

# OPERATION NEST EGG SITUATION ANALYSIS

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## **Contract Report No. 2999**

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# 1. INTRODUCTION

## 1.1 Overview

The management technique that became known as BNZ Operation Nest Egg™ (hereafter referred to as ONE) was first tested in 1994. ONE has subsequently been widely taken up and implemented by a range of kiwi (*Apteryx* spp.) recovery projects and captive management facilities as a way to increase the number of kiwi that are recruited into the breeding population (see Colbourne *et al.* 2005 for an account of the initial development phase of ONE from 1994-2002). ONE achieves this, in comparison to other in-situ management techniques, by increasing the proportion of eggs that successfully hatch, followed by increasing the proportion of chicks that survive through to a size (typically 800-1,200 g in weight). At this stage, kiwi are less at risk of predation by stoats (*Mustela erminea*).

The basic ONE process involves the monitoring of breeding adult kiwi by telemetry, removal of eggs from wild kiwi nests, transport of eggs to a captive rearing facility for incubation, hatching of eggs, and rearing of chicks to around three weeks of age, release of chicks into a “crèche” site that is free of major predators, and recapture and release of chicks back to the wild when they are judged to be at “stoat-safe” weight. Most, if not all, ONE juveniles released back to the wild are marked with leg bands and/or radio frequency identification (RFID) tags. Some projects place transmitters on released juveniles and monitor their survival.

ONE techniques were developed on North Island brown kiwi (*A. mantelli*; classified as Threatened-Nationally Vulnerable<sup>1</sup>) and rowi (*A. rowi*; Threatened-Nationally Critical) from 1994. ONE has since been used on Haast tokoeka (*A. australis* “Haast”; Threatened-Nationally Critical), and great spotted kiwi (*A. haastii*; Threatened-Nationally Vulnerable). ONE has not been used on little spotted kiwi (*A. owenii*; At Risk-Recovering), which is increasing in numbers due to the establishment of new populations on predator-free islands.

A variant of ONE has been developed in recent years using “ChickTimer” transmitters on breeding adults. The transmitters enable the user to detect when hatching has occurred. The chick is collected, and released straight into a crèche, thus bypassing ex-situ incubation. This technique is sometimes referred to as “Operation Nest Chick” or “ONC”.

Twenty-four projects, or thereabouts, have used or are using ONE and/or ONC to recover their particular kiwi population. A smaller number of projects have used ONE as a way to establish new kiwi populations, and a third group of projects and organisations have used ONE as an ad-hoc/emergency tool when kiwi nests have been inadvertently discovered or disturbed. Since 1994, at least 3,000 eggs and chicks have been removed from the wild, and c.2,000 juveniles returned.

Some kiwi recovery projects are now moving from using ONE to the use of “kohanga kiwi”, whereby kiwi populations are established in pest-fenced mainland sanctuaries

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<sup>1</sup> Threat classifications from Miskelly *et al.* (2008).

and pest-free islands, usually using ONE in the translocation process. Surplus juveniles can then be collected and released back into the source population.

## 1.2 Project scope and objectives

‘Kiwis for Kiwi’ have identified the need for a situation analysis report that provides an overall perspective of ONE, addressing relevant taxa, participating organisations, projects, and sites, and current and future issues and trends. Kiwis for Kiwi envisage that this situation analysis will be an important first step in assessing whether national coordination of ONE would add value to the current utilisation of ONE as a conservation tool, and what would be required to achieve this.

Kiwis for Kiwi’s objectives for the situation analysis are to have gained an understanding of the following:

- Who is currently involved with ONE?
- The reasons for their involvement.
- ONE activity to date e.g. number of eggs/chicks collected, pairs monitored, crèche sites used, and numbers of juveniles released back to the wild.
- The capacity of existing ONE facilities to incubate eggs and brood chicks, and capacity of kiwi crèche sites (including those on-site at ONE facilities)
- Demand for ONE services - both current and for the foreseeable future, e.g. by project, taxon plans, and nationally.
- What ONE costs e.g. per egg/chick, per annum?
- Outcomes: does ONE achieve what it set out to achieve? And what is the level of monitoring and reporting of achievements?
- What reporting or records are currently kept and in what format? What analysis of data is being undertaken?
- Is training (and opportunities for training) sufficient to enable ONE to be used successfully?

This situation analysis report is primarily strategic in its scope and intent. Consequently it has not undertaken detailed or comprehensive technical analyses of the conservation management techniques that are employed in ONE, nor of the operational results and outcomes at project, taxon, or species level, as the former have been well-documented already (e.g. Colbourne *et al.* 2005, Robertson and Colbourne 2003, Bassett 2012), and the latter are the domain of the various kiwi recovery project managers and Recovery Group personnel.

The situation analysis focuses primarily on the use of ONE to protect existing kiwi populations (ONE kiwi are considered part of the original population when returned to within c.30 km of their parental territory), as opposed to its use in the establishment of new kiwi populations, kohanga kiwi, or captive kiwi populations. We have included projects using ONC in the situation analysis because of its similarity to ONE.

Several kiwi recovery projects, facilities, and crèches are no longer involved in ONE and we have attempted to identify and list as many of these as possible for the sake of completeness, but they are not considered further as part of the situation analysis.

## 2. METHODS

A survey questionnaire was used to canvass the views of ONE users and obtain details of their facility or project, including basic information; goals, objectives, and progress; operational data; costs and funding; viewpoints on strengths/weaknesses/potential improvements to ONE; and future levels of ONE activity (Appendix 1). The survey comprised 43 questions, some applicable to all participants, and others specific to rearing facilities, crèche facilities, or kiwi recovery projects.

The questionnaire was initially sent to key users, particularly rearing facilities, as they were able to then provide a list of all kiwi recovery projects and crèches that were involved with the facility. Some users were interviewed in person, particularly rearing facilities and major kiwi recovery projects. Other surveys were undertaken by telephone, and some users responded by email. Survey respondents were made aware that any information that they provided would be used for the purposes of the Situation Analysis only.

