Maps

**Method:**
1. Choose 3-6 listening stations with a view to covering the widest listening area within the prevailing weather and topographical conditions. Best listening stations are situated on prominent knobs, hilltops, ridgelines, spurs, or river flats, away from loud river or sea noise.
2. Because the same listening stations will be used for future monitoring counts, you should permanently mark the exact location of each listening station with a permanent marker such as an Allflex cattle ear tag (orange, blue or yellow) with a strip of reflective tape added, unless the site description is self-explanatory and/or the tag is likely to be removed by passers-by (or kea) between listening counts. The marker tag should be attached to a stake in the ground or nailed to a tree. The exact location should be photographed and the photos held in the nearest Area Office, with duplicate copies sent to Rogan Colbourne, Science & Research Unit, DOC. The position should be plotted as accurately as possible on NZMS 260 series maps, using GPS wherever possible, with a general description of the location of the site.
3. The stations should preferably be situated at least 1 km apart to reduce the coverage overlap between adjacent listening stations.
4. On a topographical map, estimate the listening range available from each listening station – at many places a ridge or spur will cut out distant calls in certain directions, giving a less than circular listening range. Work out how many nights you need to sample given the number of stations you have to complete the required 48-50 hours of listening (use Table 4.2).

**Table 4.2: Deciding on number of sampling nights required**

<table>
<thead>
<tr>
<th>Number of stations</th>
<th>Number of nights</th>
<th>Hrs / night</th>
<th>Total hr / survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8</td>
<td>2</td>
<td>48</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>2</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>2</td>
<td>48</td>
</tr>
</tbody>
</table>

5. Go through the survey methods and survey card before you go out to do the survey. You may want to practice your skills using other animal calls at night.
6. Before leaving to the listening stations remember to synchronise watches with the other personnel involved in the survey.
7. Arrive at the listening station with enough time to get ready for recording. Remember that if the station is on a hill you will be hot and sweaty and will require some time to cool off, then pile some clothing on and get your forms ready before you will be ready to listen. Make sure that you have all the clothing and gear you will
need through the survey handy, so that you do not make unnecessary noise during the survey.
8. Start your listening period no earlier than 45 minutes after sunset. It is a good idea to make notes on the timing of the sunsets at the time of year when you are conducting the survey prior to the survey.
9. Start listening at the same time each night at all listening sites on each occasion.
10. Listen for two hours within the first four hours of darkness. Listening conditions are best on a dark night, away from excessive river and wind noise.
   o Limit yourself to recording the birds that called during the two hour period that you chose to record birds.
   o Take note of birds that called outside this period making sure it is clear that they did not call while you were surveying.
11. During each 1 hour listen, take some time to fill the parts of the card that deal with the weather conditions at the site. It is a good idea to record weather conditions about halfway through each hour, and average at the end, rather than recording right at the start.
12. Fill in a separate card for each 1 hour period.
13. **Do not solicit calls from kiwi using tapes.**
14. You should continue with the second hour of the survey even if you did not hear any kiwi calls during the first hour.
15. Only record complete hours of listening. If a count is stopped part-way through an hour (e.g. if heavy rain starts), then that complete hour must be re-counted on another night, to bring the sample up to the appropriate number of hours.
16. After the survey, total up the number of calls at the completion of listening and make an estimate of the number of individuals you heard during the listening period (in each hour, and over the 2 hour period).
17. Nationwide call count data should be sent to Rogan Colbourne, Science & Research Unit, DOC.
18. Repeat this procedure for three consecutive years, then reduce to one survey every 5 years.
19. If call rates decrease significantly during a repeat survey in unmanaged populations, then listening at that station must be repeated at the same time of year the following year to verify the trend, especially if there is an important conservation risk to particular taxa.

**During nationwide monitoring, DO NOT play any taped calls or imitate kiwi whistles.** This scheme was deliberately developed not using tapes and broadcasts of calls because changes in technology may bias later results. Data collected by soliciting calls will not be useful.

**Monitoring kiwi using radio-telemetry and designated radio-tagged kiwi populations**

Radio-telemetry is the best tool to monitor the survival and movement of kiwi and it also provides the mechanism to find nests and follow their fate. Radio-telemetry has been used in a number of kiwi populations that are being intensively managed though predator control programmes and/or Operation Nest Egg. Data collected through monitoring with transmitters can be used to model the response of the kiwi population to management, but cannot assess how unmanaged populations are faring.

The number of kiwi that should carry transmitters depends on what is being monitored. For a survivorship/population study, it is preferable to have transmitters on members of at least 20+ pairs in the particular area that you are working. The large sample size is required because:
there is considerable individual variation in the productivity of kiwi
there can be considerable variation between years in predator density and effect
chance events can greatly affect population statistics.

However, there can also be situations where having transmitters on a few birds (e.g. a few males to determine if breeding is taking place after a translocation) can be valuable. Seek the advice of the Kiwi Coordinator (Research and Monitoring) for guidance as to what is appropriate in your area.

Be aware of human-induced stresses that may cause birds to desert their nests, or accidents that cause birds to die prematurely (e.g. transmitter becoming entangled) and take this into account when modelling their population dynamics.

For help with population modelling consult Hugh Robertson (Science & Research Unit, Wellington) and/or Ian Westbrooke (Science & Research Unit, Christchurch).

Radio-tagged populations of kiwi have been established as part of ongoing research and management projects at eight sites around the country (Table 4.3). These provide information on the survival and population turnover of male kiwi in particular, and females are monitored mainly through banding/recapture, although at most sites some are radio-tagged. The geographical scale is much smaller than that of the Nationwide Call Count Monitoring Scheme, but provides much more detailed information on the life history and fate of individuals than any other monitoring method. This complements the designated banded populations (see the next section) to cover all known taxa of kiwi, but includes only populations with conservation management.

**Monitoring kiwi using banded birds and designated banded populations**

Banded populations of kiwi have been established as part of research or management projects at a number of sites around the country. The Kiwi Recovery Group has identified 7 sites where enough territorial birds have been banded to be able to usefully monitor the survival of individuals, and to record population turnover and population change. The geographical scale of monitoring from this scheme is smaller than that covered in the Nationwide Call Count Monitoring Scheme, but it provides critical information on the survival and replacement of individual birds that can be used to make population projections. The seven chosen sites complement those with designated radio-tagged populations (see immediately preceding section) to cover all known taxa of kiwi and include sites with and without protective management (Table 4.3).
Table 4.3: Sites where banded populations of kiwi will be monitored at 5-year intervals.
Sites in italics are being monitored with radio telemetry in 2002 and do not need specific followup at this stage. Great Spotted Kiwi site number 5 is yet to be established.

<table>
<thead>
<tr>
<th>North Island Brown Kiwi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trounson Mainland Island</td>
</tr>
<tr>
<td>Purua- Rarewarewa-Hodge’s (part of Whangarei Kiwi Sanctuary)</td>
</tr>
<tr>
<td>Coromandel Kiwi Sanctuary</td>
</tr>
<tr>
<td>Northern Te Urewera Mainland Island</td>
</tr>
<tr>
<td>1 Puketukutuku Peninsula, Lake Waikaremoana</td>
</tr>
<tr>
<td>Tongariro Forest Kiwi Sanctuary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rowi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Okarito Kiwi Sanctuary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Haast Tokoeka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haast Kiwi Sanctuary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Southern Tokoeka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinton Forks, Fiordland</td>
</tr>
<tr>
<td>2 Island Hill Homestead area, Mason Bay, Stewart Island</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Great Spotted Kiwi</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Saxon Hut, Heaphy Track, Kahurangi National Park</td>
</tr>
<tr>
<td>4 No.3 Hut to Blue Stream, North Hurunui River, Canterbury</td>
</tr>
<tr>
<td>5 Lowland site in West Coast Conservancy or at Kahurangi Point</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Little Spotted Kiwi</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Tiritiri Matangi Island</td>
</tr>
<tr>
<td>7 Red Mercury Island</td>
</tr>
<tr>
<td>8 Kapiti Island (Okupe, Te Kahuotearangi, Te Rere, Rangatira/McKenzie/Trig)</td>
</tr>
</tbody>
</table>

You can use birds carrying bands in order to get an idea of kiwi survival and population turnover. For instance you can band all the birds in an area and return after a few years to recapture them. This will give you an idea of how many birds die or leave that area during that period of time, and also an idea of how many new birds are recruited to that population.

To maintain a good level of banded birds in a population, banding visits are recommended every five years. This time period gives a reasonable chance of recapturing a large proportion of the birds banded on the previous check, and minimises the possibility of death of both members of a pair (complete turnover of pairs) between visits.

You need to catch a representative sample of the entire population. To accomplish that, aim to have at least 20 to 40 birds banded (10 to 20 pairs) at all times. If you have 30 adult kiwi banded, and we assume that annual adult kiwi survival is 90-95%, then 59-77% of the banded birds (18-23 birds) should be alive after five years. After ten years, expect 34-60% (10-18 birds).

If you capture all new birds when you return to recapture the older birds, you can get an idea of the replacement rate of dead or dispersed birds. You will also be able to find out if banded birds have learned to avoid recapture; in this case, call rates and territory mapping techniques will also have to be used, along with capture for rebanding.

You will need:
Banding gear
Method:

1. Every 5 years visit individual chosen sites to band or re-band as many birds as possible during a 2-3 week period.
2. Because of potential adverse effects from human disturbances, on the natural survival and productivity rates of kiwi in these study sites, it is important that these banded populations are not disturbed (e.g. birds removed to repopulate other sites) between the 5-yearly visits. Additionally, the visits should be made outside the main breeding period.
3. You should plot the locations of birds calling at night on maps of the study area, and link this to data from the capture and, if available, short-term radio-telemetry of some birds to determine the number of pairs present. At a few sites where the population density is very high (e.g. Kapiti Island, central Northland) the site visit should be limited to checking specific territorial kiwi in well established burrows.

Permits should not be issued to conduct new scientific research on kiwi at the long term study sites listed in Table 4.3, or to transfer eggs or birds from study pairs in these study areas. Permits to conduct management or other scientific research at these sites should be issued only after consideration of the effect that any disturbance may have on the banded kiwi populations there. The exception to this rule is where banded populations have been established as part of an ongoing conservation research-by-management programme (e.g. in Mainland Islands or in Kiwi Sanctuaries), where the effects of disturbance can be quantified.

Given that Little Spotted Kiwi populations are flourishing on a number of offshore islands (Colbourne & Robertson 1997) and have low mortality rates there, the Kiwi Recovery Group considered that banded populations on Hen Island, Tiritiri Matangi and Long Island (Marlborough) need to be checked only every 10 years after the 2001-02 check on Tiritiri Matangi.
5: CAPTURE TECHNIQUES

This section to be withheld if manual is publicly released.

This module explains all current techniques used to catch kiwi and indicates the most appropriate time and terrain for each to work successfully.

Contents:

5.1 Introduction
5.2 Catching kiwi at daytime shelters
5.3 Mapping daytime shelters
5.4 Hand capture of kiwi at night
5.5 Catching kiwi using fishing nets or mist-nets at shelter burrows

Contributors to this chapter (sections contributed):
Rogan Colbourne (all sections)
Lance Dew (5.4 and 5.6)
Hugh Robertson (all sections)

Additional related documents:
For information on where to buy gear see Appendix 2.1

Methodology for working with kiwi dogs and for catching kiwi with mk2 nets has not yet been sorted to best-practice level. The techniques and comments currently part of good practice are given in Section 10 (using dogs) and Section 11 (using nets)).

5.1 Introduction

Catching kiwi is stressful on the birds, can potentially attract attention of predators, and can cause desertion of nests. For this reason catching birds shall only be done as part of a Kiwi Recovery Project, and after approval by the Kiwi Recovery Group.

The main reasons for catching kiwi are:
∞ to establish a marked population of kiwi for designated monitoring programmes (capture)
∞ to record band numbers or replace transmitters (recapture)
∞ to take samples of various kinds as part of Kiwi Recovery Projects (capture or recapture).

You can catch kiwi both at night and during the day. The decision on what technique to use should be based on your own circumstances and your training.
If you are catching birds for the first time, you shall follow this protocol:

<table>
<thead>
<tr>
<th>Kiwi density</th>
<th>Day</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low density</td>
<td>Very difficult but may be possible with</td>
<td>Specialist dog (see Section 10 on current practice)</td>
</tr>
<tr>
<td>populations</td>
<td>specialist dog</td>
<td>Hand catch (light understorey)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hand catch using nets (all terrain)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Locate nests by plotting male calls, then set up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>capture stations nearby (kiwi species specific,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>avoid catching females during breeding season)</td>
</tr>
<tr>
<td>High density</td>
<td>Daytime shelters (all terrain)</td>
<td>Specialist dog (see Section 10 on current practice)</td>
</tr>
<tr>
<td>populations</td>
<td>with specialist dog</td>
<td>Hand catch (light understorey)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hand catch using nets (all terrain)</td>
</tr>
<tr>
<td>Okarito</td>
<td>As for other populations</td>
<td>Hand catch using nets – see notes in Appendix 5.1.</td>
</tr>
<tr>
<td>population</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To recapture birds:
- locate birds with transmitters (can use the help of trained kiwi dogs)
- extract birds from known daytime burrows using bare hands to remove birds
- dig a shaft if burrow is too long, or use netting outside the burrow entrance at night when it is impossible to dig a shaft (e.g. from a hollow log, the hollow base of a tree, or very deep burrows).

**Weather:** Catching works best if weather conditions are still and dry, although there is nothing to stop the operation proceeding if there is drizzle or light showers. However, it is not a good idea to handle wet kiwi because the birds’ waterproofing can lose its effectiveness. You should avoid catching birds in very wet weather.

**Season:** Gravid females may be particularly vulnerable to egg damage and so bear this in mind when handling kiwi likely to be breeding. Consult with the Kiwi Recovery Group before proceeding with captures.

### 5.2 Catching kiwi at daytime shelters

**You will need:**
- Permits
- Radio-telemetry gear
- Torch
- Hand trowel or spade
- Pruning saw
- Small flexible mirror (those used for car/motorbike)
- Gear for whatever you are catching the bird for (i.e. banding, blood sampling, measuring).

**Method:**
1. Locate a burrow or shelter by using trained kiwi dogs (see Section 10), radio-telemetry or your own knowledge of the location of daytime shelters.
2. Approach unknown sites carefully. Remember that kiwi can breed at any time of year, and so be aware that the daytime shelter may be a nest, or contain a heavily gravid female. As a general rule if the entrance is covered with vegetation, treat the...
shelter as a nest, mark the location and leave the area quietly, preferably by walking further on rather than back-tracking (in case predators such as dogs or ferrets follow your trail to a dead end).

3. Determine if there are multiple exits from the shelter, and block these off with bags, clothing, or handy rocks or fallen branches.

4. Check the contents of the shelter first by shining a torch in one of the entrances, if necessary, use a small mirror on a stick. If available you can use a small camera with LCD to see around corners. It is usually possible to see how many birds are present. To record colour-bands, the birds may need to be gently moved with the help of a stick or your hands, to make their legs visible.

5. If you can’t reach the bird safely, then you will need to block the entrances and dig a shaft. To dig a shaft, use a hand trowel or spade, and a pruning saw, to remove roots found in the way.
   - Find out the direction of the shelter using a stick and feeling the sides of the shelter.
   - Start digging into the shelter further along in the direction that the burrow or hollow log is running (it always seems further down than you imagine).
   - Once you have gently broken through, check the next length of the burrow with torch and mirror, and then dig further shafts as necessary.
   - Remember that birds might be immediately below the shaft, so the holes should be dug carefully, especially when breaking through the last bit of soil.
   - Before you catch the bird, make sure that the entrance is sufficiently big that a bird can be pulled out easily.
   - Depending on species and need, it may be preferable to wait until the bird has moved to a more easily accessible location to capture it. Being dug out of the burrow is presumably very stressful for the bird.

6. In kiwi populations, where catching a specific bird may be able to wait a few days, to save time at deep burrows that are difficult to look into, set up a small palisade of 10 cm long sticks spaced 5 cm apart at the burrow entrance, and then inspect this daily to see if a bird may have entered to shelter.

7. Extract the bird with a bare hand (with gloves you lose the necessary feel and dexterity) by taking hold of both feet by the bare skin below the ‘knee’ joint, never by the bill, body or upper leg. Remember that extracting kiwi from shelters is a dangerous operation as you can easily hurt the bird in the operation. Additionally, the bird will often lash out with its feet and could inflict serious wounds or be injured itself. Once you have a firm grip of one leg, it should be possible to work the bird around so that you can get hold of both feet. Make sure that a root is not caught between the legs. Slowly pull the bird out in steps with pauses to allow the bird to relax between pulls, this reduces the amount of feathers shed. If your kiwi is losing patches of feathers in this process you are moving too fast, slow down to let the bird relax.

8. Once the bird is out, tape the legs and proceed with sampling.

9. If you have dug a shaft:
   - Place the bird in bag (in a safe place such as hanging from a branch) while you get the burrow ready.
   - Remove all the soil that fell into the shelter before returning the bird to the burrow.
   - Close the shaft(s) using boards, nearby rocks or fallen branches well so that they remain closed for years.
   - Mark the location of the shaft(s) so that you can re-use them on later visits if necessary.
10. Once you have finished handling the bird, cut the tape holding the legs together, and return to burrow head first, release the legs once the bird is well into the burrow.
11. Remove all the materials you used to block entrances.
12. Pick up the gear you used and feathers lost by the handled bird. These feathers can be given to iwi. Consult your local DOC Kaupapa Atawhai manager for advice on how to arrange this.

5.3 Mapping daytime shelters

In high density populations of kiwi you may be able to find the birds without the aid of dogs or transmitters by looking into daytime shelters and burrows that you have mapped over a period of time. This technique is possible because some kiwi use certain burrows regularly, and by marking and mapping burrow locations you can find these birds.

You will need:
- Map of the area
- GPS
- Tags – numbered plastic tags usually orange (or other bright colours). In some areas where there are weka, kea, kaka or lots of human traffic, you should locate the markers at a distance from the burrow to prevent leading predators to the nests.