Further information was obtained through informal conversations and a presentation at the Kiwi Hui held in May 2013.

Each ONE user and facility was asked to provide data on the number of eggs and chicks collected on a year-by-year basis and individual outcomes of eggs and chicks that went through the ONE process. We then collated data provided into a single data set in order to present as full a picture of ONE effort as possible, and identify any gaps or issues in the data set.

## 3. REASONS FOR USING ONE

### 3.1 The strategic context - Kiwi Recovery Plan

The use of ONE as a kiwi recovery tool is set out in the Kiwi Recovery Plan (Holzapfel *et al.* 2008), and associated taxon plans (Craig *et al.* 2011, Scrimgeour and Pickett 2011, DOC 2013a, DOC 2013b). Topic 17 and part of Topic 25 of the Kiwi Recovery Plan are reproduced below. There are stand-alone sections on ONE in each of the taxon plans for Northland brown kiwi, western brown kiwi, rowi and Haast tokoeka. These are all derived from the over-arching Kiwi Recovery Plan and are similar in terms of content and structure.

#### **Recovery Plan Topic 17 - BNZ Operation Nest Egg**

BNZ Operation Nest Egg was developed in 1994 using funding from BNZ. It has become a powerful tool for increasing kiwi populations that is used for several taxa of kiwi and involves six captive facilities and a large number of community and Department of Conservation-led programmes.

Throughout the development phase of BNZ Operation Nest Egg, data on its use were collected and analysed nationally. However, since completion of the development phase, data collection has not been continued, making comparisons between taxa and techniques difficult and thus hindering further improvements and optimisation of its employment.

Standards that were developed for critical aspects of the programme, such as egg handling, incubation and chick rearing, have been superseded by further refinements undertaken by practitioners and captive institutions. A variety of protocols are now used, without national guidance as to minimum standards required.

The identification or creation of incubation capacity and suitable crèche sites has been largely uncoordinated, driven by local needs rather than through regional or national planning. This has increased the risk of duplication or less efficient use of resources. Communication and sharing of information between captive facilities appears to be restricted.

Because it provides the opportunity to be directly involved in handling of kiwi, BNZ Operation Nest Egg is an attractive tool for advocacy purposes. However, its high cost and labour requirement make it less economical than other tools in larger populations. The comparison of cost versus benefit of BNZ Operation Nest Egg versus predator control is not widely understood.

A national, long-term plan for BNZ Operation Nest Egg and how it supports the kiwi recovery plan is lacking. There is currently no plan for the number of crèche sites/location or the number of incubation facilities needed.

The following issues, objectives, and actions are provided:

### *Issues*

**Issue 17.1:** National data on the use and success of BNZ Operation Nest Egg is not available.

**Issue 17.2:** Minimum standards have not been developed or updated and agreed on between practitioners.

**Issue 17.3:** The use of BNZ Operation Nest Egg lacks national coordination.

### *Objectives and actions*

**Objective 17.1:** To ensure that the use of BNZ Operation Nest Egg is effective and undertaken to sufficient standard.

### *Actions*

17.1 Review protocols for all components of BNZ Operation Nest Egg, including the development of minimum standards as part of ARAZPA best practice, by 2009 and update biennially.

17.2 Initiate national coordination for the collection and reporting of data on the use of BNZ Operation Nest Egg by 2009 ARAZPA.

17.3 Develop guidelines for when and where to use BNZ Operation Nest Egg instead of, or in conjunction with, other tools by 2010.

17.4 Develop a 10-year plan for BNZ Operation Nest Egg, including number and location of incubation facilities and crèche sites, by 2010 ARAZPA.

### **Recovery Plan Topic 25 - Genetics and taxonomy**

25.2 Support/lead research on the genetic diversity of translocated, captive, BNZ Operation Nest Egg-based and island populations by 2013.

(Holzapfel *et al.* 2008)

## **3.2 Why projects are using ONE**

Facilities and projects were asked ‘What led to your involvement with ONE?’ Seventeen responses were obtained; five from rearing facilities, 11 from recovery projects, and one from a crèche facility.

Involvement with ONE was a natural progression for most of the captive rearing facilities. Auckland Zoo, Kiwi Encounter, and NZCT Kiwi Breeding Centre (Willowbank) were already incubating kiwi eggs and rearing young kiwi as part of captive-breeding programmes when the opportunity arose to work with ONE. Auckland Zoo was part of the initial research to determine whether ONE could be used to assist kiwi recovery. Pukaha Mount Bruce was a well-established captive breeding facility for threatened species. The Department of Conservation approached the NZCT in 2003-2004 for assistance with the management of Haast tokoeka and rowi. The West Coast Wildlife Centre (WCWC) was established primarily as a tourism venture. However, the facility was developed in close partnership with the Department of Conservation, given the clear benefits for the Haast tokoeka and rowi recovery programmes by having the centre in close proximity to Okarito and the main Department of Conservation office running both the Haast tokoeka and rowi sanctuaries.

Kiwi recovery projects and the crèche cited a variety of reasons for using ONE. In some cases, respondents provided more than one reason; these have been split as appropriate, as summarised below.

- Trapping is ineffective or not sufficient to protect kiwi population (e.g. Whirinaki; Project Kiwi Kuaotunu; Rowi Sanctuary; Haast tokoeka).
- ONE is considered to be the most effective use of funding; insufficient funds to commence large-scale predator control operation (e.g. Paparoa Wildlife Trust; Whakatane Kiwi Project; Whirinaki).

- ONE is a key requirement for taxon recovery (Haast tokoeka and rowi sanctuaries).
- Best method for the establishment of a founder population, through collaboration between crèche site and kiwi recovery project (Maungataniwha and Cape Kidnappers - Maungataniwha has used Cape Kidnappers as a crèche, and in return has provided ONE-reared chicks to Cape Kidnappers as a founder population).
- Directed to use ONE by the Department of Conservation (Hawdon/Hurunui Valleys).
- Approached by the Department of Conservation for a source of eggs for a restoration area; worked in well with requirements for mitigation for commercial forestry activities (Waimarino-Karioi Rahui).
- Quickest method for increasing kiwi population at the site (Whakatane Kiwi Project).
- Improve genetics of kiwi population at the site; better utilise the effective pest control regime. Reason for use of ONE has changed, and is now primarily for advocacy purposes (Whangarei Heads Landcare Forum or WHLF, “Backyard Kiwi”).
- Had a large existing population of monitored pairs (Whangarei Kiwi Sanctuary).
- Protection of chicks outside or on fringe of trapping area (Project Kiwi Kuaotunu).

The most commonly given reason for use of ONE (from four of 16 respondents) was that trapping was insufficient for the recovery of the population. In three of these cases, this conclusion was based on intensive monitoring of chick survival.

### 3.3 Planning by ONE users

Sixteen operations responded to the question “Do you have a written plan?” Twelve had written plans of some description. Of the four captive rearing facilities, only West Coast Wildlife Centre had a plan that covered ONE operations (called the Programme Outline and Advocacy Plan). However, it had not been written by kiwi practitioners so was not particularly realistic in its initial goals and objectives. It was reviewed every year for the first three years, and will be reviewed every three years after that. Auckland Zoo has a strategic plan for the entire zoo, and a collection plan for kiwi, but not one that specifically deals with ONE.

Of the 11 kiwi recovery projects and one crèche, only the Department of Conservation Hawdon/Hurunui Valley project operated without a plan. This was because the office was directed to use ONE, and had not anticipated the requirement.

Other Department of Conservation projects (Haast tokoeka, Okarito rowi, Whangarei, and Tongariro Kiwi Sanctuaries) operate according to their respective taxon plans and also have active five-year operational plans and/or strategies.

All of the community-run projects have written plans, although the Paparoa Wildlife Trust's five-year strategy was no longer current. The primary objective of the strategy has largely been met (release of 25 ONE great spotted kiwi), and the trust is keen to change the focus of management from release to determining whether ONE birds are surviving to breed. The six other projects have active plans; three of these responded that their respective plans undergo annual review; five plans are active for specific timeframes. A number of projects chose to provide details of the vision, goals, objectives, and performance indicators.

## 4. FACILITIES AND PROJECTS USING ONE

### 4.1 Overview

The following section briefly summarises the kiwi recovery projects that use ONE to boost the recruitment of kiwi chicks into their source population (as opposed to using ONE to establish entirely new populations, which is outside the scope of this project). Where available, basic summary information is also provided for ONE facilities that incubate the eggs and rear the newly hatched chicks in brooders before transferring them to an on-site crèche containing natural/semi-wild kiwi habitat, or to predator-free sites.

Table 1 summarises kiwi recovery projects, their ONE rearing facilities and crèches, sorted by taxon.

### 4.2 Kiwi Recovery Projects

The situation analysis identified 26 projects currently or recently using ONE to boost existing kiwi populations. Of these, around 14 plan to continue using ONE in the foreseeable future.

Eight of these projects are Department of Conservation-led, while a number of other projects also have significant Department of Conservation involvement. All other projects are led by community groups and/or trusts, except for one project specifically dealing with West Coast mining mitigation management.

### 4.3 ONE rearing facilities

Seven rearing facilities are currently involved in ONE: Auckland Zoo, Kiwi Encounter, West Coast Wildlife Centre, New Zealand Conservation Trust Kiwi Breeding Centre (Willowbank), Westshore Wildlife Reserve, Pukaha Mount Bruce, and Whangarei Native Bird Recovery Centre.

Other ONE facilities that are no longer undertaking ONE include Kiwi Birdlife Park (Queenstown), and Department of Conservation-run facilities in Hokitika and Arahura.

Table 2 below provides basic details on each ONE rearing facility.

Table 1: Kiwi recovery projects, their ONE rearing facilities and crèches, arranged by taxon.

Project	ONE Years	Size (ha)	Total Estimated Kiwi Population	Main ONE Rearing Facilities	Main Crèche Sites
<b>Northland brown kiwi</b>					
Whangarei Heads Landcare Forum	2003 -	8,800	700	n/a - ONC	Matakohe Limestone Island
Whangarei Kiwi Sanctuary (DOC)	1996 -	4,800	500+pairs	Auckland Zoo	Motuora Island
<b>Coromandel brown kiwi</b>					
Project Kiwi-Kuaotunu	2004 -	2,850	600	Kiwi Encounter	Kiwi Encounter
Moehau Kiwi Sanctuary (DOC)	2001 - 2008	18,556	431 (in 2008)	Kiwi Encounter	Kiwi Encounter
<b>Eastern Brown kiwi</b>					
Boundary Stream Mainland Island (DOC)	2004 - 2011	3,500		Kiwi Encounter, Westshore	Kiwi Encounter, Opouahi
Lake Waikaremoana Hapu Restoration Trust	2003 - 2008	1,500	130-170	Kiwi Encounter, Westshore	Kiwi Encounter, Westshore
Maungataniwha - Forest Lifeforce Restoration Trust	2006 -	6,120	160	Kiwi Encounter, Westshore	Kiwi Encounter, Cape Kidnappers
Omataroa	2007 -	559		Kiwi Encounter, Westshore	Kiwi Encounter
Otanewainuku Kiwi Trust	2007 -	950		Kiwi Encounter, Westshore	Kiwi Encounter
Whakatane Kiwi Project	1999 - 2012	3,000	300	Kiwi Encounter	Kiwi Encounter
Whinray Reserve Trust and Crèche	2001 -	800	>10	Kiwi Encounter	Whinray kiwi crèche
Whirinaki Kiwi Project (DOC)	1999 - 2012	30,000	33	Kiwi Encounter	Kiwi Encounter, Cape Kidnappers
Ruahine Ranges - Te Potae Awarua Trust	2007 - 2012	3,000	12	Kiwi Encounter	Panpac Opouahi, Cape Kidnappers
Hinepukohurangi	2005 - 2010	2,500	>10	Kiwi Encounter	Kiwi Encounter
Save Our Kiwi Hawke's Bay / ECOED	2002 -	25,000	200 - 1,000	Kiwi Encounter	Panpac Opouahi
Cape Sanctuary, Cape Kidnappers	2013 <sup>1</sup>	2,200	55	Westshore	Cape Sanctuary
<b>Western brown kiwi</b>					
Karioi Rahui	2003 - 2012	5,300	35	Kiwi Encounter	Kiwi Encounter, Wairakei Golf + Sanctuary, Warrenheip
Tongariro Kiwi Sanctuary (DOC)	2001 -	20,000	206	Kiwi Encounter	Kiwi Encounter