Method:
1. Nail the marker on at a suitable location where it can be seen. Do it in a systematic way for the site.
2. Note tag number and location.
3. Mark on a map all kiwi burrows, nests, and day-shelters you find during your work with kiwi.
4. Systematically check each burrow in a given kiwi area or place stock palisades across each entrance and check daily for birds entering the burrow.

5.4 Hand capture of kiwi at night

Refer to Appendix 5.1 for details on this method.

5.5 Catching kiwi using fishing nets or mist-nets at shelter burrows

This technique should not be used for catching males at the nest as they come off the nest as this can cause the abandonment of the egg by the bird.

You will need:
- Permits
- 6 m to 7 m of fishing net or mistnet with a mesh of max. 60 mm knot to knot.
- Sufficient number (e.g. 4) of stakes of about 1m length.
- Rope
- Gear for whatever you are catching the bird for (banding, blood sampling, measuring, attaching transmitters)
- Torches

Method:
1. Locate burrow/hollow log/tree stump.
2. Before dark set up a c.70 cm tall net (fishing net or mist-net) on a set of stakes, or tied to nearby trees, in a circle about 2-3 m from the burrow entrance.
3. Make sure that there are no gaps at the bottom of the net. Use stakes or rocks or metal pegs in bag with net to pin the net to the ground.
4. Wait 5 m away (preferably behind and out of sight of the burrow entrance) for the bird to emerge after dark.
5. When the bird has emerged, move quickly but quietly to catch the bird by hand - the instinct of the bird is generally to try to run off through the netting rather than to return to the burrow, but some do try to duck back in.
6. Carefully remove bird from the net.
7. Be aware that a second bird may be present in the burrow. Catch each bird in turn.
8. Remove the net before you leave the site.
6: HANDLING TECHNIQUES

This module describes best practices to be employed when handling kiwi and on the requirements to be fulfilled before you carry them out.

No one should handle kiwi without having been trained. Kiwi require special care when being handled because they are easily injured as they have no sternum, weak pectoral muscles and ribcage, and a long thin bill. They also have an ability to shed feathers easily (presumably a defence mechanism similar to lizards dropping their tail). In addition, kiwi are able to seriously injure handlers with their claws.

Before embarking in any handling of kiwi, please read the Animal Ethics requirements regarding the issuing of permits (Appendix 6.1).

Contents:
- 6.1 Holding kiwi
- 6.2 Measuring birds
- 6.3 Marking kiwi
- 6.4 Ageing kiwi
- 6.5 Sexing kiwi
- 6.6 Blood sampling

Contributors to this module (contributed sections):
- Hugh Robertson & Rogan Colbourne (all sections)
- Jonathan Miles

Additional related documents:
- Appendix 6.1. Animal Ethics Requirements
- Appendix 6.2. Guidelines for the use of blood sampling
- Appendix 6.3. Specific scientific sampling
- For information on where to buy field gear see Appendix 2.1

6.1 Holding kiwi

Special care must be exercised when holding kiwi, both for the safety of the kiwi and for that of the handler. When handling kiwi for the first time, you should be instructed by an experienced handler in what to do.

Method:
1. Always hold kiwi firmly by the bare part of their legs, preferably with the body cradled on a forearm or, if you are sitting down, on the upper legs. A firm grip around both legs is needed to prevent a bird lashing out with one leg and twisting around which may damage the upper part of the leg being held, or the sharp claws may inflict serious wounds to the handler. If a bird does get one leg free, allow the bird to rotate in your hand to prevent its upper leg from being damaged.
2. Do not hold the bird by the feathered portion of its legs as kiwi very easily drop their feathers as a ‘shock-moult’.
3. Never hold a kiwi solely by the bill or around its body, as both bill and ribcage are delicate and the bird could be easily injured.
4. Once you have both legs in your hands, bind the legs together with electrical tape around the tarsus and cradle the bird in your lap, or in the arms of an assistant.
5. It is not usually necessary to cover the head of a bird while it is being handled. However, if you are holding a bird for an extended period (e.g. when extracting or processing its partner), the bird should be placed inside a bird bag, still with its feet firmly bound, to reduce stress. The bag should be hung safely from a branch high enough to prevent the bird from bruising itself if it tries to move out of its confinement. The use of day-packs is discouraged, as it is hard to disinfect backpacks. Bird bags are light, have proper ties to close them, are softer on the bird and can easily be washed and disinfected. Bird bags should be washed and disinfected after each use with a 1% chlorine solution to prevent cross-contamination of diseases and parasites.

6.2 Measuring birds

Morphometric measurements (or measurements of physical characteristics) are useful to sex adult birds (bill length), determine age (weight and condition), decide which band size to use (tarsus depth and width) and get information on the general condition of the bird. The standard measurements normally taken from kiwi are: bill length, weight, condition, tarsus width, tarsus depth and tarsus length. Other measurements that could prove useful, and that are being developed are body length and mid-toe depth (see methods under development section).

At a minimum, you must record bill length and the weight of the bird at first capture. Once the bill has stopped growing it doesn’t need to be re-measured every time the bird is caught. Other measurements should be recorded as needed for scientific purposes. Minimise the stress on the bird by keeping handling times as short as possible.

The most important thing to remember when taking measurements is that the value of the measurement relates to its repeatability. If you get widely different values each time you take a measurement, that measurement has little value because it is not reliable. The following shows the variation found between measurements of kiwi from the same person and between measurements from different people. It shows that tarsus depth and length are less reliable measurements than tarsus width and bill length.

<table>
<thead>
<tr>
<th>Table 6.1. Variation between the same person and between different people when measuring kiwi.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement</strong></td>
</tr>
<tr>
<td>Bill length (to cere)</td>
</tr>
<tr>
<td>Tarsus width</td>
</tr>
<tr>
<td>Tarsus depth</td>
</tr>
<tr>
<td>Tarsus length</td>
</tr>
</tbody>
</table>

Prior training:
Before measuring kiwi on your own you:
∞ must have been shown by an experienced approved measurer how to take each of the measurements
∞ must have measured a total of five birds on your own in the presence of an experienced approved measurer who will supply a letter of recommendation to the Kiwi Recovery Group informing of your skills.

All accredited people will be added to a centrally maintained list of approved kiwi handlers, maintained by the Kiwi Coordinator (Operations and Planning).
Between visits to different sites, and at the end of the day, you should wipe measuring gear clean with 70% isopropyl alcohol swabs.

You will need:
- 150 mm Vernier callipers
- Pesola spring balances 5 kg, 3 kg, 1.5 kg, 1 kg, and 0.5 kg.
- Electric tape

Method:
1. Make sure that you are familiar on how to read the Vernier callipers properly before you go into the field because they differ between brands.
2. Hold the bird as described in Section 6.1.
3. Take the measurements one at a time. You can take the various measurements in any order you wish, always trying to minimise the total handling time. Pay close attention to always taking the measurements in the same way.

Weight
1. Hang adult birds upside-down from a Pesola balance hooked through the tape that holds their legs together. For chicks, a small tab can be incorporated into the tape around the legs and the crocodile clip on the Pesola balance can be attached to that.
2. Weigh large (adult and sub-adult) kiwi on 1.5 kg, 3 kg or 5 kg Pesola spring balances to the nearest 10g. Use a 500 g or 1 kg Pesola spring balance to weigh chicks, and small (juvenile and sub-adult) kiwi to the nearest 5 g or less.
3. Make sure that the scale is moving freely and that the balance is held vertically – if away from vertical, the scale can catch on the barrel of the balance and give a false reading. Kiwi will often jiggle when being weighed, and so it may take some time before it relaxes and settles at a particular point.
4. Read the scale by lifting it to eye-level. You may have to stand to achieve this. Remember that the net weight of the bird is the weight excluding the transmitter package, band, and tape binding the legs. Remember to subtract these values from your reading if necessary.
5. It is worth checking that the balance is properly tared each time. Often the screw at the top and bottom of the balances come undone and the tares are wrong. You can stop this from happening by placing tape around the top and bottom of the balance.
6. About every six months, it is worth checking the accuracy of your balance by weighing various volumes of water within the typical weight range of the birds you are measuring (1 litre = 1 kg). If the balances are not accurate, replace them.

Bill length
1. Measure using the Vernier callipers. Place the one extreme of the callipers at the midpoint of the curve in the cere on top of the bill (hard fleshy covering of the upper bill) and the other on the tip of the bill. Read the callipers.
2. Often the base of the bill has dried mud on it and this is best removed (gently with your fingers, or use a damp cloth) to better show the bill/cere junction. At night, shine your torch towards the bird’s face to remove shadow from the cere.
3. In rare cases where bill length exceeds 150 mm, mark the bill with a pencil at the 150 mm mark, measure the rest of the bill, and add the lengths before and after the mark.

Tarsus width
1. Measure the minimum width of the tarsometatarsus bone, with the callipers closed tight against the leg, measured to the nearest 0.1 mm.
2. Kiwi chicks in the nest initially have swollen legs and so this measurement is of less value for very young chicks.

Tarsus depth
1. Measure the minimum depth of the tarsometatarsus bone, with the callipers closed loosely against the leg – there is considerable flesh in front of and behind the bone and it is advised not to close the callipers too tightly.
2. Kiwi chicks in the nest initially have swollen legs and so this measurement is of less value for very young chicks.

Tarsus length
1. The length of the tibiotarsus bone measured from the notch between inner toe and middle toe when bent at right angles to the tibiotarsus and the end of the bone at the tarsometatarsal joint. This latter point is not at the back of the bent leg, but at a lump found at the outside of the joint.
2. Note that this measurement is difficult to take on kiwi compared with many species of birds that have a clearly defined upper point to the tibiotarsus. In kiwi this joint is ill-defined and the great strength of kiwi legs means that it is difficult to bend the toes back in a systematic way to standardise the distal point of the measurement.

Assessment of general condition
Hold bird upside down as for weighing or on your lap. Check the physical features of the bird to note down if there are any abnormalities such as: blindness in one or both eyes, injuries to toes, unusual length of wing claws, skin disorders, etc. General condition is scored by feeling the amount of fat covering the ribcage, and the backbone and tailbone. Assess condition before weighing to make your assessment more independent of actual weight.
∞ First, gently feel the lower abdomen of female kiwi with your fingers evenly from both sides, to see if an egg can be felt, in which case the bird is described as “gravid”.
∞ If the ribs are like a washerboard and the backbone is clearly felt, the bird is in “poor” condition.
∞ If the ribs or backbone, but not both, can be easily felt, the bird is in “moderate” condition.
∞ If neither the ribs nor the backbone can be felt, the bird is in “good” condition.
∞ In between poor and good condition there are a variety of combinations: poor-moderate, moderate, and moderate-good.
∞ Some birds have exceptional fat deposits and are described as “very good” or “excellent”.

6.3 Marking kiwi

Banding
The Banding Office of the Science & Research Unit of the Department of Conservation controls all banding in New Zealand. All departmental banding of kiwi is now done under the permit (issued under the Wildlife Act 1953) held by Dr Hugh Robertson of Science & Research Unit. All requests to band kiwi and to obtain supplies of bands, and all completed schedules, must be made to the permit holder (Hugh Robertson), not to the Banding Office.

Procedure for banding birds
Prior training:
Before banding kiwi on your own:
∞ you must have been shown by an experienced approved bander how to attach bands

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Kiwi Best Practice Manual (September 2003)
This copy printed on 29/11/07

Please note that this paper copy may be out of date – please check the internet version or contact your local DOC office to check your copy is current.
you must have banded a total of five birds on your own in the presence of an experienced approved bander, who will provide you with a competency certification and will pass a copy of this on to the Kiwi Coordinators.

You will need:
- Metal bands
- Colour reflecting tape (or colour bands – optional)
- Banding pliers
- Circlip pliers large enough to open bands for removal

Method
1. Hold the bird as explained in Section 6.1. One person can band kiwi, however you may prefer to have another person holding the bird while you band.
2. Determine the approximate age of the bird to decide whether you should band it or not (ref. Section 6.4).
3. Choose the appropriate band size for the bird you are holding (use Table 6.2).
4. Be aware that the large stainless steel bands that are used to band kiwi have high tensile strength and tend to spring apart rather than butt together.
5. Place the open band around the bird’s leg. It is useful to band males on the right leg and females on the left leg, as this doubles the number of colour combinations available if needed.
6. Hold the band evenly in the pliers and close it gently. The largest “RA” bands do not fit standard banding pliers and so must be partially closed by hand before being applied. Once around the bird’s leg close gently.
7. Turn the pliers 90° and close again bringing the ends together in the middle of one side of the pliers.
8. The bands will spring apart, so the nose of the pliers have to be rotated so that they are held 5 mm from one end, and then pressed gently so that one end underlaps the other.
9. The band will spring back, leaving a gap which could get vegetation entangled in it, and so the same process is repeated alternately on the opposite ends of the band, until the ends click into place, evenly butted together.
10. Gentle pressure from banding pliers should not cause the bands to pop open again if you have done this sufficiently well. Sometimes during this process, the band will stick with one end underlapped – in this case the ends of the band have to be pulled apart by hand until it clicks into place with both ends butted.
11. Rarely, the band will collapse due to metal weakness, or excessive pressure, and the band needs to be removed with circlip pliers or strands of wire/cord pulled evenly against the insides of the band away from the bird’s leg.
12. With time, the metal tension in these larger bands relaxes and the band opens slightly, and so the band should be re-closed each time the bird is handled. Bands have proven to be very resilient, and are known to be still perfectly legible after over 20 years in a variety of habitats; however, bands become worn from the inside and ends from continual friction with the leg, and so birds should be re-banded every 15-25 years.

Metal bands
Three sizes of band are used on kiwi, depending on the species/sex of bird. The choice of size should be such that when the band is completely closed, it will move freely up and down the leg, with no danger of passing over the hind claw.
The decision about size lies with the field operator and depends to some extent on the shape of the leg; typical leg measurements are given Table 6.2 below, using an analysis of birds banded by R. Colbourne and H. Robertson. Please use this as a guide.
Table 6.2. Criteria used to choose the appropriate band size for kiwi.

<table>
<thead>
<tr>
<th>Band type</th>
<th>Kiwi taxon</th>
<th>Sex</th>
<th>Tarsus width (mm)</th>
<th>Tarsus depth (mm)</th>
<th>Exceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Little Spotted Kiwi</td>
<td>M/F</td>
<td>≤ 11.0</td>
<td>≤ 16.5</td>
<td>Large females with tarsus size greater than specified. For those use R bands.</td>
</tr>
<tr>
<td>R</td>
<td>NI Brown Kiwi (outside Northland)</td>
<td>M/F</td>
<td>11.5-13.5</td>
<td>17.0-17.5</td>
<td>Males and females with larger tarsus than given</td>
</tr>
<tr>
<td></td>
<td>NI Brown kiwi (Northland)</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Okarito Brown Kiwi</td>
<td>M/F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Great Spotted Kiwi</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RA</td>
<td>NI Brown Kiwi (Northland)</td>
<td>F</td>
<td>≥ 13.5</td>
<td>≥ 17.5</td>
<td>Males and females with smaller tarsus than given</td>
</tr>
<tr>
<td></td>
<td>Great Spotted Kiwi</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Haast Tokoeka</td>
<td>M/F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Southern Tokoeka</td>
<td>M/F</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you are in any doubt whether the bird is fully grown and think that the band size might be too small in the future then use a different marking method (e.g. transmitter or transponder).

**Colour banding**

Colour banding, to recognise individuals in daytime shelters or at night without the need to handle them, is best done by applying coloured reflective tape (as used for road marking signs) to the metal band.

**Method:**

1. Before going into the field to band kiwi decide on the colour combination you are going to use. The size of the strips will depend on how many colours you want. Wait till the band is on the bird to apply strips of reflective tape to the band.
   - Blue and Green colours should be twice the width of White, Red, Orange and Yellow in colour combinations as they do not show up as well at night.
   - We recommend that for sightings at night, initially use combinations of Red, Yellow, White, and Blue or Green.
   - Orange can be confused with Yellow, and Blue and Green are often difficult to separate, especially if only a small amount is used in combination with other brighter colours.
   - Use a maximum of three colours on any band.
   - If the band feels greasy wipe it with a 70% alcohol wipe to ensure the reflective tape adheres to the surface of the band properly.

2. Hold the bird as described above. You will need to attach a metal band if the bird has not been banded before.

3. Place two rounds of reflective tape around the metal band. This should last about five years, except in rocky areas (e.g. scree slopes) or in dense scrub (e.g. gorse), where the life will be shorter.
**Transponder insertion**

A transponder is a tiny microchip embedded in sterile and inert glass that is implanted under the skin on the flank of a kiwi with a special syringe. The transponder bonds with the tissue and remains in place for life. Each transponder is programmed with a unique ten digit alphanumerical code that can be read by passing a special pocket calculator-sized radio frequency reader within 3 cm of the transponder.

There are two possible problems with transponders: Infection at the point of insertion and migration of the transponder from the insertion point to other parts of the body. To date, over 100 transponders have been used on North Island Brown Kiwi and they have proven to be completely reliable. None is known to have migrated within a kiwi, or fallen out. The insertion does not appear to harm the bird, and no infection of the insertion site has been noted.

There are several brands of transponder and reader available in New Zealand, with two of the most widely used being Trovan and Alflex. At present, the Trovan brand of transponders is being used for kiwi work in several areas, also by zoos and by New Zealand veterinary practices for marking cats and dogs. Because the two systems are incompatible, different readers are needed depending on what type of transponders have been implanted. Only use one brand per population, and make sure you record which system has been used.

**Prior training:**

Before placing transponders on kiwi on your own:

∞ you must have been shown by an experienced person how to insert a transponder.

∞ you must have inserted a total of five transponders on your own in the presence of an experienced person, who will supply a letter of recommendation to the Kiwi Recovery Group.

**You shall not attempt to insert transponders in a kiwi without proper training.**

**You will need:**

- Transponders
- Insertion syringe
- Transponder pocket reader
- Cleansing swabs

**Method:**

1. At first, two people are required, one to hold the bird, the other to do the implanting, but with practice, the procedure can be done by one person alone.
2. In a population where you already have birds with transponders the first step is to make sure that the bird does not have a transponder in it already!
3. Then make sure that the scanner is reading the code inside the transponder needle before you open the sterile envelope.
4. Note the code in your notebook or field data sheet.
5. The transponder will be inserted under the skin over the ribcage of the kiwi chick, behind and below the base of the wing on the right hand side.
6. First, cleanse the area with 70% isopropyl alcohol skin cleansing swab to sterilise the area and moisten the feathers, giving better visibility and control of where the transponder is located.
7. Pinch the skin, then insert the needle, bevelled side upwards, towards the rear of the bird, parallel with the ribcage and about 1.5 cm behind the wing.
8. Make sure that the needle does not come out through the skin on the other side of the pinched skin.
9. Push the trigger gently but steadily, remove the needle, push on the flesh as you pull the needle out to ensure the transponder stays under the skin. Hold a fresh swab over the hole and massage the skin gently to prevent the transponder popping back out the insertion hole.
10. Check that the transponder can be read okay.

Transmitters

Transmitters have revolutionised the study and monitoring of kiwi because they allow us to know the whereabouts of these secretive birds. Like any other device we use on wild animals, transmitters need to be used with care to prevent unwanted results, particularly death of the study animals.

Transmitters are electronic devices that emit radio waves at particular intervals (pulses) within a given frequency. In New Zealand, wildlife transmitters (designated as ‘restricted radiation devices’) operate in a 2 MHz frequency range between 160 and 162 MHz.

Although you can buy transmitters from overseas companies, transmitters designed specifically for kiwi have been developed in New Zealand in conjunction with Sirtrack Ltd. Transmitters made by Sirtrack Ltd., and picked up on the standard tuning of a Telonics TR4 receiver, are labelled as channels 1 through 99, corresponding to wavelengths of 160.12 MHz through 161.11 MHz. Avoid using channels 1-9 due to interference, especially near urban centres.

Effects of the transmitters on kiwi

Two effects can immediately be identified:

- Transmitters add weight to the bird.
- Transmitters may be an obstacle to everyday life as, one way or another, they stick out from the bird’s body.

Studies of other ground birds show that the weight of the transmitters and the paraphernalia we use to hold them on the birds, should be no more than 5% of the body weight of the bird. Birds carrying more than that are at higher risk of predation, may not breed as well, and their movements are slower. For this reason, transmitters developed for kiwi take into account the weight of the bird (Table 6.3). For kiwi, the transmitter should weigh less than 3% of the body weight, since the weight is only attached to one leg of the bird and therefore the weight is not distributed evenly.

Transmitters themselves have very rarely caused the death of kiwi when they have become entangled in vegetation preventing the birds from feeding, or once by dislocating a joint when a bird was hung up by its leg after falling though tangled vegetation. Although you cannot completely prevent such accidents, you can reduce the odds greatly by following carefully the instructions given herein.

Double-stage vs. single-stage

There are some differences in the function and structure of double-stage and single-stage transmitters. Single-stage transmitters do not have the same range as double-stage transmitters, but they are smaller and lighter. If your birds do not range widely, single-stage transmitters could be quite adequate for your needs. If you are in doubt about what type of
transmitter to use, seek advice from members of the Kiwi Recovery Group, or other people with substantial experience with transmitters.

**Choosing the appropriate transmitter**

There are a number of factors that can be adjusted when selecting a transmitter, and these can affect things such as the pulse rate, size, weight, and functionality of the transmitter. Suggestions have included lowering the pulse rate to 20 pulses to allow reduction in the package size. If you are contemplating using transmitters that vary from the standards given in the table below, you should seek the advice of members of the Kiwi Recovery Group, or other people with substantial experience with transmitters.

**Table 6.3. Guide for the selection of transmitters**

<table>
<thead>
<tr>
<th>Transmitter type</th>
<th>Weight of bird (g)</th>
<th>Transmitter specifications</th>
<th>Weight (g)</th>
<th>Aerial size</th>
<th>Pulses/min*</th>
<th>Range**</th>
<th>Life (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiwi Chick</td>
<td>&lt;800§</td>
<td>6</td>
<td>0.7 mm</td>
<td>40</td>
<td>1.5 km</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Kiwi Juvenile</td>
<td>800-1200 (up to 18)</td>
<td>11</td>
<td>Internal</td>
<td>40</td>
<td>5.0 km</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>Kiwi Adult</td>
<td>&gt;1200</td>
<td>20</td>
<td>Internal</td>
<td>40/activated</td>
<td>5 km</td>
<td>12-15</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>&gt;1200</td>
<td>20??</td>
<td>Internal</td>
<td>40</td>
<td>5 km</td>
<td>12-15</td>
<td></td>
</tr>
</tbody>
</table>

* Recommended.

** In line of sight.

§There are two juvenile kiwi transmitters, an 11 g that lasts 3.9 months and a 17 g transmitter that lasts 7.1 months. Further combinations include internal non-directional aerials or more directional whips. Different aerial and transmitter combinations will give different weights.

**Mortality transmitters** are available which change the pulse rate if the transmitter does not move for a set period of time (usually 24 hours), i.e. if the bird dies or the transmitter falls off. A variety of other programming options are available which can be tailored to your own study – e.g. transmitters' life can be doubled if they are programmed to function only between 0900 and 2100 hr rather than all day.

**Transmitter frequencies.** Before buying transmitters, try all the frequencies available in your area. You can seek advice from the electronics laboratory at Science & Research. Transmitters operating on adjacent channels are acceptable if they are distant from one another, but if your study has fewer than 45 study animals, then you should aim for even- or odd-numbered channels on a TR4 receiver, to avoid frequencies being too close together. If you are close to urban areas, go through the channels and note down those that pick up interference and don’t get transmitters in those channels.

Kiwi transmitters should be a dark package such as green or brown, so that it they are clearly visible to a predator (e.g. dogs, cats, stoats and ferrets).

**Procedure for attaching transmitters**

**Prior training:**

Before attaching transmitters on kiwi on your own:

∞ you must have been shown by an experienced person how to attach a transmitter.
you must have attached a total of five transmitters on your own in the presence of an experienced person, who will supply a letter of recommendation to the Kiwi Recovery Group.

Before attaching a transmitter to a chick on your own, the same requirements apply. This is in addition to your five adult transmitter attachments.

You will need:
- Transmitters
- Electric tape
- Plastic identification bracelets, as used in hospitals
- TR4 receiver
- Antennae

Method:
1. Choose the transmitter you are going to use based on the weight of the bird you are going to put it on.
2. Using the TR4, check the frequency and the power of the signal of the transmitters you are going to use before you go to the field. Make sure that the transmitters work well and that the signal is clear and sharp. If unsure do not use the transmitter, return it to the manufacturer.
3. Store and carry your transmitters separately so that they cannot be turned on accidentally by a neighbouring magnet – this is best done by cutting out appropriately shaped holes in foam rubber within a plastic lunchbox. You should periodically check all stored transmitters to ensure that none are switched on.
4. Check the weight of a typical transmitter package (hospital band and three rounds of electric tape) before it is attached to the bird:
   - Make sure you do not attach a transmitter that weighs more than the recommended value of 3% of body weight.
   - Subtract the weight of the package from the bird’s total weight whenever a bird is subsequently handled. This is of most importance when weighing young birds as their weight is lighter and therefore the package can have a greater influence on their weight.
5. If you are attaching the transmitter by yourself, hold the bird by cradling it in your right arm so that you can hold the legs with your hands. If you have someone else with you this person can hold the kiwi for you.
6. Pass a hospital band through the loop in the transmitter.
7. Place the transmitter on the bird’s leg immediately above the “knee” (tibiotarsal) joint in the position you want it to stay. If you are putting a transmitter on a chick, make sure that the antenna of the transmitter is “looking upwards”.
8. Close the hospital band so that there is sufficient room to allow the band to turn freely around the bird’s leg, but not so much that the package can be pulled over the tibiotarsal joint. For chicks and juveniles, cut off the wide portion of the hospital bracelet and use only the narrower section (see figure 1 of Miles & McLennan 1998). Click the male: female union closed on the bracelet with the male part innermost.
9. Cut the hospital band at the hole next to the one you have used to close the band.
10. For chicks and birds up to 1200 g, add a single round and a half of dark (blue, green or black) electrical tape on top of the bracelet. This is done to make the package less conspicuous, and to add strength, but still allow the transmitter to be shed within 10 weeks if the transmitter fails or the bird is not recaptured in time (Table 6.4). For the safety of the birds, the need for tape could be determined by the habitat. In scratchy habitat e.g. blackberry scrub, pine slash or gorse, you might need to use tape to ensure...
the transmitters stay on, but in forest or open habitats, tape is probably not needed.

The most important things to remember when putting rounds of insulation tape on are:

- To make sure there are no feathers or grit between the layers. To achieve this you may want to wrap a piece of cloth, or glad-wrap, around the feathery part of the tibiotarsus.
- To ensure that there are enough rounds of tape around the hospital band. One way to do this is by cutting 35 cm of tape each time and winding it around the band up to three times. To help wrap the tape around the band you should stick the end of the tape to the piece of hospital band you cut off to use as a guide.

11. For sub-adults and adults (≥800 g), use the full-sized hospital bracelet, and add 7-10 loops of electrical tape around the bracelet as the leg will not grow significantly and weight is less of an issue. It is still important that the package is not too tight to start with as sub-adults will be growing slowly, and the condition of adults will vary. (Table 6.4). Subadults of > 1200 g should be recaptured quarterly to check transmitter attachment.

12. While chicks (<800 g) should be caught at the latest monthly after having transmitters put on, juveniles up to 1200 g should be caught and checked every six weeks, and the bracelet replaced if it is getting too tight. (Table 6.4).

13. An adult transmitter package should be checked every six months to make sure it is not too tight, or to replace worn bracelets and tapes. Defunct packages are known to have remained on a bird for 2.5 years, but most fall off after about 12-18 months.

Table 6.4. Instructions on transmitter use and monitoring

<table>
<thead>
<tr>
<th>What to do/kiwi age</th>
<th>Chick and juvenile up to 800g</th>
<th>Juveniles 800 to 1200g</th>
<th>Sub-adult &gt; 1200g</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rounds of tape</td>
<td>1.5 rounds</td>
<td>2 - 3 rounds</td>
<td>4-6 rounds</td>
<td>7-10 rounds</td>
</tr>
<tr>
<td>When to check</td>
<td>Monthly</td>
<td>Every 6 weeks</td>
<td>Every 3 months</td>
<td>Every six to 12 months</td>
</tr>
</tbody>
</table>

The same transmitter can be used on several birds in succession, for instance, if it is a growing chick, or if you only want to carry out short-term monitoring. Additionally, transmitters can be re-potted (battery changed, see next section) and so you should keep track of elapsed transmitter life by entering start and stop dates for each transmitter in an Excel file. This file can highlight the date when transmitters should be replaced (allowing some leeway in case batteries fail early, or if the bird is not accessible on the first day you try to recapture it).

Ensuring the best performance from your transmitters

Two of the hardest things to accept when working on kiwi in any environment are transmitter failures and transmitters falling off.

An adult transmitter lasts for 15 months, but good practice is to take the transmitter off after 10-12 months. For breeding males change the transmitter before they go on their first nests to ensure they will be in working order during the whole breeding season. It is also good to change the transmitters of the breeding females slightly earlier to avoid handling a gravid bird.

2 For Little Spotted Kiwi, transmitters are attached differently – if you wish to attach transmitters to Little Spotted Kiwi please seek the advice of the Kiwi Recovery Group before proceeding.
One or two visits a year to check the transmitter and the hospital band is all that is necessary if you attach the transmitter properly in the first place.

The transmitter you remove can be re-potted by Sirtrack. The cost of re-potting was $142.00 + GST in 2001. The transmitter should only be re-potted three times; any more than this and you will be running the risk of premature transmitter failure because to remove the epoxy resin that encases the battery, and microchip, the transmitter is heated and repeat heating will eventually corrupt some of the components.

When you get transmitters there are a few things to look and listen for to ensure the quality of the gear:

∞ Check for bubbling in the epoxy resin coating the transmitter. Bubbling occurs when the drying process is sped up. If there are bubbles present, when the epoxy coating wears, these bubbles will be exposed opening up small holes in the water-tight package, allowing water into the internal parts of the transmitter. This could result in transmitter failure. If you observe bubbles on the epoxy coat of your transmitters, send them back.

∞ Make sure there is a good gap for the hospital band and enough insulation tape, so the transmitter can spin freely around the strap, and the strap and transmitter spin freely on the kiwi leg. If there is not enough room, send the transmitter back.

∞ Listen to the signal, each transmitter has its own sound, if you are unhappy with its sound and fine-tuning don’t use it. Again, send the transmitter back.

∞ Chick transmitter antennae check. One problem with the chick transmitters is that the antenna snaps easily. When you receive your chick transmitters, and before you attach the transmitter to a chick, press your thumb down on the rubber joint between the antenna and the transmitter package. If the connection between them breaks send the transmitter back.

A method of intercepting wild chicks for transmitter attachment (NI Brown Kiwi)

Some kiwi are known for being nervous, and some may desert the nest when a person is less than five metres away. This is important to remember when you intend to tag wild chicks. In the case of North Island Brown Kiwi, the longer a male has sat on a clutch, the more reluctant he will be to abandon it. The rule of thumb here – and for most birds – is that a bird will desert a nest when it is under a big threat of danger or has a low investment in the nest. If the threat to the bird is low or the investment in the nest is high, the bird will be more apt to stay.

The procedure set out below is one that was developed for a population where experience showed that chicks cannot be handled at the nest without the parent(s) deserting. This technique was developed for North Island Brown Kiwi at Lake Waikaremoana. However, you should consider that some kiwi taxa are more nervous than others (and some are less nervous) when attempting the following procedure on your birds. Be ready to proceed with O.N.E. if the male deserts.

Permits. Before you use this technique, you must have approval from the Kiwi Recovery Group.

You will need:
- AA Maglite
- Flagging tape
- Clothes pegs and luminous tape
- Measuring gear
- Transmitterising gear
Radio-telemetry gear

Method:
1. Locate the nesting area. To do this:
2. Sit down and plot all nests you have located for each pair, the longer you have been monitoring them the clearer the picture will become. Most kiwi pairs first clutch in one area of their territory and second clutch in another.
3. Look through your records to determine when each male went on their first nests as this may help in establishing at which time of the year (June/July) to be more vigilant with each breeding pair.
4. Visit these areas at least weekly to get updates on the male’s movements. Bear in mind that within the nesting area there can be between 2-4 nests that may be used for the nesting attempt. These are not that far apart and therefore you may record the wrong nest. It appears that both sexes dig the nest, but it is the male who lines it hence the signal will be coming for a period of time from each one of the readied nests. The female chooses the nest for that clutch and it is then the male settles down into his incubating regime. This is why you need to get signals on at least a weekly basis. Over a period of four weeks you will establish when the male settles down plus or minus x days (x depending on the times between your visits). The more visits (signals) the more accurate the picture.
5. When taking signals from the males use a visual marker or record a compass or GPS bearing to have as reference.
6. Once you have him settled down go back into your records and establish when this actually happened, and count 35 days and 75 days. Mark these dates in your calendar. On day 35 you will mark a track to the nest, and on day 75 you will go into the nest at night for the first time.
7. Keep on monitoring the location regularly.
8. 35 days after he started sitting, according to your records, go into receiver distance from the nest (not actually sighting the nest, if you do it is a lucky break) and mark the spot so you can get back in if he deserts.
9. Mark a route to the nest so that you can get there either during the day or night. Because of the routine of nesting in distinct areas of their territories, over a period of time you may find that with a single main trail through the area you can side branch off to access nests. It is recommended to permanently mark the main trail with reflective tape, but only temporarily mark the side branches to prevent confusion when you are repeatedly going into the same area year after year. Temporary marking can easily be achieved using clothes pegs with reflective tape attached to either side of the pegs. Drawing pins with a small square of luminous tape on top also work well and are less obtrusive. They are harder to locate when you pull in the line, but may be necessary in areas with kaka (islands) or cattle who may be curious and pull the pegs out.
10. One or two days before you go in to the nest at night (or day 73 or 74) go to the nest during the day and locate the entrance. Kiwi are creatures of habit and will leave the nest and come back to it nine times out of ten using the same path. So over a period of time a track will be worn and you can follow it to the entrance. Do not get too close, just establish the entrance so that you are confident that you will be able to locate it again at night. Remember that things appear to be different at night so if you are able to mark the entrance by a carefully placed peg on a branch, etc, so that you can easily find the entrance all the better, again, time is of essence here.
11. On the night of the 75th day, wait at a safe distance (100 m, or so) until the male is off the nest and well out of the area. If the female is radio tagged keep track of her as well as she sometimes turns up, especially close to hatching. Once you have made
sure of the location of the male and female, and the male is well away from the nest area, approach the nest entrance.

12. Carefully pull away the camouflaging material noting how it was placed so that you can replace it in the same way when you leave.

13. Feel for either eggs or even chicks. Make sure you are sure there are one or two eggs in the nest. Sometimes either or both can be buried.

14. If you are concerned that the eggs should be hatching and they are not, take each one out and candle them. See Section 7, Translocation, for further detail on handling and candling eggs, and for information on what to do with dead eggs.

15. Once at the nest you can find six situations depending on how accurate you were in detecting when the male went on the nest, and when the female laid the eggs. Carefully follow the instructions given for each situation as shown in Figure 6.1. Remember that if you have an egg in the nest you should not visit the nest in the daytime or the male is likely to desert it. Day visits are only good if both chicks are out and about. Do not bring your dog. Work, if necessary, with one other person only. Keep the following in mind:
Figure 6.1: Flow chart for visit at 75 days from male settling down

**On night visit after 75 days from male settling down, you will find one of these situations, follow the arrows to know what to do**

- **2 eggs**
  - Full clutch
  - **Come back in 5-7 nights** to see if egg(s) have hatched. Follow instructions for applicable situation.

- **1 egg & 1 chick**
  - Full clutch
  - **Do not put tx on if chick(s) wet and lethargic (just hatched). Come back in 2 nights to attach tx.**

- **2 chicks**
  - Full clutch
  - **Come back during the day when the chick you found in nest is 8-9 days old to attach tx to second chick.**

- **1 chick**
  - Single egg clutch or older chick out
  - **Come back in 5-7 nights** to see if egg has hatched. Follow instructions for applicable situation.