<sup>1</sup> 2 chicks sent to Westshore during 2012-13 drought.

Project	ONE Years	Size (ha)	Total Estimated Kiwi Population	Main ONE Rearing Facilities	Main Crèche Sites
Waimarino Forest	1999 - 2012	14,000	200	Kiwi Encounter	Kiwi Encounter, Bushy Park
Taranaki Kiwi Trust	2003 -	14,700		Kiwi Encounter	Kiwi Encounter, Bushy Park
Rimutaka Forest Park Trust	2008 - 2013	2,900	80	Pukaha Mount Bruce	Pukaha Mount Bruce
<b>Great spotted kiwi</b>					
Paparoa Wildlife Trust	2007 -	3,500	100	Willowbank	Crèche du Bois Gentil
Waimakariri - Hawdon Hurunui Nina (DOC)	2009 - 2013	7,480	100	Willowbank	Crèche du Bois Gentil
Stockton Mine mitigation	2011 -			Willowbank, WCWC	Paparoa Wildlife Trust
<b>Haast tokoeka</b>					
Haast Tokoeka Sanctuary (DOC)	2003 -	11,400	325	West Coast Wildlife Centre (2011-), Willowbank (2004-2011)	Centre, Bute and Rona Islands
<b>Rowi</b>					
Okarito Rowi Sanctuary (DOC)	1994 -	21,000	400	West Coast Wildlife Centre (2011-), Willowbank (2004-2011)	Motuara Island

Table 2: Current ONE rearing facilities, taxa reared, and approximate annual through-put.

Rearing Facility	Incubation Capacity	Brooding Capacity	Eggs/Chicks Per Annum <sup>1</sup>	Notes
Auckland Zoo, 1996 - (Northland brown kiwi)	8-10 eggs	7 chicks >8 days, 4 <7 days	c.20-30	Operating near capacity. Occasionally has issues with lack of brooding facilities, but chicks are generally sufficiently spread over time.
Kiwi Encounter, 1995 - (Eastern, western and Coromandel brown kiwi)	90-100, main incubator 15-20, hatch room	36 chicks at one time	c.130-210	Running near capacity. Brooder capacity is a system bottleneck, and timely clearing of chicks to crèches (mainly Cape Kidnappers) is crucial.
Pukaha Mount Bruce 2001 - (Mixed provenance western-eastern brown kiwi)	20	20	c.10-30	Spare capacity now that Rimutaka Forest Park Trust have phased out ONE.
Westshore Wildlife Reserve, 1999 - (Eastern brown kiwi)	-	-	0-5	
Whangarei Bird Recovery Centre, 1996 - (Northland brown kiwi)	30	30	0-15	Captive Coordinator summaries indicate Whangarei Bird Recovery Centre has been used for ONE only one year in the last five, in 2011-2012.
Willowbank (NZCT Kiwi Breeding Centre), 2004 - (Great spotted kiwi, rowi, Haast tokoeka)	100 eggs	60 chicks	c.75-100 (2008-2009 to 2010-2011), dropping to 13-20 in (2011-2012 to 2012-2013)	Significantly underutilised since West Coast Wildlife Centre took over ONE of all rowi and Haast tokoeka in 2011.
West Coast Wildlife Centre, 2011 - (Haast tokoeka, rowi, great spotted kiwi)	25 eggs at a time	80 chicks in a season	c.16-80 (building up since first year in 2010-2011)	May have issues if required to raise >5 great spotted kiwi chicks (resulting from mining mitigation at Stockton) in a season because of the need to house species separately.

<sup>1</sup> Approximate annual number raised, based on last 5 years data

Table 3: ONE crèche sites by taxon (shaded sites are not currently in use).

Taxon	Name	Years of ONE	Size (ha)	Notes
Northland brown kiwi	Matakohe Limestone Island	2001 -	38 ha	
	Motuora Island	1998 -	85.5 ha	
	Whangarei Bird Recovery Centre	1996 -		
Eastern and western brown kiwi	Kiwi Encounter	1995 -	-	Fewer birds being crèched than capacity due to funding constraints.
Eastern brown kiwi	Panpac Opouahi Kiwi Crèche	2008	40 ha	
	Whinray kiwi crèche	2006 -	1 ha	
	Cape Sanctuary (Cape Kidnappers)	2008 -	2,200 ha	Resident kiwi population established and growing, but there will be sufficient crèche capacity for a number of years.
Western brown kiwi	Wairakei Golf + Sanctuary	-2011--	150 ha	
	Warrenheip	2002-2010	16 ha	
	Bushy Park	2004 - 2010	100 ha	
	Rotokare	2010-2011	230 ha	Used as crèche by Taranaki Kiwi Trust for one year only. It is now intended that Rotokare will be used as a kohanga kiwi.
Mixed provenance western-stern brown kiwi	Pukaha Mt. Bruce	2001 -	-	
Great spotted kiwi	Crèche du Bois Gentil	2007 -	12.5 ha;	Can take 10 chicks, but averages 5-6 at any one time.
	Adele Island	2007 - 2008	88 ha	Not used since Crèche du Bois Gentil built.
Great spotted kiwi, rowi, Haast tokoeka	Willowbank	2005 -	-	Willowbank developed significant ONE capacity, but this has since been under-utilised because Haast tokoeka and rowi ONE is now carried out at WCWC.
Haast tokoeka	Centre Island	2003? -	18 ha	
	Rona Island	2003? -	60 ha	
	Bute Island	2003? -	c.15 ha	
Haast tokoeka, rowi	West Coast Wildlife centre	2010 -	-	*Theoretical capacity = 81 (51 rowi, 27 Haast tokoeka, and 3 great spotted kiwi), based on 3 birds per pen - unmanageable in practice.
Rowi	Motuara Island	1997 -	200 ha	
	Arahura Department of Conservation facility	1995 - 1998	?	No longer used