- **1 egg**
  - Single egg clutch or older chick out
  - **Go in next day to attach txs to chicks.**

- **No chicks**
  - Full clutch. Both chicks out.
  - **Put tx on chick(s) if dry and moving about. Measure.**

To remove a chick and attach transmitter during a day visit: reach in around the male and carefully extract the chick. You will have to reach in over the male’s shoulder as nine times out of ten the chicks will be in front of the male, under his bill. When there is one chick already transmitterised, pull out only the chick without tx. Attach tx, take measurements and return chick to nest.

Kiwi Best Practice Manual
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Females lay up to two eggs about 30 days apart, but sometimes the period between eggs is longer. If this is the case, a male can be sitting on a nest for an amazingly long period. For instance, a male sat for 186 days at Lake Waikaremoana, the first egg hatched at 93 days and the second at the end of that period.

- Because it is relatively easy to tell the approximate age of a 1-5 day old chick as it is still in the nest, always take the conservative approach and count from age 1-2 days and go in to put the transmitter when the chick is 8-10 days of age.
- Remember the following “clues” for successful hatching:
  - Faeces inside the nest.
  - Egg fragments less than 9 mm.
  - Presence of fragments inside (throughout the lining) as well as outside at the entrance of the nest.

6.4 Ageing kiwi

Ageing birds in a population is very important for long term management because the age structure of the population is an indication of its health. For instance, a population with no young birds is a population in trouble. Many factors affect the size and growth rate of kiwi, including species, age, gender, location, weather conditions, size of the egg they hatched from, and health.

Estimates of age are increasingly inaccurate away from hatching, mainly because the individual histories of wild birds are generally unknown. We can place wild, unknown kiwi into size/age classes (chick, juvenile, sub-adult and adult) (Table 6.5). Our knowledge of kiwi ageing will improve as our monitoring of managed populations continues, as we will increase the number of birds of known age for which we have measurement data.

Procedure for ageing chicks

You can determine the age of a chick by looking at it, weighing it and measuring it.

By sight:
- If the chick is still wet, it is <1 day old.
- If it retains an external yolk sac, it is <5 days old.
- If it has been feeding – from dried mud on the bill, it is >5 days old.

By weight:
- The weight of kiwi chicks declines for the first 10-20 days, before increasing, so if the weight is declining, the chick is likely to be <15 days old.

By bill measurements:
- Bill length is the most useful measure, as it grows approximately linearly for the first 180 days, so you can calibrate bill length of a chick/juvenile of unknown age against known aged chicks in your study area.

Procedure for classifying sub-adults and adults

A bird of unknown history is considered an adult if
- its bill length does not increase by 1.5 mm between measurements taken 6 months apart
- it is nesting or has a brood patch
- it shares a burrow with another adult bird (NI Brown, Little Spotted Kiwi)
- it is a gravid female.
Other ageing techniques are unreliable and must only be used as part of research programmes.

**Age categories**

<table>
<thead>
<tr>
<th>Chick</th>
<th>Juvenile</th>
<th>Sub-adult</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>NI Brown Kiwi and Great Spotted Kiwi</td>
<td>0 to 10-50 days</td>
<td>10-50 to 180 days</td>
<td>180 days to 4.5 years or the age at which they breed if less than 4.5 years old</td>
</tr>
<tr>
<td>In nest continuously or returning each day</td>
<td>Independent from nest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Okarito Brown Kiwi and Tokoeka</td>
<td>&lt;60 days old</td>
<td>60-180 days</td>
<td>180 days to 4.5 years or the age at which they breed if less than 4.5 years old</td>
</tr>
<tr>
<td>Little Spotted Kiwi</td>
<td>still in the nest</td>
<td>Independent young birds of &lt; 500g</td>
<td>Independent young birds of &gt; 500g but generally &lt; 1kg when in good condition</td>
</tr>
</tbody>
</table>

6.5 Sexing kiwi

There are two ways to sex kiwi: morphological measurements and molecular techniques. You should use morphological measurements to sex adult (breeding) birds and use measurements and molecular techniques to sex non-adults (birds that are not known to be breeding).

**Sexing from measurements**

Females are larger and heavier than males in all kiwi taxa. Sexes can be distinguished by bill length in all populations studied so far. Middle toe length is useful for sexing Great Spotted Kiwi (see section 12).

To sex kiwi by measurements you must:

- take the bill length (and/or middle toe) measurements of as many known males and females in your area (or population) as possible. The larger the number of birds in each category that you measure the better your estimation.
- place your measurements by sex in order of size to obtain a range (smaller bill size for a male to larger bill size for a male; smaller bill size for a female to larger bill size for a female).
- determine if there is an overlap between the largest bill size for a male and the smallest bill size for a female. If there is not, you can sex the birds using the bill measurement.

Some populations have already been measured this way; the results are presented in Table 6.6. (Note: Kiwi can breed while still growing; therefore, the final adult size can strictly be determined only by repeated measurements.)
Table 6.6. Sexing kiwi using bill length measurements: minimum - mean - maximum (sample size).

<table>
<thead>
<tr>
<th>Location</th>
<th>Bill length (mm)</th>
<th>Female if bill size greater than (mm)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Little Spotted Kiwi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kapiti</td>
<td>61.9-68.1-73.1</td>
<td>77.7-83.7-90.1</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>(131)</td>
<td>(111)</td>
<td>Colbourne &amp; Robertson</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Spotted Kiwi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hurunui</td>
<td>86.8-93.4-99.5</td>
<td>108.3-118.3-126.6</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>(8)</td>
<td>(14)</td>
<td>Colbourne &amp; Robertson</td>
</tr>
<tr>
<td>Kahurangi Point</td>
<td>83.0-93.0-96.0</td>
<td>103.0-114.0-120.0</td>
<td>99.5</td>
</tr>
<tr>
<td></td>
<td>(6)</td>
<td>(5)</td>
<td>McLennan and McCann 1991</td>
</tr>
<tr>
<td>Saxon Hut</td>
<td>90.3-98.3-105.1</td>
<td>114.0-122.6-135.0</td>
<td>109.5</td>
</tr>
<tr>
<td></td>
<td>(22)</td>
<td>(23)</td>
<td>Colbourne &amp; Robertson</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Island Brown Kiwi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Northland</td>
<td>86.1-99.5-117.8</td>
<td>120.1-135.6-155.4</td>
<td>120.0</td>
</tr>
<tr>
<td></td>
<td>(96)</td>
<td>(104)</td>
<td>Miller, Robertson &amp; Colbourne</td>
</tr>
<tr>
<td>Waikaremoana</td>
<td>80.0-92.2-104.0</td>
<td>108.0-117.0-130.0</td>
<td>107.0</td>
</tr>
<tr>
<td></td>
<td>(16)</td>
<td>(12)</td>
<td>McLennan and Miles</td>
</tr>
<tr>
<td>Okarito</td>
<td>83.5-94.8-104.2</td>
<td>109.9-125.5-140.3</td>
<td>107.0</td>
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<td></td>
<td>(48)</td>
<td>(51)</td>
<td>Various</td>
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<td>Haast Tokoeka</td>
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<td></td>
<td></td>
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<tr>
<td>Haast</td>
<td>87.1-92.8-96.6</td>
<td>110.8-119.9-124.0</td>
<td>104.0</td>
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<td></td>
<td>(12)</td>
<td>(8)</td>
<td>Colbourne</td>
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<tr>
<td>Southern Tokoeka</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stewart Island</td>
<td>91.9-104.4-118.3</td>
<td>132.8-141.8-152.9</td>
<td>125.6</td>
</tr>
<tr>
<td></td>
<td>(30)</td>
<td>(22)</td>
<td>Colbourne &amp; Robertson</td>
</tr>
</tbody>
</table>

**Sexing kiwi using DNA**

Dr Leon Huynen and Prof. David Lambert from the Institute of Molecular Biosciences at Massey University have developed a technique of sexing kiwi from the identification of female specific DNA extracted from DNA present at the bases of feathers (Huynen et al., 2002).

To date, the method has correctly sexed over 95% of known sex wild birds of all four species. Failure to sex the bird correctly has been mainly due to contamination of samples in the field or in the laboratory, or lack of amplification of the smaller female loci at small concentrations of DNA. The latter results in the misidentification of females as males. Feathers collected from birds as young as 3 days old, and feathers stored for up to 7 years have been correctly identified.

**Procedure for collecting samples for sexing**

**You will need:**
- Philatelist envelopes, small zip-lock bags, or small canisters.
- White labels and pencil

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*Kiwi Best Practice Manual (September 2003)*
This copy printed on 29/11/07

Please note that this paper copy may be out of date – please check the internet version or contact your local DOC office to check your copy is current.
Method:
1. Collect 6-20 feathers from each bird. Preferably collect feathers dislodged from the bird during handling. However, if there is any doubt about the origin of the feathers (e.g. adhering to clothing or hand-nets from a bird caught earlier), or if no feathers are shed during normal handling, then 6 feathers should be plucked from the bird. Kiwi are specially adapted to quickly replace lost feathers and will not suffer any ill effects from this procedure.
2. To avoid potential contamination of your samples, avoid touching the shaft of the feather where it attaches to the bird’s body. It is there that the DNA will be extracted.
3. Place the feathers in a philatelic envelope or zip-lock plastic bag.
4. Label container with the location, date, and band/transponder or transmitter number. Remember that your sample is only valuable if you can recognise the bird you took it from.
5. Store at room temperature.
6. Prior to sending the sample to be analysed, in case the package goes missing in transit, split the sample in two and send one set off for identification. Remember to avoid handling the feathers by the base end of the shaft, and to label the new envelope with the same information given in the original one.
7. Given that the DNA test costs about $40 per sample (in 2001), and that you can safely store the samples for many years (we know they can be stored for 7 years), only get samples analysed:
   - if you can not determine the sex of the bird at a later date from measurements
   - or
   - if your project requires it.
8. Send samples in a padded envelope with a cover letter (or e-mail) to:
   Dr Leon Huynen (e-mail: L.J.Huynen@massey.ac.nz)
   Institute of Molecular Biosciences
   Massey University
   Private Bag 11222
   Palmerston North
   Results are usually back in less than one week.

6.6 Blood sampling

Blood sampling is an invasive technique and much care should be taken when employing it. Most important of all is for you to know what kind of information you can get from blood sampling and the limitations of the techniques that use blood samples. Guidelines for the use of blood sampling are contained in Appendix 6.2.

Prior training:
Before you are allowed to take blood samples:
   ∞ you must take blood samples from five kiwi in the field in the presence of an experienced approved person, who will supply a letter of recommendation to the Kiwi Recovery Group.

You shall not attempt to take a blood sample from kiwi without proper training.

You will need:
   Alcohol swabs
   1 ml insulin syringes (22-26 gauge needle)
Specific gear for the particular use you’ll give the blood.
Plastic container or large zip-lock bag to place trash
Ferric subsulphate

Methods:
1. Have all the equipment set up before extracting the kiwi from burrow or day-shelter so the bird is held for as short a time as possible.
2. Hold the bird on its back with the legs pointing towards you so that you have clear access to the metatarsal vein in the leg. This is the only practical collection site for kiwi. This vein runs on the inside of the lower (unfeathered) part of the leg and can be seen running from the 4th toe (spur) diagonally upwards to the front of the “hock” (tibiotarsal) joint, roughly following the line where the leg colour changes.
3. Clean dirt or faeces from the area of the vein with a swab of 70% isopropyl alcohol.
4. Insert a needle at a 30-45° angle, between the scales above the vein, towards the body.
5. Apply a small amount of traction on the plunger until you see the blood entering the syringe.
6. Collect the smallest sample needed for your purposes (Appendix 6.2). It is unusual to need any more than 1 ml of blood for all analyses.
7. Draw the blood slowly, but consistently. Do not take longer than 15 seconds to complete collection, or the blood will clot. If you apply too much suction the vein may constrict or collapse.
8. When you have the blood you need, withdraw the needle. Place a fresh gauze swab over the site and maintain a steady (but not too strong) pressure on it for at least 2 minutes to stop blood flow.
9. Sometimes before applying pressure on the wound you may want to collect blood haematocrits (Appendix 6.3). Do so, and apply pressure afterwards.
10. Replace the cap on the needle and dispose of it and the syringe in appropriate containers. Do not reuse syringes or needles on different birds.
11. Check that the bird is not bleeding, and release back into burrow or shelter as appropriate. If the bird continues to bleed, apply a little ferric subsulphate to the site until bleeding stops, or apply a temporary bandage with gauze and electrical tape.

NOTE: Blood clotting ability varies among the different species of kiwi. The blood of North Island Brown Kiwi clots very quickly, and the needle may have to be washed with an anti-clotting agent such as heparin or EDTA. You must check that the tests you are using the blood from allow the use of these anticoagulants. To coat the syringe insert the sterile needle into the bottle, pull the plunger up then push back to eject the liquid (not back into the bottle!!).

Little Spotted Kiwi, Great Spotted Kiwi and Tokoeka are easier to bleed and usually an anticoagulant is not needed. Do not use anticoagulants on Okarito Brown Kiwi, as these are “free bleeders”, and use a small (26 gauge) needle diameter. If the bleeding does not stop (very rare) apply a little ferric subsulphate to the site until bleeding stops. Be aware that it may do some damage to the surrounding tissues if used excessively.
7: KIWI TRANSLOCATIONS (TRANSFERS)

In this module you will find information on the steps and gear required when translocating kiwi (birds and eggs).

Contents:
7.1 Transferring sub-adult and adult birds
7.2 Transferring eggs and chicks

Additional related documents:
Standard Operating Procedure for the Translocation of New Zealand’s Indigenous Terrestrial Flora and Fauna (QD: NH1042)
Protected Wildlife in Captivity (QD: NH1160)
Appendix 7.2: O.N.E. and husbandry protocols

Translocations have five steps:
1. Capture of kiwi to be translocated or removal of eggs
2. Quarantine
3. Transportation
4. Release
5. Monitoring of released birds or incubation of eggs.

Make sure that you have read the Translocation SOP and worked out each step carefully.

7.1 Transferring sub-adult and adult birds

You will need:
- Transporting boxes
- Transmitters and bands
- Measuring gear
- Other gear as appropriate (blood sampling, etc.)

Method:
1. Obtain approval from the Kiwi Recovery Group to carry out the translocation.
2. Follow the procedures in the translocation SOP, including consultation with iwi at both the capture site and the release site.
3. Iwi should also be consulted about their desire to be involved in subsequent identical transfers. In our experience, most iwi have been closely involved in the first collection of eggs and release of sub-adults as part of Operation Nest Egg, for instance, but happy to just be informed of all later collections and releases.
4. If you are translocating kiwi in the South Island, plan it for the summer months (especially for young birds) as kiwi survive better then. In the North Island any time of the year is good. Avoid translocating birds that are breeding.
5. Before catching birds to be moved, you should have visited the population and attached transmitters to birds. You can then return to the site during the day and catch birds in their daytime roosts. You should make efforts to catch true pairs, and avoid disrupting existing pair bonds.
6. If birds look like they are in poor condition when caught, a health check should be carried out before translocating them. Remember that poor condition could be caused by lack of food at the capture site, and this could be due to intense competition amongst birds for territories rather than by poor health in a disease-related sense.
7. Birds should be caught close to the time of transfer, though it could be more sensible to hold birds overnight rather than rush to catch them on the day of the transfer. In practice, birds are often caught one day, left in the boxes overnight transported, and released the next day.

8. For long stretches of walking with captured birds in forest or in difficult terrain canvas bags can be used to carry kiwi (rather than transfer boxes which are large and bulky).

9. Decide when and where to release birds, following Table 7.1 as a guide.

10. Organise public involvement and an iwi blessing if this is desired. Try to tie all public events together so that the birds are held in transit for as short a period as possible.

11. Make sure any quarantine protocols are followed.

12. Prepare the release site in advance.
   - If releasing during the daytime, find or dig an appropriate hole.
   - If digging a hole, dig a 30 x 30 x 30 cm burrow per bird at the release location on a slight slope. Excavate a cut or ramp for them to get out and cover the hole with a lid of plywood or logs but leave exit for kiwi to get out. Make sure the burrow is dark and will not flood if it rains.
   - If you are not using burrows, familiarise yourself with the area to release the birds in the best place possible.

13. Keep the whole translocation to an absolute minimum duration, up to a maximum of 48 hours in exceptional circumstances from capture to release. Translocations should be expedited and not held back for public events or take longer than 48 hours. Keep the handling of birds to a minimum. Offer food (worms) and water to birds if they are held longer than 24 hours.

14. Mark the birds as follows:
   - Chicks and juveniles: Use transponders. Additionally use transmitters if birds are released in a new area. Be aware of possible problems transmitter entanglement particularly if the vine *Muehlenbeckia complexa* is in the release area. If you are going to use transmitters you must request the advice of the Kiwi Recovery Group.
   - Sub-adults and adults: use bands as appropriate and transmitters if necessary for monitoring.

15. Place birds in specially built kiwi transporting boxes.

16. Place boxes in the transport carrier (vehicle, boat or plane/helicopter). Ensure that birds are transported in pressurised heated aircraft holds.

17. Release birds as planned.

18. Monitor the released birds.
### Table 7.1. Release guidelines

<table>
<thead>
<tr>
<th>Kiwi age group</th>
<th>Release guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chick</td>
<td>Mainland, no predator control</td>
</tr>
<tr>
<td>Adult</td>
<td>Any time (not-breeding)</td>
</tr>
<tr>
<td>Juvenile</td>
<td>&gt;1000g (&gt; 180 days)*</td>
</tr>
</tbody>
</table>

* Juveniles weighing up to 1180 g have been killed by stoats. So when deciding the weight of juveniles for translocations on the mainland err on the conservative side, especially if the young kiwi is very fat and will drop to well below that weight after release, or if the release is planned for the November-January period when stoats are particularly numerous.

** Stoat levels reduced to minimum possible. In mast years do not attempt translocation to mainland sites.

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**Health screening and quarantine**

Populations of endangered species have been moved throughout New Zealand for the past 100 years and translocations can be a very effective management tool. However, each animal moved is a potential carrier of a wide range of viruses, bacteria, fungi and parasites, which could threaten the health of the wild kiwi populations to which they are introduced or even the health of other bird species. Quarantine, the physical isolation of animals for the purpose of health screening and disease control, is thus a significant part of kiwi management.

The following material is taken from Jakob-Hoff (2000). This reference can be accessed through the DOC DME system at WGNCO-22188.

A Wildlife Health Working Group was established by the Department in 1993 following Dr. Milton Friend’s report on disease risks in relation to threatened species management. This Group (chaired by Christine Reed and comprised of veterinarians and others concerned with wildlife health) produced the Department’s draft guidelines for *Health Management of Species Protected under the Wildlife Act*, April 1998 (QD: NH1176).

A key aim of that document – as well as that of the Department's previously published *Standard Operating Procedure for the Translocation of New Zealand’s Indigenous Terrestrial Flora and Fauna* – is to minimise the risk of exposing wildlife to disease through the controlled movement of fauna.

Exposure of wildlife to diseases via animal movements can occur by transporting diseases from the source population to the destination population, or by exposing the moved animals to diseases in the destination population to which they have no resistance.

Minimising these risks requires a three-pronged approach, including health screening and quarantine, wildlife health surveillance, and captive health management.
Health screening and quarantine

Effective quarantine and a thorough health screen of animals prior to their movement is the best insurance against the possibility of transferring any diseases they may be harbouring. A recent example of where this has been applied is with New Zealand dotterels. Apparently healthy captive-reared birds, subjected to routine health screening, were found to be infected with two mosquito-borne diseases, avian malaria and avian pox. Neither disease was found in a subsequent survey of 30 free-living New Zealand dotterels. Consequently captive birds are now reared in mosquito-proof aviaries and are specifically screened for these diseases before release. All diseases to date detected in the ONE kiwi chicks have been found to be in wild populations too.

Wildlife health surveillance

The collection of baseline wildlife health data is critical for conservation managers to be able to make informed disease risk assessments relating to animal movements. At present very little information exists on what diseases or potential disease-producing organisms exist in free-living populations of native birds and reptiles, or on the normal (healthy) values for blood, microbiological and other diagnostic tests used to evaluate the health of native species. Without this information it is not possible to develop species-specific health screening protocols which focus on diseases of concern. It is essential that the Department plan to collect this data on a proactive basis – prioritising those species for which there is likely to be an active program of animal movements over the next 5-10 years.

For kiwi, these issues have been addressed in recent years, and so quite good baseline information is now available about the incidence of disease in the wild and what blood normals are.

Captive health management

Ensuring that captive facilities maintain good standards of health management will further reduce the risks of disease transfer from captive to wild populations and vice versa.

The routine health screen should be designed to assess the general health and fitness of the animals for movement. At a minimum, this should include:

- a physical examination, including a check for external parasites and the recording of body weight and standard body measurements
- a blood smear – for a complete blood count, differential white blood cell count and blood parasite exam
- a capillary tube of blood for packed cell volume and total serum protein
- a faecal exam including:
  - direct smear for protozoa
  - gram stain for bacteria and yeasts
  - flotation for internal parasites.

Also, because some parasites (e.g. Coccidia) and bacteria (e.g. Salmonella) are shed intermittently, multiple (pooled) samples should be taken over several days or weeks, as these are more likely to give a true indication of the carrier status of an individual animal than would a single sample.

Finally, observation of the immune-suppressive effects of stress due to confinement over a period of time can help identify animals which are non-symptomatic carriers of viral and other diseases (i.e. the carrier animals may start to show symptoms of disease).
The opportunity to identify these animals and to take repeat samples will depend on the length of the quarantine or observation period.

**Extensions to the quarantine period**

For any movement category, the quarantine may need to be extended if:

- one or more of the animals is found to be unfit for movement (e.g. poor body weight),
- a disease is uncovered through the health screen which requires treatment (in this case the quarantine would need to begin again after the end of the treatment)
- a disease of concern in this or related species is known to take more than 30 days between infection and first signs of illness (i.e. incubation period > 30 days)

This judgement should be made by the consultant veterinarian.

**Checklist of actions to set up quarantine**

The stringency of quarantine will depend, to some degree, on what diseases you are aiming to exclude (e.g. protection against insect-borne diseases will require insect-proof facilities). Every effort should be made to comply with all of the requirements listed below. Even though the list aims at the broadest coverage possible, very few of the individual items are in fact negotiable.

**Location**

A suitable site where human and animal access can be strictly controlled has been identified.

**Facility**

An animal containment facility has been reserved at the above location and meets the following criteria:

- meets the species' physical, physiological and psychological needs
- can exclude vectors of diseases of concern
- entry and exit can be restricted to a single lockable door
- hygienic standards of husbandry can be maintained
- adequate ventilation and drainage
- a ready supply of clean water
- incorporates a service area suitable for dry storage of food, cleaning utensils and protective clothing
- animals can be looked at daily
- animals can be readily captured and restrained for physical examination and diagnostic sample collection
- wastes can be hygienically stored in a covered bin and disposed of (e.g. incineration, burial etc).

**Equipment**

The following equipment has been obtained:

- a sign stating “Quarantine - No Unauthorised Entry” to be posted on the facility's access door
- protective clothing (overalls, boots, rubber gloves, disposable surgical caps and, in the case of birds and bats, face masks) to be worn and stored in the facility throughout the quarantine/observation period
- feeding, watering and cleaning utensils dedicated to this area
insect/rodent control equipment
branches, shelters, etc, as required to furnish the animal enclosure to the species' requirements
animal capture (e.g. nets) and restraint (e.g. bags) equipment dedicated to this facility or disinfected
diagnostic sample collection and transport equipment (syringes, swabs, sample bags etc)
forms and pens to maintain animal observation and health records
book to maintain Quarantine Register.

**Budget**
The cost of the quarantine and health screening process has been established and allocated to the appropriate budget.

**Personnel**
A person or people experienced with the species have been allocated the care of the animals during the quarantine period and designated “Quarantine Supervisor(s)” for this period. During this time they will not, if at all possible, be in contact with similar animals.

**Responsibilities**
The Quarantine Supervisor(s) has/have been given the following responsibilities and have had these explained to them:
care for the welfare of the animals throughout the quarantine period
maintain security of the quarantine facility, including the Quarantine Register,
ensure that they and all persons entering the facility follow quarantine procedures
maintain legible animal health and observation records (see below)
maintain a clean and hygienic environment within the facility at all times
collect or assist the collection of diagnostic samples as appropriate for this animal movement
administer any animal treatments/vaccinations (e.g. worming agents) as directed by veterinarian
immediately notify the project manager of any deaths or signs of ill health among the quarantined animals
immediately refrigerate (NOT freeze) any animals that die in quarantine and record the time and circumstances. Forward for post-mortem, or if not possible, collect samples.

**Training**
Training needs that ensure the Quarantine Supervisor can competently carry out the above responsibilities have been identified and will be provided prior to the beginning of this quarantine.

**Records**
A record system for documenting the behaviour and health data collected from the quarantined animals has been set up. If quarantining kiwi, you should contact the Wildlife Health Coordinator, BRU (currently Kate McInnes) for advice.

**Transportation boxes**
1. Transportation boxes should be built specifically for the transportation of kiwi to avoid disease spreading between species. They **shall not** be used to transfer weka, poultry or other animals.
2. The most important feature of a transport box is that it must have good ventilation. Although the box should not be too small there should not be so much space around the bird that if jolted the bird could hurt itself by hitting the walls at speed.

3. If the transportation involves helicopter, boat or jet travel, temporary squares of closed cell foam can be stapled to the inside of the box to cushion the bird and cut down noise, but make sure the vents are not blocked.

4. Boxes used successfully in the past are either single boxes or double boxes that take a pair, two juveniles or two sub-adults. Double boxes are preferable for stacking, keep members of pairs together, and are more stable, however single boxes can give more flexibility and are lighter to carry if the release involves much walking to the release site.

5. The double boxes have a separating barrier to keep the birds apart. Do not place two kiwi in the same compartment; heat build-up may cause stress. Adult kiwi are highly territorial and to stop birds becoming highly agitated place true pairs in the double boxes. Juveniles or sub-adults can also be transported in the same double box.

6. Make sure the boxes are well stapled or tacked as kiwi can ingest loose tacks, which could be fatal. The vents must have a fine mesh (insect screen) on the inside to stop the kiwis’ bills from probing through. Not only could they scrape their bills on the metal but if another box or item were to bang against their box while their bills were poking outside, the result could be a broken bill.

7. Line the bottom of the box with folded newspapers and on top of that with a ‘nest’ of absorbent paper towels (non-scented). Kiwi can be very messy so have a supply handy for a complete change if the transportation is over a long time period. The lid should be secured with a fastener to prevent it from opening in transit and should be tight-fitting so that a bill tip cannot push under it.

8. If a plywood lid is used, make sure it does not warp in the sun. A frame of supporting battens will prevent this. Marine grade ply stops boxes from rotting particularly as they often get wet from rain, sea spray on boats, and during washing. Sturdy fold-down galvanised steel handles, bolted, make the boxes easier to carry. Latches should also be sturdy. White enamel paint inside and out, with appropriate undercoat will make washing down and disinfecting much easier. In some instances, birds can be carried in a less robust container. If a bird is only to be transported by car, and signage is not needed on the box (e.g., for a media occasion), a cardboard cat-box (available at any veterinary practice) is all that is required but tape up the corner holes to prevent kiwi damaging their bills.

9. It is not necessary to provide water to the birds if they are only kept one night in the box. If birds are to be in the box for more than one night, provide worms so that they receive water by that means (worms are 75% water). If over-nighting, always keep the birds on the premises of the DOC officer responsible for their care. This avoids the temptation for people to take a look, open the lid and risk kiwi escaping.

10. Noise must be reduced so the kiwi are disturbed as little as possible.

11. The boxes must be cleaned using Virkon which is available from vets (or 1% chlorine solution) and scrubbing brush after each use. They should be left to dry in a well-ventilated area before being stored in a dry area.

**Transport**

Travel during the day is preferable to minimise disturbance to feeding routines. The birds will also be sleepy.

**Car**

Vehicles should be kept as cool as possible during transportation to avoid heat stress. Full ventilation or air conditioning is essential for sunny or warm days. Do not transport boxes in
the boot of a car, as not only is ventilation reduced, but also there is a risk of carbon monoxide poisoning.

The translocation box should be secured at all times during the translocation procedure. Either secure the box with the seatbelt or (preferably) have someone hold on to it. Don’t have the radio on loud and keep voices down. Watch to be sure that the birds do not get their bills through the ventilation holes.

**Boat**

Boats are often used for transfers from offshore islands. Bad weather should be a risk assessment in these transfers. Always have a helicopter back-up or be prepared to release birds back into the territories where they were caught if conditions deteriorate so much that transportation is impossible. Stow transport boxes in a dry area or place tarpaulin over them to prevent spray getting into the vents, but maintain ventilation. Sometimes the deck is the best place, rather than deep down in the hold.

**Air**

Contact an airlines coordinator in plenty of time before a transfer so that as little stress as possible is experienced by the bird and you. Airline regulations prevent birds being carried in the cabin in commercial passenger aircraft, so they must travel in the hold. As some cargo holds are unheated, make sure kiwi are loaded into pressurised, heated holds. Have DOC staff at the departure, transit, and arrival destinations to observe the loading and unloading of the boxes. On non-commercial charter flights, a DOC staff member or volunteer should accompany the eggs or box inside the cabin and the box should occupy an adjacent seat. Birds shall not have live transmitters while in the aircraft. To overcome any problem, use transmitters that can be deactivated and activated again using a pass of a magnet. This avoids the stress to the bird from removing the transmitter and then putting it back on again. This can be a big undertaking when dealing with over ten birds at once at an airport.

**Monitoring**

Monitoring should be intensive enough to provide good information regarding the survival of the birds and their whereabouts after the translocation, but not so intensive that the birds suffer from it. We recommend the following schedule, but if the pattern of growth and survival of released birds in your area (e.g. Ōkārito) is well established, much less frequent monitoring of radio-tagged birds is acceptable. In that case monitoring should be frequent enough to prevent the transmitter harnesses failing or restricting leg growth in chicks and juveniles. Variation from these recommendations can be approved by the Kiwi Recovery Group and any variations should be carefully recorded for future updates of this manual.

**Sub-adults/juveniles – all should be transmittered**

Monitor by checking location, catching, measuring and weighing weekly for the first month after release, fortnightly for the next two months, and three-monthly thereafter. Check to ensure the transmitter is safely attached. Band birds at the first opportunity (when they are big enough).

**Adults – all adult kiwi being transferred must be banded**

Whether transmitters are attached will depend on the circumstances surrounding the release – e.g. at Karori Sanctuary, most Little Spotted Kiwi released did not carry transmitters, but some males did have transmitters to monitor breeding. In most instances, monitoring of adult birds will involve checking the fate of transmittered individuals and catching, measuring and weighing them no more frequently than at monthly intervals. Follow-up monitoring of the
banded population should be carried out at no longer than five-yearly intervals until such time as it is determined that the transfer was successful.

Monitoring must be adequate to measure the success of the translocation and must meet the requirements set out in the Department's Standard Operating Procedure for the Translocation of New Zealand's Indigenous Terrestrial Flora and Fauna.

**7.2 Transferring eggs and chicks**

Eggs or very young chicks are mostly collected from active nests as part of Operation Nest Egg (O.N.E.), although eggs and chicks are also rescued when possible from deserted nests.

**When O.N.E. should be used**

O.N.E. is only one of a number of management options and must not be embarked upon without full consultation with the Kiwi Recovery Group. It will remain an experimental programme until its effectiveness is more fully proven. While O.N.E. benefits kiwi, it has a neutral effect on the rest of the community. An intensive, long-term, fully integrated pest control programme consisting of poisoning and/or trapping may benefit the plants and other threatened animals as well. Alternatively, this pest control programme may benefit kiwi, but be detrimental to other animals through upsetting the natural balance of predators and their prey - the removal of stoats may allow the increase of mice and rats, key predators of invertebrates, small reptiles and passerines.

O.N.E. should preferably be used in conjunction with control of ferrets and dogs, as these are the two main predators of adult and sub-adult kiwi.

O.N.E. should be used:
- where new populations are to be established (e.g. Boundary Stream),
- where very depleted populations are to be enhanced (e.g. Bream Head),
- to rapidly recover the populations of the most endangered taxa of kiwi,
- where other threatened species may be affected by predator changes caused by controls used to protect kiwi,
- during years of stoat plagues or high stoat numbers when conventional pest control methods fail to adequately protect young kiwi (i.e. less than 20% survival),
- where populations receive no protection but the offspring can be moved to neighbouring populations that have a successful long-term management strategy,
- where transfer of disease or parasites is an issue if adult birds were to be moved,
- to establish a captive population of taxa not already held in captivity

The use of O.N.E. as an advocacy tool should not be underestimated. It has proven to be excellent for building critical conservation linkages with tangata whenua, local schools, local communities and captive-breeding institutes, as well as being a vehicle for highlighting threats to kiwi in the popular media.

**Transfer procedure**

DOC Conservancies in major kiwi strongholds are encouraged to buy a commercial incubator in which the eggs can be held safely in an emergency (e.g. when a bird abandons a nest, or when eggs are handed in by the public) while arrangements are made with the appropriate institutions. In the absence of an incubator, eggs have been successfully kept alive using a chillybin that has been made into an emergency incubator. A small plastic slicker pad heated in a billy of hot water (or in a microwave) placed in the bottom of the chillybin will provide a
heat source. Make sure the egg does not come into contact with the pad. A digital thermometer with an external sensor is inexpensive and can be used to check that the air around the egg is no hotter than 37°C.

Method:
1. Several days before collecting eggs let relevant people know this is planned and confirm that each staff member responsible is available.
2. Eggs should be collected at least halfway through their incubation to maximise egg/chick survival.
3. In the wild, male North Island brown kiwi and little spotted kiwi come off their nests on average of 5–7 hr a night midway through the incubation period, leaving the eggs alone. With a normal transfer, you should try to complete the transfer within this timeframe, without needing supplementary incubation, especially if the egg is wrapped and in a draught-free container. In other taxa where incubation is more continuous, you should keep the eggs warm throughout the transfer process.
4. On the day, phone or radio ahead the estimated schedule for delivery and the number of eggs/chicks collected so everything will be ready.
5. Collect the eggs as specified in the next section.

Removal and transportation of eggs from nests
1. The most successful incubation comes when eggs are removed from the nest at a later stage of their development. While there have been rare instances of freshly-laid ONE eggs hatching, the probability of hatching is very low until 10 days old. It increases dramatically between ten and thirty days old at collection, and slowly with age thereafter. Eggs from a single-egg clutch should be removed from 30-50 days onwards, and for two-egg clutches of North Island Brown Kiwi, the oldest egg should be over 60 days old, which means that the second egg should be over 30 days old.
2. Collect the egg during the day. North Island Brown Kiwi nests are often (but not always) shallow burrows and if the male does not appear to be agitated remove the eggs from beneath the bird with a smooth action. Gently grasp the egg with a hand above and over egg so that if the male does strike out it is the hand not the egg that receives the kick. Use a bare hand rather than gloved to increase sensitivity to holding the egg - make sure your hand is completely dry. Ensure that the egg is transported in the neutral position, i.e. let it roll until it balances with the airsac uppermost and transport like that. The egg will be disinfected later. Repeat with second egg if present.
3. If the male appears agitated, the nest is too deep or is in a difficult position, collection should be at night when the male comes off the nest to feed. An access shaft can be dug to one side of the cavity, not directly over the chamber.
4. In South Island taxa, the parents often back-off the egg or run off. If they don’t, return at night and try playing a tape of a kiwi call nearby to see if that will lure the bird off the nest. These birds are much stroppier than those from the North Island and there is a greater risk of feet striking out and damaging the egg. The nests are attended all the time.
5. Immediately on removing eggs from the nest candle to find the top of the egg (where the airsac lies uppermost). Alternatively, put the egg on a flat lunchbox lid, and the egg will naturally balance with its airsac uppermost - this works better for older eggs.
6. With a soft-leaded pencil, write on the egg an identification code such as location, the name of the nest number, the band or transmitter number of the parent(s) and the date collected, and identify the top of the egg.
7. Place the egg top up in a small (6-litre) chillybin, packed around with shredded paper. Do not use plastic as a packing medium as the egg is a living, breathing organism and the shredded paper provides plenty of air gaps for the gaseous exchange through the pores. A chillybin also protects the egg from bumps in the course of getting the egg out of the bush, and helps prevent the egg from cooling rapidly.