#### 4.4 Crèche sites

Fourteen sites are currently used to “crèche” kiwi chicks through to a size where they are deemed large enough to be released back into the wild (see Table 3 above). Six crèche sites are islands, and eight are fenced mainland sites that are free of predators of kiwi chicks (or have very low predator densities, c.f. Cape Sanctuary).

## 5. SUMMARY OF ONE ACTIVITY

### 5.1 Collection and collation of ONE data from projects and facilities

One aim of this report was to provide a snapshot of ONE activity to date, and to report the total number of kiwi that have undergone ONE, i.e. the number of wild eggs and chicks harvested each year by species, taxon, and project, which ONE facility they were reared at, where they were crèched, and how many juveniles were ultimately released back to the wild.

Three types of data were received from ONE users that participated in the situation analysis:

- Detailed data and summary data from kiwi recovery projects.
- Detailed data from ONE facilities of all eggs and chicks received and reared.
- Summary statistics of annual ONE throughput at all ONE facilities, compiled by the Kiwi Captive Coordinator.

The content and structure of data held by projects and facilities varied considerably, and not all data supplied by recovery projects was in a format able to be efficiently incorporated into a larger data set. In a number of cases, project data sets were either incomplete, not provided, or there was reliance on third parties (e.g. the project’s ONE facility, or Department of Conservation) to collect and/or store their ONE data. These factors made the recovery project data sets of limited use in collating an overall ONE activity data set.

Overall, collection of ONE data is split in a non-systematic way between recovery projects and ONE facilities, resulting in duplication of effort, as well as creating data sets that do not match up. This situation is similar to that identified in Topic 17 of the Kiwi Recovery Plan.

Data from the various ONE facilities tended to use similar data types and formats, and was easier to collate and standardise than recovery project data. Therefore we primarily used data sets supplied by the ONE facilities, which meant collation and formatting involved a smaller number of data sets, but maximised the number of individual egg/chick records that could be included.

Where detailed ONE facilities data were not available, we used ONE summary data compiled by the Kiwi Captive Coordinator (Suzy Barlow, Zoo and Aquarium Association New Zealand). These data sets included:

- Kiwi Encounter, from 1996-1997 and from 2011-2012.
- Auckland Zoo, from 1997-1998.
- West Coast Wildlife Centre, from 2010-2011 onwards.
- Willowbank, from 2005-2006 (334 individual egg/chick records; all manually transcribed from paper records to spreadsheet; Sarah Forder, Lincoln University, unpubl. data).
- Estimates of total numbers of wild-released ONC juveniles from the Whangarei Heads Landcare Forum and ECOED/Save Our Kiwi Hawkes Bay projects, who harvest wild-hatched kiwi chicks (using 'chick timer' transmitters) and rear them in predator-free crèches, thus bypassing ONE facilities.

Data not obtained included:

- Pukaha Mount Bruce - all years.
- Westshore Wildlife Reserve - all years.
- Whangarei Native Bird Recovery Centre - all years.
- Rowi eggs and chicks collected and incubated at Department of Conservation facilities at Arahura and Hokitika - all years.
- Kiwi Encounter detailed data for 2012-2013, which is currently in paper format only.

The main limitation of ONE facility data is that for many eggs and chicks it is not clearly identified where they were crèched or how many chicks were eventually returned to the wild. Because of this data limitation, it was not possible to provide a complete summary of the total number of chicks that survived the crèching period (as well as where they were crèched), or the total number of juveniles that were released back to the wild.

The main measure we have reported is the total number of eggs and chicks collected from the wild, which is a measure of total ONE activity. These data are presented for each facility for each year of operation (Table 4), and for each taxon, sorted by project and facility (Table 5). The final outcomes, where these could be confidently inferred, for all eggs/chicks in the collated data set are presented in Table 6.

Table 4: Numbers of wild-collected ONE eggs and chicks for each ONE facility for every year of operation, and total number of ONC chicks.

ONE Facility	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	Grand Total
Auckland Zoo <sup>1</sup>			14	10	11	17	14	24	35	24	18	14	25	26	23	23	30	28	18	354
Kiwi Encounter <sup>2</sup>		1	6	13	9	23	29	49	90	88	134	173	188	193	218	192	195	186	150	1937
Pukaha-Mt Bruce <sup>3</sup>															13	10	26	24	26	99
West Coast Wildlife Centre <sup>4</sup>																	24	34	84	142
Westshore Wildlife Reserve <sup>3</sup>	2	5	9	2	4	22	16	5	5	12	5	5	18	16	4	4	2	6	7	149
Whangarei Native Bird Recovery Centre <sup>3</sup>																			13	13
Willowbank <sup>5</sup>												1	18	52	59	88	80	17	13	328
ECOED - ONC (approx.) <sup>6</sup>																				c.100
WHLF - ONC (approx.) <sup>7</sup>																				98
<b>Grand Total</b>	<b>2</b>	<b>6</b>	<b>29</b>	<b>25</b>	<b>24</b>	<b>62</b>	<b>59</b>	<b>78</b>	<b>130</b>	<b>124</b>	<b>157</b>	<b>193</b>	<b>249</b>	<b>287</b>	<b>317</b>	<b>317</b>	<b>357</b>	<b>308</b>	<b>298</b>	<b>3,220</b>

<sup>1</sup> Auckland Zoo, unpubl. data

<sup>2</sup> Kiwi Encounter, unpubl. data; Suzy Barlow, Kiwi Captive Coordinator, unpubl. data (for 2012-2013)

<sup>3</sup> Suzy Barlow, Kiwi Captive Coordinator, unpubl. data

<sup>4</sup> West Coast Wildlife Centre, unpubl. data

<sup>5</sup> NZCT (Willowbank) and Sarah Forder, unpubl. data

<sup>6</sup> www.ecoed.org.nz

<sup>7</sup> Todd Hamilton, WHLF, pers. comm.

Table 5: Numbers of wild-collected ONE eggs and chicks arranged by taxon, recovery project, and ONE facility.

Taxon	Kiwi Recovery Project	ONE Facility	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	Grand Total	
Northland brown kiwi	Whangarei Heads Landcare Forum (WHLF)	ONC																				98	
	Whangarei Kiwi Sanctuary	Auckland Zoo			14	10	11	17	14	24	35	24	18	14	25	26	23	23	30	28	18	354	
		Whangarei Native Bird Recovery Centre																		13			13
<b>Northland brown kiwi total</b>					14	10	11	17	14	24	35	24	18	14	25	26	23	23	30	41	18	467	
Coromandel brown kiwi	Coromandel	Kiwi Encounter									1											1	
	Moehau Kiwi Sanctuary	Kiwi Encounter								2	4	7	18	7	7	5						50	
	Project Kiwi Kuaotunu	Kiwi Encounter											7	16	15	18	20	11	11	16		114	
<b>Coromandel brown kiwi total</b>									2	5	7	25	23	22	23	20	11	11	16			165	
Eastern brown kiwi	Boundary Stream	Kiwi Encounter											1			3	2		1			7	
		Westshore						1															1
	Cape Sanctuary	Westshore																			2	2	
	Hinepukohurangi	Kiwi Encounter												3	1	4	4	4				16	
	Save Our Kiwi Hawkes Bay - ECOED	ONC																					100
		Kiwi Encounter							6	13	14	20	21	24	22	16	7	5	11	9			168
	Lake Waikaremoana	Westshore						8	9														17
		Kiwi Encounter										4		5	3	1							13
	Maungataniwha	Westshore	2	5	9	2	4	13	7	5	5	12	5	5	5	3	8	3	4		6	5	103
		Kiwi Encounter														22	28	29	30	42	57		208
	Omataroa	Westshore														15	8	1	2	2	9		26
		Kiwi Encounter															6	8	5	2	9		30
	Otanewainuku Kiwi Trust	Kiwi Encounter															4	8					12
	Ruahines	Kiwi Encounter															4	7	4	4	4		23
	Te Urewera National Park	Kiwi Encounter														1	1						2
Whakatane Kiwi Project	Kiwi Encounter							2	8	15	8	12	22	26	34	39	37	31	9			243	
Whinray	Kiwi Encounter									4					2	2	3	2	1	2		16	
Whirinaki	Kiwi Encounter						5	4	3	5	7	16	25	23	17	30	20	33	22			210	
<b>Eastern brown kiwi Total</b>			2	5	9	2	4	27	28	33	39	51	55	84	118	136	141	111	127	118	7	1197	
Western brown kiwi	Bushy Park	Kiwi Encounter											2	1								3	
	Karioi Rahui	Kiwi Encounter										3	1	2	5	6	6	3	5	7		38	
	Maungatautari	Kiwi Encounter															10	6	3	7		26	
	Taranaki Kiwi Trust	Kiwi Encounter										1	3	25	23	12	20	26	12	4		126	
	Tongariro Kiwi Sanctuary <sup>1</sup>	Kiwi Encounter		1	6	13	9	13	9	13	40	25	43	27	15	9	11	16	27	24		301	
	Waimarino	Kiwi Encounter						5	8	6	11	13	10	15	23	23	13	22	12	12		173	
Wanganui	Kiwi Encounter													1								1	
<b>Western brown kiwi Total</b>				1	6	13	9	18	17	19	51	42	59	71	66	50	60	73	59	54		668	
Eastern and western brown kiwi	various	Kiwi Encounter																			150	150	
<b>Eastern and western brown kiwi Total</b>																					150	150	
Mixed provenance eastern and western brown kiwi	Rimutaka Forest Park Trust	Kiwi Encounter															1	1				2	
		Pukaha-Mt Bruce															7	10	9				26
	Various	Pukaha-Mt Bruce																		17	24	26	73

<sup>1</sup> From 2006 onwards eggs collected by Tongariro Kiwi Sanctuary were returned to the wild at hatch weight/c.2 weeks old i.e. they did not undergo ONE to safe weight. The hatching rate of these eggs was probably higher than the wild hatching rate, therefore they have been included in the data presented.

Taxon	Kiwi Recovery Project	ONE Facility	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	Grand Total
<b>Mixed provenance eastern and western brown kiwi total</b>																14	11	26	24	26	101	
Northland and Hauturu mixed brown kiwi (Ponui Island)		Kiwi Encounter																		4		4
<b>Mixed provenance Northland and Hauturu brown kiwi total</b>																				4		4
Great spotted kiwi	various	West Coast Wildlife Centre																			5	5
	Arthurs Pass	Willowbank													1							1
	Hawdon	Willowbank																6		7		13
	North Hurunui	Willowbank														2						2
	Paparoa Wildlife Trust	Willowbank													4	9	8	9	9	7	11	48
	Stockton	Willowbank																		3		3
	Waimakariri	Willowbank																	19		2	21
<b>Great spotted kiwi total</b>															7	9	14	28	17	18	93	
Haast tokoeka	Haast tokoeka sanctuary	West Coast Wildlife Centre																		24	30	54
		Willowbank												1	3	21	10	36	21			92
<b>Haast tokoeka total</b>														1	3	21	10	36	21	24	30	146
Rowi	Okarito	West Coast Wildlife Centre																	24	10	49	83
		Willowbank													15	24	40	38	31			148
<b>Rowi total</b>														15	24	40	38	55	10	49	231	
<b>Grand Total</b>			2	1	29	25	24	62	59	78	130	124	157	193	249	287	317	317	357	308	296	3,220

Table 6: Known outcomes of wild-collected ONE eggs and chicks, and ONC chicks.