8. Occasionally an egg is collected that has cracks in the shell or even holes in it, as opposed to the egg pipping from inside. So long as these haven’t been incubated like this for too long and the egg hasn’t lost too much moisture, or let in too many bacteria, they can be salvaged and successfully hatched. Use nail varnish or a very quick drying glue such as Loctite or Superglue to seal the crack(s). If the airsac is abnormally large the egg will need to be incubated in a much higher humidity so it won’t be too dry on hatching. It is worth the effort because a healthy chick could still result.

9. Another problem sometimes encountered is mud encrustations over the egg (often the egg is brown). This mud must be removed as it will block the pores and suffocate the egg. If mud has dried this must be dampened and wiped off. If that doesn’t work, as a last resort scrub the egg (as gently as possible) and disinfect the shell.

10. Occasionally an egg will be incubated alongside a rotten egg so that it smells bad as well. Still persist with this if the candling or movement indicates it is still alive but keep separate from other eggs in another incubator.

11. In a situation when an egg is collected (e.g. through desertion of the adult) and cannot be transferred to captivity or a commercial incubator that day, there are custom made incubators that run off 12v car batteries, though they are often power-hungry. Likewise a battery-operated portable incubator, which cradles the egg in transit, is available commercially.

12. If eggs are driven over rough terrain have someone hold the chillybin by the handle to cushion the shocks. If on the tarseal road place the chillybin on the seat (secured by the seatbelt) rather than on the floor of the car or in the boot of the car to give extra cushioning.

13. If the egg is to be flown, make sure that the container is very clearly labelled as very fragile, kept upright, and is carried in a pressurised compartment (so the change in pressure does not distort the air sac membranes). A helicopter is fine so long as it is not flying too high and changing altitude too quickly.

14. If a freshly hatched chick is to be transferred, treat it as for an egg, for that is all it is, but without the shell. Be careful handling particularly if it still has an external yolk sac (i.e. less than five days old), which is easy to perforate.

15. Once in captivity follow instructions in Appendix 7.2.

**Candling eggs**

Candling eggs is important to determine the age of the embryo, and whether it is alive. Candling should be always done before translocation of eggs to prevent taking eggs that are too young to ensure successful hatching. Even when you have been very accurate in the monitoring of your nests, occasionally, after loss of an egg early on in incubation the female lays a replacement egg. While the male or pair may have been nesting for over 60 days and the egg(s) is thought to be nearing the hatch date, one egg may be only a few days old. If this egg is removed its chances of hatching in captivity are extremely low and it would be better to leave it with the father (or parents) until later.

**Methods:**

1. Candle the egg immediately after removal under a swandri or jacket; the less external light the better the result. A purpose-made large dark bag may be useful. While in the field an AA Maglite torch is usually sufficient to determine if the egg is ready to
be taken or not. A more powerful, battery operated, ‘candler’ is also commercially available. Place the egg under the swandri or large bag and illuminate the blunt end with the torch.

2. The size of the airsac is the first clue (Appendix 7.1), particularly if the egg candler is not powerful. The airsac is located at the blunt end of the egg and gets progressively larger with time (air replaces water that is lost by evaporation).
   - The airsac in a normal egg develops off centre. If there is no airsac or it is very small then the egg is freshly laid and the egg will look yolky.
   - Look for a circular opaque disc or faint red ring at the top of the egg, which appears after 10 or so days from the start of incubation. This indicates a fertile egg.
   - If the egg is yolky looking but the airsac is large, the egg is likely to be infertile.
   - Dark diagonal lines may be detected just under the shell; these don't belong to the embryo but are part of the shell/membrane structure.
   - If the airsac is larger than 5-6 cm in diameter, blood vessels will begin to radiate towards and around the perimeter of the airsac. In a dead egg these vessels quickly break down and liquid may even slop around in the airsac space. With live eggs do not candle for too long or too frequently as the embryo reacts to the light.
   - In an egg nearing full term incubation the whole egg, apart from the airsac, is very dark (Appendix 7.1). The pointed end of the egg should still show a little yellow colour. This is the yolk sac of the chick and indicates that the chick is probably in the correct position for hatching.
   - Before hatching, the chick breaks through the inner membrane into the airsac; this may take place one to eight days before hatch. The chick is now breathing air directly and can sometimes be heard ‘peeping’. If the water content of the egg is too high a small 'ding' may appear in the shell at the airsac end four to five days before hatching. The chick hasn't broken the shell but fractures radiate from one or two points of impact. Nothing may happen for two or three days but suddenly hatching will begin and normally takes 10-48 hours, though hatching has occurred within 2 hours. If the egg shows any of the above characteristics, it can be removed.

3. If you see no airsac or a small airsac (Appendix 7.1):
   - If the egg was taken by day, replace the egg back in nest and block the entrance for 20 minutes to lessen the chance that the bird will desert the nest. If parents do desert there is the possibility another kiwi incubating nearby will accept the egg. Experiments in Northland have shown that eggs from other kiwi are readily incubated by their nesting neighbours. Otherwise remove the egg into captivity, as once an incubating bird runs from a nest it generally will not return.
   - If the egg was taken by night, replace the egg into the nest. Monitor the male’s/parent’s behaviour to ensure that there is no desertion. If the male/parent is not back when it should be, take the egg either into another nest as suggested above, or into captivity.

4. If candling shows that the egg is suitable for removal from the nest, measure the egg with Vernier callipers to the nearest 0.1 mm, recording the length and two width measurements at 90° to one another. Weigh to the nearest gram, either in a plastic bag, or by hanging it from a tab in a tape running right around the egg (subtract bag or tape weight) or weigh to the nearest 0.1 gram on scales in the laboratory.

5. When the egg is cool, after transportation from the nest, gently swab the shell (don’t scrub) with cotton wool to clean off any of the parents’ faecal material or soil using a
warm 30-35°C solution of appropriate disinfectant such as ‘Chickguard’ or ‘Techsan’. If the solution is cooler than the egg then disinfectant could be drawn inside through the pores as the air cooled in the airsac contracts. With soft paper towels dry completely. Re-candle and with a soft leaded pencil lightly outline the airsac and label the top of the egg with its identification code. This label is a reference point during the turning of the eggs. The 'top' of the egg is that part where the asymmetrical airsac tends to intrude backwards into.

6. Place the egg in an incubator previously disinfected with Virkon solution.

**Fresh eggs**

Because less than 1% of freshly laid eggs have hatched in artificial incubators, the temperature and turning requirements have not yet been sorted out. Failure may be through incorrect temperature, humidity, turning, air-flow or incubator design. To advance knowledge, different institutes with a record of successfully producing hatch rates of over 80% (of fertile eggs) must be given some flexibility for applying different experimental techniques for young eggs; this however must be based on sound reasoning. Protocols successfully used at Auckland Zoo, Rainbow Springs and Westshore Wildlife Centre are given in Appendix 7.2, and one of these must be followed, except with the express permission of the Kiwi Recovery Group.

**Egg and chick care**

Refer to Appendices 7.2.1, 7.2.2 and 7.2.3 for O.N.E. husbandry protocols used at Auckland Zoo, Rainbow NZ and Westshore Wildlife Centre respectively. Note which of the protocols you choose to use, depending on what suits your local conditions (e.g. ambient humidity and temperature), and record any variations from the protocol, e.g. through equipment failure.

**O.N.E. chicks**

Kiwi chicks hatch with a large eternal yolk sac which is gradually absorbed over the first 10 days of life. Chicks are semi-precocial and stand upright at less than 6 hours old, and walk freely by 1-2 days old. They are never fed by their parents in the wild and survive entirely off the stored yolk until they first venture from the nest at 5-7 days old.

Weigh all chicks within 24 hours of hatching to determine a hatching weight. Weigh all O.N.E. chicks daily or on alternate days until their weight starts to consistently increase. A **special watch must be kept on any O.N.E. chick that does not start consistently gaining weight by 15 days old, or which has lost more than 30% of its hatching weight. A veterinarian must be called to inspect any O.N.E. chick that is not consistently gaining weight by 18 days old or which has lost more than 33% of its hatching weight.**

**Health screening and quarantine for O.N.E. chicks**

Preferably, kiwi eggs for O.N.E. should be sourced from one discrete area, hatched and reared in purpose-built facilities, or on a small island crèche, completely isolated from other kiwi populations so that when they return to the source population they have not possibly picked up any kiwi diseases. An incubator and brooder room in a city location is ideal. To date, all diseases detected in O.N.E. juveniles in captivity have been found to be naturally occurring in the source/destination population.

To maintain quarantine, pens and crèche islands that have held captive kiwi in the last five years should not be used by O.N.E. birds. Northland O.N.E. birds must not be reared in the same location as Tongariro O.N.E. birds. Haast Tokoeka must not be reared in the same location as rowi from Okarito etc.
In reality this isolated type of quarantine area rarely occurs as the expertise needed is often only found in captive kiwi display/breeding parks or in zoos. It is in these places that, more than ever, quarantine standards have to be exceptionally high, as not only are kiwi on the premises but other animals are present that potentially have diseases that kiwi have never met and established an immunity against.

**Captive health management**

Captive health management for eggs and chicks requires the same sort of precautions as management of subadults and adults.

**Extensions to the quarantine period**

Extensions of quarantine for eggs and chicks will be on the same basis as for subadults and adults.
8: RADIO-TELEMETRY

This module contains information on the main methods of radio tracking.

Contents:
8.1 Ground tracking
8.2 Air tracking

Contributors to this chapter (sections contributed)
Rogan Colbourne and Hugh Robertson (all sections)

Because kiwi are cryptic, nocturnal creatures with limited home ranges, radio-telemetry has revolutionised research on them. Adult kiwi are large enough to carry transmitters (see Section 4) that last over one year and these provide a signal strong enough to be picked up several kilometres away, line-of-sight. Signals are adequately broadcast from underground, though signal strength drops the deeper the bird is. Hills and ridges provide an effective barrier to signal detection, especially if the bird is in a gully.

8.1 Ground tracking

Most kiwi radio-tracking is done from the ground because kiwi are relatively sedentary - birds rarely move more than a few kilometres. The signal is picked up on a receiver (e.g. Telonics TR4) with a three-element Yagi hand-held aerial. The signal is strongest when the aerial is held parallel to the ground and is pointing directly at the bird, but is moderately strong when pointing away from the bird. The closer you get to the bird the stronger the signal, until you are so close to the bird that the sound is almost the same strength in all directions.

Sometimes, if the bird is over a spur or ridge, the signal is detectable only when the aerial is held at right angles to the ground, so occasionally try this orientation when searching for birds.

On flat ground radio-tracking is simple, but in hilly country signals can bounce and disappear altogether. The main source of confusion is when the bird is uphill, as the signal sometimes disappears completely or seems stronger downhill – persist in climbing and the signal will suddenly appear strongly, unless of course the bird really was at the bottom of the hill!

Assuming that you have worked your way close to the bird and the signal is now very strong and less directional even with the “Gain” turned down, and no obvious burrow is in sight, remove the aerial from the receiver and turn up the “Gain” – if you are within 5-10 m of the transmitter, you should be able to hear the signal. The receiver minus the aerial can be used like a geiger counter and swept over the ground to pinpoint the transmitter (fallen off, or on a bird in a hole whose entrance is obscured (e.g. a nest) or some distance away – e.g. an under-runner). Be aware that the transmitter may be up a tree in a stoat/rat den, or the bird may have climbed up the inside of a hollow tree.

When searching for missing transmitters, try to get high up a hill some distance away from where the transmitter is expected to be (it is often hard to pick up a signal directly below the top of a hill, because the convex curve near the top of the hill prevents a line-of-sight contact).

Keep the receiver dry (inside a plastic bag on a wet day) and be aware that the fine-tuning on receivers can vary slightly, and transmitter frequencies can change slightly with battery age, especially in the first few minutes after being activated, and then again as they are about to fail. Note the fine-tuning each time you encounter the bird. The central and front elements of...
the Yagi aerial are the most critical, and the base ones (closest to your head) can normally be folded away without losing ability to detect signals; always replace front or central elements if they are damaged, and check connections if no signals can be detected.

8.2 Air tracking

Some kiwi, especially juveniles and sub-adults, can wander long distances (20+ km) and the only effective way to find them is to detect their signal and identify their general location from an aircraft. The Civil Aviation Authority has approved a radio-antennae system to be attached to the struts of Series 172 Cessna aircraft. Sirtrack sell or hire this antennae system and clamps, but this must be fitted by an aeronautical engineer the first time it is used on a particular aircraft. Aeronautical engineers are present at airports where there are commercial flights, and possibly at some smaller airports too. Some observers have found that there is considerable signal interference on TR4 receivers (which have limited filtering), but TR2 receivers are fine (but use a different numbering system to TR4s and so each signal must be translated), as are TR5 receivers and ATS scanning receivers. The latter are pre-programmable to search for missing transmitter frequencies, and are recommended if you expect to do much tracking from aircraft for multiple birds. You can pinpoint the location of birds by switching between aerials mounted on either side of the aircraft through a simple switching box, which is part of the air-tracking kit.

At present, mounting aerials on other types of aircraft or on helicopters has not been approved by Civil Aviation Authority in New Zealand, though the standard Sirtrack 3 element Yagi antenna can be used from inside the aircraft.
9: SICK, INJURED AND DEAD KIWI AND KIWI EGGS

This section addresses the steps to take if you encounter sick, injured or dead kiwi or kiwi eggs.

Contents:
9.1 Treatment of sick and injured kiwi
9.2 Dead kiwi
9.3 Dead kiwi eggs

Contributors to this chapter (sections contributed):
Rogan Colbourne and Hugh Robertson (all sections)

Additional related documents:
Issue of Permits to Collect Flora/Fauna (QD: NH1167)
Collecting of Plant or Animal or Soil Samples (QD: NH1210)
Allocation of Dead Specimens of Species Protected Under the Wildlife Act 1953 (QD: NH1244)
Injured Bird Permits (QD: NH1164)
Health Management of Species Protected under the Wildlife Act (QD: NH1176)
Protected Wildlife in Captivity (QD: NH1160)
Request for Kiwi Feathers (QD: NH1169)

9.1 Treatment of sick and injured kiwi

If you come across a sick or injured kiwi you should attempt to get the bird to veterinary care as quickly as possible. If the bird is unduly distressed and clearly beyond recovery, it should be euthanased. Unless you have experience with sick and injured birds and humane methods of euthanasia it is best to take the bird to a veterinarian. Let the veterinarian make their own professional judgement on whether to euthanase the bird.

Following initial treatment, the bird may have to be held captive while the injuries heal, or the disease is treated, in which case the bird should be transferred to a permitted kiwi display facility or other recognised carer for injured birds, and held off display in predator-proof facilities. Again, a veterinarian should decide whether a treated bird is suitable to be released to the wild or whether it needs to be held in captivity for the rest of its life; it is reasonable to ask for a second opinion.

Kiwi are resilient birds, and can recover from a broken leg in the wild (e.g. a bird killed in a leg-hold trap in 1999 was found to have previously broken its leg, probably in another encounter with a trap) and birds with toes missing are often encountered in the wild.

Table 9.1 and Appendix 9.1 show what information needs to be recorded from sick and injured birds and what you have to do when releasing them into the wild. Figure 9.1 shows the steps to follow when a sick, injured or dead bird or egg is found.
Table 9.1. Treatment of sick or injured kiwi

<table>
<thead>
<tr>
<th>Information required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thank the person handing in the kiwi. Note down the circumstances and exact location where the bird was found and the symptoms of the illness. Explain to the person who recovered the bird that it is important to try to release the bird back into its normal territory if possible.</td>
</tr>
</tbody>
</table>

A good range of blood normals for wild kiwi has now been obtained from North Island Brown Kiwi, Great Spotted Kiwi and Haast Tokoeka which should assist veterinarians in diagnosis. These are available to vets on request from Hugh Robertson (SRU) or Richard Jakob-Hoff (Auckland Zoo).

If the veterinarian takes a blood sample for smears or other blood tests, ask them to set 0.2 ml aside in 100% ethanol for possible DNA testing or DNA sexing. If no blood sample is collected during the diagnosis phase, you should ask the veterinarian to collect 0.2 ml blood into pure alcohol or to collect several pin feathers. Samples for DNA analyses should be sent to Hugh Robertson, Science & Research Unit, Department of Conservation, Wellington.

Ask the veterinarian to keep detailed records of their diagnoses and treatment schedules, as this may help treatment of similar cases in the future. Records of successful and unsuccessful treatments should be sent to the Kiwi Coordinator (Research and Monitoring). If possible, these records should be published in a veterinary journal so that other vets can access the material.

<table>
<thead>
<tr>
<th>Release and monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a bird can be released, it should be banded or transpondered, measured, weighed and sexed, and given an overall health clearance, in accordance with best practice.</td>
</tr>
</tbody>
</table>

The bird should be returned as close as possible to the site where it was found, or if this is unsafe (e.g. if a kiwi was mauled by a dog which is still present), then consult with the Kiwi Recovery Group about possible release sites nearby.

In some cases there is an advantage in having a transmitter on the bird to see if it copes with the transition back to the wild following traumatic injury, as this will provide useful information for dealing with birds which have similar injuries in the future.

Birds should be radio-tagged when released away from their original location, to see if they return home.

It is a good idea to invite local iwi and the person(s) who handed in the injured or sick bird to the release.

9.2 Dead kiwi

Field workers will occasionally come across dead kiwi, mainly radio-tagged birds. Other birds found injured or sick may die. If the specimen is simply skin and bones, or a suppurating mess, then there is little value collecting the specimen as detection of poisons or disease will be impossible, and it will be difficult to obtain useful material for cultural uses. However standard bill measurements may provide information on the age and sex of the bird. If the specimen is still quite fresh, then place it into a plastic bag and seal it. Follow instructions below.