Taxon	DOA/ Infertile	Egg Death	Hatched	Chick Death Pre- Release	Released to Creche	Retained as Captive Breeder	Returned to Wild	Outcome Unclear	Grand Total
Northland brown kiwi	23	47		15	233	4	130	13	465
Coromandel brown kiwi	27	8		13			117		165
Eastern brown kiwi	247	94		80	207		564	5	1197
Western brown kiwi	159	46		31	120		312		668
Eastern and western brown kiwi	22	2		6	85			35	150
Mixed provenance eastern-western brown kiwi					2			99	101
Mixed provenance Northland and Hauturu brown kiwi		1		1	2				4
Great spotted kiwi	6	4		10	42			31	93
Haast tokoeka	15	3	5	11	76			36	146
Rowi	19	13	51	22	124			2	231
<b>All Taxa</b>	<b>518</b>	<b>218</b>	<b>56</b>	<b>189</b>	<b>891</b>	<b>4</b>	<b>1123</b>	<b>221</b>	<b>3,220</b>

## 5.2 Reporting of outcomes

Notwithstanding the ONE data management issues covered elsewhere in this report (and identified in the current Kiwi Recovery Plan), a number of project reports submitted by respondents contained analysis of ONE outcomes in terms of numbers of juveniles returned to the wild, and/or their subsequent survival.

No reports went to the same level of detail in reporting ONE outcomes as Colbourne *et al.* (2005) and Robertson *et al.* (2010). Some examples of project outcome reporting are summarised below.

### 5.2.1 Whangarei Kiwi Sanctuary

Whangarei Kiwi Sanctuary and WHLF (Topia 2012) reported on annual numbers of ONE birds released from 2004-2005 to 2011-2012 inclusive (totalling 233 kiwi released back to the wild).

### 5.2.2 Tongariro Kiwi Sanctuary

Tongariro Kiwi Sanctuary (Sutton *et al.* 2012) reported on survival rates of ONE sub-adults for the years 2001-2012 (n = 77, survival rate = 61.6%), versus survival rates of wild-hatched sub-adults over the same period (n = 43, survival rate = 57.8%).

### 5.2.3 Maungataniwha - Forest Lifeforce Restoration Trust

The Forest Lifeforce Restoration Trust (Shaw 2013) summarised ONE activity over seven breeding seasons from April 2006 - March 2013. Of 300<sup>1</sup> eggs harvested:

- 112 eggs were non-viable
- 25 died as egg or chick
- 72 chicks were released back at Maungataniwha
- 50 chicks were released at Cape Sanctuary to form a new population
- 27 chicks remained (at time of writing) at Kiwi Encounter or Cape Sanctuary
- Five chicks were planned for release into the Whirinaki Kiwi Project Area
- Two chicks went to Auckland Zoo as part of the national captive breeding programme.

### 5.2.4 Waimarino Forest

The Waimarino Forest kiwi project did not supply a report example, but this project's data set (K. Oates, Enviro Research Ltd, unpubl. data) was one of the most complete that we viewed, in terms of charting the full ONE process, and where the ONE outcomes and last known life stage could be readily interpreted. Data types included:

- Season (year)
- Parent (name)
- Egg # (alpha-numeric code)

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<sup>1</sup> NB: there are only 293 reported outcomes.

- Chick (name)
- Chip (numeric code)
- ONE facility where raised
- Crèche
- Release date
- Transmitted (yes/no)
- Status (e.g. 'now breeding', 'MIA', 'died while hatching').

Table 7: Outcomes of ONE eggs/chicks harvested from Waimarino Forest, 1999-2012.

ONE Outcome	Last Known Life Stage	Total
DOA/infertile	-	34
Died in ONE facility	Egg death	19
	Chick death pre-release	5
Died in crèche	-	1
Released to wild	Died - predation	5
	Died - natural causes	4
	Died - vehicle collision	2
	Sub-adult	12
	Territorial	3
	Breeding	9
	Unknown fate	64
<b>Grand Total</b>		<b>158</b>

### 5.2.1 Whirinaki Forest kiwi project

King (2012) reported on two years where ONE juveniles released back to the wild were monitored using transmitters. In 2005-2006, all 15 monitored juveniles survived for 3-5 months post-release, before transmitters were removed. In 2007-2008, all five monitored juveniles survived for three months post-release, before transmitters were removed.

### 5.2.2 Haast tokoeka sanctuary

ONE summary outcomes were reported for 2003-2004 to 2012-2013 inclusive at the Haast tokoeka sanctuary (DOC 2013b). For each year, reporting included:

- Total number of pairs monitored (increased from 36 to 60), and how many were used for ONE (increased from 5 to 60).
- Total number of eggs harvested (increased from 3 to 29 annually).
- Total number of chicks hatched (increased from 2 to 23 annually).
- Total number of chicks surviving beyond 1,000 g (increased from 1 to 12 annually).

## 6. DATA COLLECTION AND MANAGEMENT

### 6.1 Overview of responses

Four facilities and 11 projects responded to question 12 of the survey form “What records do you keep and in what format?”

West Coast Wildlife Centre and Auckland Zoo keep detailed spreadsheets containing all data pertaining to egg and chick rearing. The former facility also compiles internal annual reports. At the other extreme, one facility had no spreadsheet management, and instead had years of data on paper only. Another facility was in the process of transferring data from hard copy to electronic spreadsheet. Auckland Zoo transfers its data into the Zoological Information Management System. This facility also sends data to Hugh Robertson, and some of this data has been published.