It is important that all deaths of kiwi are documented and, where possible, samples are collected for scientific, pathological and cultural use.
Figure 9.1 – Steps to follow if you find sick, injured, or dead kiwi and eggs

**Kiwi – Bird(s) or egg(s) found**

- **SICK OR INJURED**
  - Too sick or badly injured
  - Not too sick or badly injured, OR
  - Unsure about the gravity of the sickness or injury
  - Take the bird to a veterinarian
  - Measure and take blood samples
  - Write symptoms of disease/injuries
  - Depending on recommendations...
  - OR If you can't do it

  Regardless of who found the bird (DOC/Public)

- **Euthanasia**
  - Take photo at site if possible
  - Measure bird
  - Collect several pin feathers (or normal feathers) for DNA testing
  - Fill out kiwi death data sheet
  - Fill out label and attach to bird
  - Decide on possible cause of death

- **Poisoned?**
  - Take extreme caution to prevent self-poisoning
  - Place bird in bag and freeze
  - Contact a National Kiwi Coordinator to receive instructions on what tissues to collect
  - Send results of tests to NKC

- **Diseased or unknown?**
  - Place bird in fridge, NOT freezer
  - Send for autopsy to Alpha Scientific, Hamilton
  - Contact a National Kiwi Coordinator & send any results

- **DEAD**
  - Collect only if in reasonable condition

  - **BIRD**
    - Measure and label egg
    - Secure egg with tape
    - Store in fridge, not freezer
    - Fill out kiwi death data sheet
    - Send egg to Murray Potter, Massey
    - Send results of autopsy to NKC

  - **EGGS**
    - Bag bird and freeze
    - Contact Cultural Materials Committee
    - Contact National Kiwi Coordinator & send any test results

**Rehabilitation and/or Release?**

• Write down information about the incident
• If public involved, make them a part of it
• Always inform National Kiwi Coordinator

Please note that this paper copy may be out of date – please check the internet version or contact your local DOC office to check your copy is current.
**Information collection**

The information required from a dead bird will vary with the circumstances of the death.

**What to do if poisoning is suspected**

In cases where poisoning was suspected, or in study areas where this is being specifically investigated, follow these steps:

1. If possible, take a photograph of the dead kiwi in situ.
2. Put on latex gloves, and carefully, to avoid self-poisoning, place bird in a bag.
3. Complete and attach a leg label, providing details of date of death, location of death, apparent cause of death, person who found the bird, person who reported the death (if different), and person who filled in the tag.
4. Place the specimen in a fridge or freezer (note putting the bird in a freezer will compromise the ability to investigate disease as a cause of death, so seek advice from the National Kiwi Coordinator if there is significant doubt).
5. Contact an appropriate person to carry out the necessary dissections for testing. This may be the relevant CAS, a National Kiwi Coordinator, or someone else with dissection skills and experience.
6. Contact a National Kiwi Coordinator, and Geoff Wright, Landcare Research, Lincoln (ph 03 325 6700) to arrange courier delivery (do not send samples on a Friday or Saturday) before necessary samples are removed. The Department of Conservation has a contract with Landcare to provide poison assays of non-target species.
7. Ask that minimal damage is caused to the specimen if it is later required as a museum specimen or for use by the local Cultural Materials Committee.
8. Arrange for return/forwarding of the specimen to the next user.
9. Dissect the appropriate body parts for suspected poisoning (liver for anticoagulants—such as brodifacoum or warfarin, muscle for 1080 or cholecalciferol, upper digestive system for cyanide), and place in a specimen container marked clearly with: species, code or band number, locality, date, name of sender, and toxins to be analysed.
10. Refreeze samples.
11. Store the remainder of the specimen in the freezer for other uses.
12. Send package in ice in a small chillybin, marked ‘Perishable’, by overnight courier to Geoff Wright, as arranged previously.
13. Complete a ‘Kiwi Deaths’ data sheet (see Appendix 9.2).
14. Results of assays from Landcare Research NZ Ltd, and a photocopy of the ‘Kiwi Deaths’ data sheet shall be sent to the National Kiwi Coordinator (Research and Monitoring) and to relevant Area Managers and CASs.

**What to do if disease is suspected or possible (i.e. no obvious cause of death)**

In cases where disease is suspected as the cause of death (e.g. in poor body condition, with superficial lesions or lumps, other symptoms recorded before death, or birds that have died for no obvious reason), follow these steps:

1. If possible, take a photograph of the dead kiwi in situ and search the nearby area for other clues about the cause of death (e.g. predator faeces, dog footprints).
2. Put on latex gloves. Complete and attach a leg label, providing details of date of death, location of death, apparent cause of death, person who found the bird, person who reported the death (if different), and person who filled in the tag.
3. Store the specimen as soon as possible in a refrigerator, NOT in a freezer – freezing can cause cells to become distorted and destroyed on freezing and thawing. Maggots, if present, can be killed with fly spray or be picked off.
4. Complete a ‘Kiwi Deaths’ data sheet (see Appendix 9.2).
5. Contact a veterinarian or diagnostic laboratory familiar with kiwi autopsies. The following are recommended:
   - Alpha Scientific Ltd, PO Box 195, (57 Sunshine Ave), Hamilton.
     Ph: (07) 846 2266, Fax (07) 846 2346,
     Maurice Alley, Institute of Veterinary, Animal and Biomedical Sciences,
     Pathology, Massey University, Palmerston North.
     Phone: (06) 356-9099
     Email: M.R.Alley@massey.ac.nz

6. Get the specimen to the veterinarian or laboratory as quickly as possible in a chillybin with an icepack to keep the specimen cool while in transit.

7. Ask that minimal damage is caused to the specimen if it is later required as a museum specimen or for use by the local Cultural Materials Committee.

8. Arrange for return/forwarding of the specimen to the next user.

9. Results of the autopsy and a photocopy of the completed ‘Kiwi Deaths’ data sheet shall be added to the conservancy database, and sent to the National Kiwi Coordinator (Research and Monitoring) and relevant Area Managers and CASs.

**What to do if another cause of death**

For cases where a kiwi is known to have died from accidental causes (e.g. ferret, dog, trap, car) and where poisoning or disease are not suspected, the specimen can be used for a variety of purposes.

1. If possible, take a photograph of the dead kiwi in situ and search the nearby area for clues about the cause of death (e.g. predator faeces, dog footprints).

2. Put on latex gloves. Complete and attach a leg label, providing details of date of death, location of death, apparent cause of death, person who found the bird, person who reported the death (if different), and person who filled in the tag.

3. Place specimen in a freezer until you find out the possible uses for it.

4. Complete a ‘Kiwi Deaths’ data sheet (see Appendix 9.2).

5. Ask your CAS, or the National Kiwi Coordinator (Research and Monitoring) if they know of particular approved research programmes under way which need fresh kiwi specimens (e.g. the need for museum skins from particular taxa or regions, or scientific research on diet, condition, or state of body organs).

6. Contact the Cultural Materials Committee (CMC) in the Conservancy in which the specimen was found (this is not necessarily the Conservancy where the bird was handed in, e.g. road-killed birds can be handed-in many kilometres away from where they were found) to arrange for the transfer of the specimen.

7. Forward the clearly labelled specimens, following instructions from the users.

8. After research use or CMC use, freeze the remains of the specimen and ask your CAS/Conservancy kiwi coordinator to determine if the remains of the specimen are needed for any other research work, and/or arrange for appropriate disposal following consultation with CMC representatives.

**9.3 Dead kiwi eggs**

During research and management work, kiwi eggs are discovered which have either been abandoned, gone well past due hatch date, are displaced from nests, or fail to develop in captivity. Be aware that during the first week or so of incubation, the first egg of a clutch can be left unattended during the day, and so an unattended egg is not necessarily abandoned.

If you find a dead egg, these are the steps to take:

1. Secure broken eggs with electrical tape to prevent further breakage. Likewise use tape to block any puncture holes.
2. Measure the egg with Vernier callipers to the nearest 0.1 mm, recording the maximum length and two width measurements at 90° to one another. Weigh to the nearest gram, either in a plastic bag, or by hanging it from a tab in a tape running right around the egg (subtract bag or tape weight).
3. Label the egg with a soft lead pencil with the locality, date, observer and nest identifier and/or band number of the parents.
4. Place the egg in a clean plastic bag and carefully transport back to the office, and store in a refrigerator, not a freezer.
5. Complete a “Kiwi Deaths” data sheet (see Appendix 9.2)
6. Photocopy, file and send a copy to CAS/Conservancy kiwi contact and to the National Kiwi Coordinator (Research and Monitoring).
7. Contact Murray Potter, Ecology Department, Massey University (06) 350 5799 to make courier arrangements. He can supply packaging materials and courier labels for safe transport of the eggs, but you can use rigid containers such as 2 litre ice cream boxes, and place the egg amongst shock-proof materials.
8. Label the package ‘FRAGILE’, ‘PERISHABLE’ and ‘Refrigerate, DO NOT FREEZE’.
9. Send copies of the results of the egg analysis together with a copy of the Kiwi Dead data sheet CAS, the National Kiwi Coordinator (Research and Monitoring), and to the relevant Area Office and/or egg collector.
10: METHODS UNDER DEVELOPMENT: USING DOGS IN KIWI WORK

This module helps you:

∞ Assess whether you require a kiwi dog for your work.
∞ Learn about the necessary skills to get approval to have a kiwi dog.
∞ Understand the criteria used to select and train a kiwi dog while minimising the risks of choosing the “wrong” dog.
∞ Learn about the steps to certify your handler/dog team.

The module also provides contacts who can give you more information if you are interested in using a dog in your kiwi work.

Contents:
10.1 The use of dogs for kiwi work
10.2 Before you get a kiwi dog
10.3 Selection of a kiwi dog
10.4 Training of a kiwi dog
10.5 Training dogs to find kiwi
10.6 Rules for those using dogs for kiwi work
10.7 Certification procedure
10.8 Who to talk to
10.9 Monitoring kiwi using trained kiwi dogs
10.10 Catching kiwi at night using a trained kiwi dog

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Lance Dew
John McLennan
Tom Herbert
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Additional related documents:
Managing Dogs on DOC Land, Proposed Changes to Legislation (QD: NH1141)
Certification of Dogs Used in DOC protected species management programmes QD: NH1415)

10.1 The use of dogs for kiwi work

Dogs are important tools to achieve some types of results for kiwi research and management, and without them it is unlikely that work on kiwi would have produced anywhere near the same outcomes and sample sizes that it has so far. Some of the activities, under the Kiwi Recovery Programme, in which dogs have made a big contribution, are:
∞ Finding birds for banding and radio-tagging as part of a wide range of research or management work, e.g. determining effectiveness of different predator control methods, assessing the effects of toxins on kiwi, and for Operation Nest Egg.
∞ Finding birds carrying failed radio-transmitters, so that the transmitter can be removed from the bird.
∞ Determining ages, and sex structures of populations. Using only dogs to locate unmarked kiwi eliminates sampling bias. Dogs apparently don’t discriminate by age or sex, whereas catching kiwi at night after listening for them results in a disproportionately high number
of adult males being caught, few females and no juveniles or chicks. Dogs can be used to
determine the percentage of young birds in a population.
∞ Finding banded birds in key populations to provide information on kiwi longevity and
pair bonding.
∞ Public relations: a lot of people are interested in dogs and the use of friendly well-trained
dogs in the media is an angle that gets the message through to the public that uncontrolled
pets and pests can devastate kiwi populations.

However, dogs are not the only means of monitoring kiwi, and not every team working on
kiwi should rush to get a dog. The day to day monitoring of kiwi populations relies on
transmitters and call surveys. As attractive as it sounds to have a dog, you must keep in mind
that they are predators, not everyone is good at training and handling dogs, and they represent
a huge commitment. Even the nicest most tractable dog can kill kiwi. In a time when part of
DOC’s campaign to save kiwi is to tell hunters and general public to show more consideration
around our kiwi with their dogs, DOC personnel and kiwi operators outside DOC, must
ensure that their kiwi dogs and the handlers that work with them are beyond reproach.

10.2 Before you get a kiwi dog

Before getting a dog you must determine:
∞ Whether you really need one. To justify the training, time, and expense to the project
dogs must be given meaningful work-time on kiwi, not just a day every now and then.
∞ Whether you will be a good handler. This will be easier to determine if you have handled
dogs before. A good handler likes dogs, does not lose his/her patience, and knows about
dog care, dog training, and most importantly dog “psychology” (behaviour).
∞ What will you do with your dog if it is no good as a species dog, or if you are not able to
train it properly? Not all dogs have the appropriate temperament to be a species dog. If
your dog does not work well with you and it is a menace to kiwi or other species, keeping
the dog as a pet, giving it away or putting it down are options to be considered.

A kiwi dog will be part of the set of tools you use to work with kiwi. It is one tool that you
will have to work very hard to keep “sharp”. Unlike most other tools, you cannot switch the
battery off when it is not being used.

As a handler you must be willing to talk to others about your dog and your skills.

Not every one can understand and train dogs. There are many aspects of kiwi work that can
be done without dogs.

10.3 Selection of a kiwi dog

A good kiwi dog does not need to be restricted to any one breed. It is largely up to the
handler’s personal preferences, the type of work required from the dog, and then up to the
personality of the individual dog. However, until recently most kiwi handlers have used
Labrador retrievers. Selective breeding over the last 400 years has incorporated desirable
traits into the gun-dog group of dogs, including a good ability to use their noses, and to
remain in close contact with the handler. More recently, heading dogs have been
successfully used for day and night work.

Before buying a dog to train for kiwi work, you should talk about the merits of various breeds
with people who already have trained kiwi dogs, and to the Department of Conservation
protected species dog coordinator/certifiers. For a list of people to talk with see the end of this section.

The correct selection of a kiwi dog candidate will eliminate many problems. However, there is no absolute recipe that you can follow to successfully choose the “perfect” kiwi dog. If you follow the hints we provide here you will minimise the risks.

In any litter there will be quite a range of personalities. Don’t select the boisterous puppy that is the first to rush up to you, but rather find the pup that watches, makes up its mind, then comes up to you (a more laid back dog so you are not forever battling for dominance). The temperament of a pup at 6-8 weeks is a good indication of its personality, especially aggressiveness, which is also related to dominance. A dog that “thinks before it acts” towards a stimulus is easier for control. Both dogs and bitches work equally well and can be just as gentle.

If you are choosing a heading dog, never get dogs of unknown origin. If you approach a heading dog-trialler and tell them exactly what type of dog is needed they will get that exact strain for you. You require a dog that does not bite (then it will only head and knock). Some strains are ‘hard’ and could be too much for kiwi work; breeder selection will circumvent this problem. The dog will need to have a good nose, a characteristic that is not desirable to some working dog breeders. Try to get a non-hyper breed for obvious reasons. Have a look at the parents when let off the chain; if they are doing somersaults or the dog equivalent, try another breed.

10.4 Training of a kiwi dog

Rules of thumb

∞ It is vital to get the pup before it is 4 months old, preferably sooner, but not earlier than eight weeks of age.
∞ The pup must begin basic obedience training as soon as you get it. By the time it is 5 months old it should have a grasp on all the basic obedience commands - ‘sit’, ‘stand’, ‘wait’, ‘lie’, ‘stay’, ‘don’t’ or ‘no’, and ‘heel’ (this is the most important command for all dogs and the most common flaw). You can also begin to put ‘walk-up’ and ‘side’ on and other handy little mod-cons after this age.
∞ Take your time. Don’t push the pup. Don’t do your block. Two or three minutes at least once a day. One thing at a time. If it is having trouble understanding what you are requesting, stop. Go back a stage. Think about what you are trying to do. Ask for advice.
∞ Maintain firm commands.
∞ Dogs may need to be disciplined from time to time, but that does not include beating or thrashing. There is no need for a handler to lose their temper over a misdemeanour. It is better to correct the dog in a calm frame of mind. A strong bond between dog and handler is vitally important.
∞ A dog will not develop bad habits if they are not exposed to situations where these can develop. In general, dogs can learn bad habits if they are placed in situations where they can perform undesirable behaviours which are out of your control. For instance, you do not want your pup to be in a situation where it can chase a cat or a hen while you are not there to discourage it from doing so. It is a good idea to keep your pup in a well-fenced area, where they are controlled and safe when you are not around.
Dogs trained to work with kiwi should not be used for any hunting where the dog kills or brings back the quarry in its mouth. A retriever, for example, can be trained not to retrieve animals but it is easier if it is not trained to retrieve them in the first place.

Dogs should never be encouraged to dig. This is especially important when you are digging out kiwi yourself. Let the dog watch but actively discourage it from assisting. Dogs that locate and begin digging out kiwi can potentially do a lot of damage to the bird even in the few moments before the handler turns up. Dogs dig when they are bored and so when leaving your dog unsupervised make sure you leave with it plenty of things to do. Also spend plenty of time with your pup.

A muzzled dog can kill kiwi by pressing the bird down, so a handler should not rely on the muzzle as a way to protect kiwi.

Treat your dog fairly and be tolerant. Earn the pup’s respect. Remember that the dog is simply learning what you teach it. Most of its mistakes are a reflection of your dog handling skills.

Do not “fall in love” with the dog and become blind to its faults or allow behaviours (such as disobedience) that may place kiwi in danger later on.

Training methods

There are two lines of thought when training dogs: using food as a reward and not using food. Both lines rely on the knowledge that the reason dogs work and come back to us is through a trade-off we create which dogs understand.

In the “food” method, dogs are rewarded with small morsels of food after performing a command in the desired way until the dog performs without the need for the reward. The basis of this system is to make a connection between a command and the approval of the handler, who as a leader of the pack provides food. For this type of training method to work, you must make sure that the dog has no access to food by itself and the handler is the only source of food. Do not overfeed your dog while training, use part of the daily food ration for training. Do not allow other people to feed your dog. As you reward the dog also use a word reward such as “good dog” and a pat. The dog will link all of the rewards: food, pat, words. Once the dog has learned that a particular action following a command will produce a reward, stop the food and only use the words and pat.

In the no food method, food in moderation can be used during the basic obedience training (sit, come, heel, etc.) in the same fashion as described above, but it should be avoided as a reward for actual field-work success. The dog learns by verbal reassurance from the handler (initiated in the earlier obedience training) that it has performed the job well.

Both techniques work and you should choose whatever works best for the breed of dog you are using. Again the best option is to talk to a variety of handlers before taking a decision on what line of training to use.

10.5 Training dogs to find kiwi

Before going into the field

By hiding bags of kiwi feathers or roost material from a burrow around the house and garden, and then rewarding the dog when they have found them, the dog will quickly grasp what is required from it. Offer a biscuit or a “good dog” reward after they have found the feathers and either pointed, sat, or gone down (means the dog is in a safer position). On rewarding the dog, call to come to the handler then reward again. This means the dog will leave the kiwi
and return to the handler on command. The excitement is getting the biscuit not finding the kiwi!

**In the field**

- When your pup is totally obedient and after passing the interim certificate (see below), introduce it to kiwi. Simply take it with you when doing normal radio tracking.
- The dog must be trained to work within sight and sound of the handler. This is important because many areas where kiwi live in are thick with scrub and vines. If the dog is out of sight and finds a kiwi the time spent searching for the dog is time when the kiwi may be at risk from the dog. A dog will only point/indicate for so long and if the kiwi is simply sheltering amongst grass it could run off. In other situations, a dog may start digging for the bird if it is left too long.
- As you approach resting kiwi don't make a fuss. Just do your job. The pup will be watching you. Encourage a small amount of interest. Let it sniff the roost for instance. Don't let it jam its head in. It should stand with its nose away from the entrance and stare, maybe raise a foot in the traditional 'point' stance or 'set'.
- Never let it dig for kiwi.
- When retrieving the kiwi, first ‘stay’ the pup out of the way. Give it a sniff but don't let it break from ‘stay’.
- Process the kiwi. Place it back in the burrow. Pack your gear.
- ‘Release’ the pup. It will move to the roost. Let it have a brief sniff then ‘heel’ it and move off.
- Give it a pat and a ‘good-dog’ as you walk off. You do not want to get the dog over excited with adulation as it may lose concentration and forget what it is doing. You want the dog to “think” this is the norm, what it does “for a living”.
- Let the pup accompany you for as long as it takes until you know it understands what you do and has proven without doubt it will instantly without thinking do as you say, especially ‘heel’ and also ‘no’ or ‘don’t’.

Once you have 100% confidence in your dog, allow it to find a bird. Let the dog work in stages. When it hits sign and begins to work, let it gain a few metres then ‘wait’ it. Move up to the dog, checking the area ahead for nests especially, start the dog again and so on. It’s teamwork and dogs feel good working as part of a pack or team. If you suspect a nest, stop the dog, mark the spot and return at night as per the procedure given earlier. Once a dog has found a kiwi it must remain quiet. Do not teach it to bark as this may cause the kiwi to run, and possibly to desert a nest. This is particularly important when dealing with the more “flighty” species such as tokoeka and great spotted kiwi.

**Important information about heading dogs**

Heading dogs are simple to train, but they need lots of meaningful work nearly every day or they go nuts. These dogs are not suitable for handlers who cannot get them out in the field nearly every day, especially in the first three years of the dog’s working life. They do require more handler’s skills than other breeds because of their overwhelming desire to please the pack boss. They satisfy this desire by doing things they know will please and doing them well. This applies to all dogs but is magnified out of all proportion by heading dogs. This aspect has been bred into reputable breeds for hundreds of years to make them more biddable.

**10.6 Rules for those using dogs for kiwi work**
Dogs must be worked only in daylight hours when the kiwi are sheltering, unless given a special exemption by a Department of Conservation protected species dog coordinator/certifier.

All kiwi dogs must be muzzled when working. Muzzles must be of an approved type (differ with different breeds/individuals), should not cause discomfort such as abrasion of the skin on the face, have soft wide straps and must not interfere with drinking or panting. Dogs need room to expose their tongue to regulate their temperature as unlike other animals they do not sweat to stay cool.

All kiwi dogs must be tied it up, kennelled, or confined to a tent or hut, at the campsite when not directly supervised or not working. There are no exceptions to this. It is essential that kiwi dogs always present a professional image. It is the law in New Zealand that working dogs must be tied up when not working. If you leave them loose they may sneak off and try and find some work to do for you and this will have disastrous consequences even though the dog is simply trying to help. This is their nature: to work to please the boss [= you]. Do not tie your dog up outside in areas that are prone to mosquitoes or sandflies, or where there is a reasonable chance that kiwi or other ground-dwelling birds will wander within range.

Dogs must be regularly wormed for internal parasites to attend to the welfare of the dog and to make sure no parasites are taken onto Department of Conservation controlled land in particular onto offshore islands.

Dogs must be treated against ectoparasites. Control ectoparasites such as fleas and be vigilant that dogs do not transport ticks from one kiwi area to another; kiwi are vulnerable to some tick-borne diseases.

Dogs must be inoculated annually against distemper, parvo and leptospirosis as these may be spread to endangered mammals such as fur seals, Hooker’s sealions and possibly bats.

Dogs must not work in packs. Usually, only one dog should be worked in an area at a time; however, the dogs will naturally come together when the handlers have to work jointly to remove/handle birds. Hierarchies and competitiveness can develop in the dogs which completely changes their personalities. Do not let other people borrow your dog even if they are also certified. They will not have the bond nor understand the finer signs exhibited by the dog that that owner has come to know. The ‘one person – one dog’ team is the certified unit.

Every dog handler must provide an annual report to the Department of Conservation protected species dog coordinator/certifier, reporting how often the dog is being used, its performance, any incidents and advice needed to improve an aspect of the behaviour. The coordinator/certifier is also there to encourage and improve the trainer/dog relationship and improve performance in the field.

### 10.7 Certification procedure

The certification is done in two stages.

Once the dog has mastered the basic commands (‘come’, ‘sit’, ‘down’, ‘stay’, ‘heel’, ‘leave’) and has reached a minimum of 9 months of age it will be ready to be tested by a registered Department of Conservation protected species dog certifier. Dog and handler will be observed to assess the degree of handler’s control over the dog, the general relationship between handler and dog, and the temperament of the dog itself. An overly dominant,
belligerent, aggressive dog will easily be detected and eliminated (as will the trainer, as it is both that are being tested). The handler must also be experienced with kiwi. If the certifier is satisfied that the dog has potential, and the handler and dog meet the assessment standards, they will be issued with an interim certificate enabling them to begin finding kiwi under controlled conditions, e.g. with other experienced dog handlers, and with non-breeding radio-tagged kiwi in deep burrows.

Over the next year the handler/dog team will be tested in the field for a full certificate. This is reviewed every three years.

10.8 Who to talk to

For selection of a pup, and/or advice on field use of dogs:
- Rogan Colbourne, 20 years experience training and working with kiwi dogs, in particular Labrador Retrievers.
- Lance Dew, 20 years experience training and working with many dog breeds.
- John McLennan, 20 years training and working with kiwi dogs, in particular Labrador Retrievers.
- Others with experience with other breeds of dogs, and different bird species, such as Dave Crouchley and Allan Munn.

For information and advice on the certification procedure
- John Cheyne – National Coordinator/North Island Certifier DOC protected species dogs programme
- Murray Willans - South Island Certifier DOC protected species dogs programme

10.9 Monitoring kiwi using trained kiwi dogs

In high density kiwi populations, valuable information on the age and sex structure of kiwi populations can be derived from samples of birds located by dogs. Dogs apparently sample birds more randomly than other techniques do (Colbourne et al., in prep.). This method is under development and has been trialled in Trounson. There needs to be more field testing to confirm if this methodology will be useful in other kiwi areas.

You will need:
- Trained kiwi dog
- Maps
- Banding gear
- Feather collecting vials
- Measuring gear
- Notebook and pencil

Methods:
Dogs work better on cooler days or early mornings.

1. Select several transect lines that sample the range of vegetation types according to their abundance in the area you are interested. For instance, young birds generally favour rank grass, dense scrub, dry swamps, along rivers, or along ridge tops. This can be done by:
   - Following randomly chosen compass bearings from randomly chosen points
   - Designing a route in advance that samples vegetation types evenly (stratified sample), or randomly (e.g. parallel transect lines across a forest block). If
vegetation is roughly uniform, then blocks can be searched thoroughly rather than do long transects, or you can follow established walking tracks.

2. Once on the transect, record the start time
3. Walk the transect slowly and allow the dog to search in its usual manner.
4. Once a bird has been found, write the time of capture, remove from the burrow or shelter and:
   - Band the bird if necessary, otherwise record its band number.
   - If the bird is a juvenile remove some feathers for sexing.
   - Take appropriate measurements.
5. Record the time when you finished handling the bird.
6. Return with the dog to the transect line and start walking again.
7. Repeat steps 3-6 on separate lines until you have captured a minimum of 30 birds, but preferably 50. If you find a pair of adult birds sheltering together this should be regarded as a single encounter. At the end of each capturing period record the time.
8. Write a report including:
   - All the information gathered from the birds.
   - Total time spent capturing, total time spent handling the birds and the difference between these two values, which will give an indication of the total time actively searching for birds.
10.10 Catching kiwi at night using a trained kiwi dog

This is an effective method of catching kiwi in areas of low/moderate kiwi density and where vegetation dictates that hand catching is not feasible (e.g. scrub, although netting can sometimes be used in these situations). This method carries some additional risks and only experienced handlers and dogs will be permitted to use it.

You shall not attempt to capture kiwi with a dog at night unless you have a permit issued by the DOC dog protected species dog coordinator/certifier to specifically do so.

You will need:
- Special permits for you and the dog
- Muzzled trained kiwi dog (with following lights)
- Map of the area
- Torches
- Gear for processing the bird

Method:
1. Select a potential kiwi area.
2. It is not a good idea to have more than two people involved with this operation. It is difficult for the dog and for yourself to concentrate. The dog needs to know where the handler is when working the bird, and too much activity can confuse the dog.
3. Fit your dog with small bicycle lights to make it easy to follow and find when it is working a bird. Two red bike taillights powered by small batteries and fitted one each side of the dog’s neck in a clear plastic tube works really well. These should be turned on before dark and left on the dog and going until kiwi catching is finished and the dog is tied up at the hut or on the truck.
4. Sit in this area with your dog from before dark and wait at least one hour. The first 3-4 hours after dark are the best hunting time. Call rates and responsiveness drop off rapidly after that. If you know the kiwi’s habits (i.e. have worked it recently) you can initiate the hunt 1/2 an hour after dark, give a call and proceed as below.
5. You should not hunt for more than four hours, because there are often some hard decisions to be made while hunting and after 4 hours in the dark your brain is not too sharp. You will put kiwi at risk and yourself and your health at risk by consistently trying to work long hours at night.
6. Wait for the kiwi to call first. The reason for this is that by letting the kiwi make the first move i.e. calling, you maintain control of the hunt. When the kiwi calls you know where it is and have plenty of time to alter your situation to get a better result.
7. Be alert throughout the catch. Watch the dog constantly. It knows what is going on. It is signalling to you constantly. Learn to ‘read’ your dog.
8. Whistle the kiwi in. Whistle at least 20 bars.
9. Give the kiwi plenty of time to close the gap. Perhaps 20 minutes later give another whistle.
10. If no calls are heard after a couple of hours, give one male call and assume the kiwi has heard you and is zeroing in on you.
11. Most male kiwi will approach to about 15 metres and whistle. If they do this whistle back as soon as they have finished. They generally charge straight in then. Females tend to close the gap to around 15 metres then circle the area. The main benefit of a catching dog is that the kiwi does not need to come close to be caught. The dog extends the catcher’s range.
12. You probably will not be fully aware of how close the kiwi is until the dog breaks and heads it. Watch the dog constantly: he will be aware of any ‘incoming’ kiwi and will be sending you info via body language—rigid stance/intense posture, pricked ears, staring etc. The dog will start to behave like this even when the kiwi is 50 or more metres out. You will be able to track the kiwi’s movements by observing the dog.

13. Let the kiwi get as close as possible. The dog will initially head straight towards the incoming kiwi. By having the dog-lights on constantly you have the direction—and it is important to follow immediately. If you wait the dog may try to herd the kiwi back to you. It is in the best interests of the kiwi that you get to it as soon as possible. If you lose contact with the dog, call the dog off. Then follow him back to the contact point. He will lead you to the area. If the kiwi has moved off, try a whistle.

14. As soon as the bird is caught, tell the dog to back off and stay.

15. If necessary because there is another kiwi nearby release the dog from ‘stay’ and give it an instruction to work it if that is an appropriate call. Don’t let the dog go off on its own accord.

16. Once caught, tape the kiwi’s legs. Give the dog a quick pat let it sight the kiwi, tell it is a clever dog, make sure it is still in ‘stay’ mode. Process the kiwi.

17. After processing, move a metre or two below your site, point the kiwi downhill after removing the tape, reinforce the ‘stay’ on the dog, hold the kiwi upright for a moment and let it get its bearings and release it. Aiming it into some undergrowth is good, so it can hide from you. It is best to let the dog watch. It must understand that this release procedure is normal, the job is finished, and must not get excited or be too interested.

18. Pack up your gear. Release the dog from ‘stay’. It should move to the area of kiwi release and test the scent then forget it. Don’t let it show any more than cursory interest in the released kiwi. Move off from the area.
11: METHODS UNDER DEVELOPMENT: USE OF MK2 NETS IN KIWI WORK

11.1 Catching kiwi using mk2 nets

This technique is useful in all vegetation types including scrub. It has been used successfully in various low population areas. Sometimes it is more effective than straight out whistle and chase.

You will need:
- Permits
- 2 x 10 metre lengths of hand made net (2 shorter nets are easier to handle and set than one long one) plus 1 x 5-10 meter length of hand made net (see instructions on how to make it below)
- A pair of secateurs for trimming the net lines
- Rope
- Gear for whatever you are catching the bird for (banding, blood sampling, measuring, etc)
- Torches

Method:

To make the net:
1. Use thick twine, green (dark coloured = camouflaged) fishing cord- cotton “cod line”- 2 mm plus twisted (not nylon) or proper fish net string. The cord is easier to work with and does not snag as does conventional netting. Make to 3-4 inch mesh. The net should be about 70 cm high. When ‘strung’ on the job it needs to be low enough to step over it easily.
2. Thread 5 mm Donaghy’s braided nylon cord along top edge to act as a (curtain) runner, which makes the net easier to handle. Keep the cord clean and white to make the net line more visible. This is so you can see the net line in relation to yourself and the kiwi, and assists gauging height and position if you have to step over it.

To set the net and catch the bird:
1. Select a good catching site:
   - Determine the (distribution) territory of the bird you want to catch.
   - Scout the territory in daylight to select sites that can be used at night.
   - Identify possible hazards (nearby cliffs, streams) escape routes for kiwi (under fallen logs), or non-target effects (e.g. petrel burrows).
   - A good site within forest is typically a gut preferably with a clear slope running uphill from the centre of the catching area, or with a fallen log as a ‘back-stop’.
2. String the 2 x 10 metre nets across gut or side of hill.
   - To set, push all the net to one end (it is easier to transport folded at one end of the top-line).
   - Tie the nylon cord at the desired height at the bunched end. Run out nylon cord along path net is to follow across the gut. Both the top line and the net can go around trees and sticks to give extra support to the set.
   - Stretch until firm.
   - Tie off both ends.
   - Slide net along. Where there are dips, let the net bunch up and it will naturally deepen to accommodate the variation.
- Lay the bottom 10cm or so on the ground on the uphill side.
- Chuck a bit of mulch or whatever is handy on it to hold the base down and plug gaps.
- The net should be low enough so that it can be stepped over easily. The top line only has to be 40 cm off the ground.

3. String the 5-10 m net at right angles to the centre of the main net and pointing uphill. This net should be kept low (from ground to top). The idea is to stand straddling the net when working the bird in. The net has to be low so you can hurdle it at speed when chasing the kiwi. The kiwi tend to track down the net line to the waiting whistler. It makes it easier to net the kiwi having this extra line in, due to their tendency to do right angle turns when being pursued as opposed to running straight. This trait is the secret to the netting.
  - It can be useful to have a volunteer or two standing at the end points of the nets, and maybe below the net too, but the system can be operated by one person.
  - On flat country it would be a good idea to use an extra net in a star shape. The technique will still work due to the kiwi habit of hard right angle turns mentioned earlier.

4. Stand on uphill side of net, 2-3 m above the centre of the main net, straddling the centre net.

5. Call the bird in using a shepherd’s whistle or tape. The aim is to call the bird in to arrive on the uphill side of the net.

6. When the kiwi gets close, chase it, cutting it off, to herd it into the net. It is easier to catch the kiwi by cutting it off and herding it towards the net than by a straight chase.

7. Remove kiwi from net.

8. Tape legs and process the bird.

Figure 11.1: Setup for catching kiwi with mk2 nets
12: METHODS UNDER DEVELOPMENT: SEXING KIWI WITH MIDDLE TOE MEASUREMENT AND CONDITION INDEX USING BODY LENGTH

12.1 Sexing kiwi using middle toe measurements

John McLennan has developed a method of sexing kiwi by comparison of their middle toe measurements. He is still trying to find a ratio that will clearly separate males from females, especially in young birds that have not yet reached adult size. At this stage it seems that middle toe depth divided by middle toe length might be useful, but it is still too soon to be certain. It would be useful for those studying kiwi populations to take middle toe measurements for refinement of this method, and to determine if this method is effective on all kiwi taxa.

Method:
1. Measure mid toe length on the inside face from the base of the toe to the base of the claw. The inside face is the face that faces the other foot.
2. Push the callipers (gently) into the V between the middle and inner toe, and straighten the middle toe with your finger until it (the toe) is full extended.
3. Measure up to the start of the claw. The measurement should be taken up to the point of the right angle on the claw, where the skin along the top of the claw bends forward to form the fleshy knob under the claw.

12.2 Measuring body length, and use for McLennan condition index

Another measurement that can be made is body length. This is done most simply with a tape measure. Hold the bird upside down and place the end of the tape measure on the pads at the base of the tibia. Then measure down the ventral side of the body to the tip of the kiwi’s bill.

An index of condition can then be calculated using weight divided by body length.
REFERENCES