All of the ONE facilities have provided data to Suzy Barlow, Kiwi Captive Coordinator, for the last five reporting years from 2008-2009 onwards. These data are entered into an electronic spreadsheet. However, the raw data obtained from the facilities and projects often did not match data in the Kiwi Captive Coordinator’s tables (e.g. numbers collected or deaths in captivity were different).

Two of the Department of Conservation-managed projects provided details on their data sets (Hawdon/Hurunui Valleys and Tongariro Kiwi Sanctuary). The four kiwi sanctuaries maintain spreadsheets or databases for their respective projects. A rowi database was being developed at the time of the interview, but it is not clear how this is different from existing spreadsheet management systems.

Some community-run projects had detailed Excel spreadsheet databases. These spreadsheets often contained a wealth of information.

WHLF “Backyard Kiwi” data on kiwi monitoring and release is managed as part of the Department of Conservation Whangarei Kiwi Sanctuary work. This database is managed by the Department and overseen by Hugh Robertson.

The Whakatane Kiwi Project reported that they are currently looking for funding to generate an ‘IT Solutions Management System’ so that all data (this appears to also include Regional Council and Department of Conservation pest control data) is stored in a single system that is able to be accessed by key people.

Most projects, including Department of Conservation projects, compiled (or attempted to compile) annual reports. One project responded that they completed interim as well as annual reports that were supplied to Kiwis for Kiwi. Some of the annual reports were provided.

### 6.2 Analysis of current ONE data collection and management

The ONE process has multiple points at which data can be collected (wild collection, receipt at ONE facility, health checks/necropsy, release to crèche, recapture and return to wild, subsequent wild-recapture events). If stored and managed effectively the data can be used to generate informative analysis and reporting. The most fundamental use

of ONE data is to document the passage of each wild-collected egg and chick through the ONE process, including:

- Unique identifier
- Chick name
- Transponder number/leg band number/colour band combination
- Species/taxon
- Recovery project
- Location of project/natal territory
- Parentage
- Egg/chick collection date
- Name of ONE facility and date of arrival
- Hatch date
- Name of crèche and date of arrival
- Release location and date of release
- Last known life stage (e.g. dead on arrival at facility, egg infertile; egg death in ONE facility; chick death in ONE facility; died in crèche; released to wild; wild fate - died of natural causes/preyed on/sub-adult/territorial/breeding) and date.

In addition to the basic data required for tracking and reporting activity, a substantial volume of other data is collected by various projects. These data are important for operational reasons, but are not crucial for documenting the basic ONE process for each egg/chick. Some of the other data being collected includes:

- Adult identification
- Adult condition
- Handling issues
- Breeding frequency
- Dispersal
- Habitat use
- Adult survival
- Territory size
- Transmitter details and checks
- Egg collection dates
- Details of rearing facility outcomes
- Crouching details including weights
- Growth rates
- Release dates, locations, weights
- Follow-up checks.

While most, if not all, kiwi recovery projects and ONE facilities are collecting data on each egg/chick, very few individual data sets explicitly cover the full chronology from wild collection of eggs and chicks through to wild release, and where each egg/chick is reared, crèched, and released. Whenever we compared data sets of kiwi recovery projects with corresponding data held by ONE facilities, and summary data compiled by the Captive Coordinator, differences were routinely found in recorded numbers of eggs and chicks passing through each stage of the ONE process. Of seven kiwi recovery projects that supplied ONE data, the variation between the numbers of wild-

collected eggs and chicks and juveniles returned to the wild compared to the data held by the ONE facilities varied from 4% to 25%. None of the corresponding recovery project and ONE facility data sets matched exactly. This compromises the utility of the data we have compiled and used.

The way that some data are collected and reported appears to contribute to this variance, including:

- Inclusion of eggs that are collected from nests other than those monitored as part of ONE.
- Inconsistent recording of eggs that are deemed DOA/infertile on arrival at facility, and are not incubated.
- Not recording the locations where individual chicks are crèched.
- End-of-year reporting occurring while some eggs and chicks remain in facilities/crèches (and potentially are omitted from ONE outcome reporting).
- Some data held by ONE facilities not being transferred from hard copy paper records into electronic spreadsheets or databases (presumably due to time constraints).

We suggest that data on each and every egg/chick that passes through ONE (and ONC) should be collated and compiled at a national level, using a standardised, minimum set of variables (such as those suggested above), filed periodically as an 'ONE return'. The onus should be on kiwi recovery projects to gather and curate this data (with assistance from ONE facility and crèche managers), since the projects handle each kiwi at the start and end point of the ONE process. Accordingly, they are best placed to file a completed return for each ONE kiwi. An annual ONE return should be filed when all eggs and chicks collected in that reporting year have completed the ONE process i.e. they have either died during ONE, or been returned to the wild. The annual return should consist of a project's entire ONE activity data set (i.e. all years) so that any updates on the status of post-wild release individuals can be included. Alternatively, an online database could be developed for individual projects to enter and manage their own data. A database administrator would then ensure that ONE data is entered within required time frames.

The suggestions above could be readily implemented for all future ONE eggs and chicks. This will provide a national standardised data set and allow the sharing of data between recovery projects and the ONE facilities they use. However, the data set will be of limited value without inclusion of all eggs and chicks that have undergone ONE to date: *c.*3,000 eggs and chicks to the end of 2012-2013. To achieve this, all existing data sets held by recovery projects and facilities would need to be checked and collated. It is likely that this would entail a significant amount of error-checking, as well as checking hard copy records held by the recovery project and/or the ONE facility, and filling in data gaps. This could prove difficult for some recovery projects to undertake using existing resources, and it may be necessary to source funding to undertake this exercise as a centralised project.

## 7. WHAT DOES ONE COST?

We looked at the cost of ONE, primarily from the perspective of the kiwi recovery projects. This is because they have the strongest incentives to weigh up the cost-effectiveness of various management interventions to protect their kiwi - such interventions include ONE, ONC, predator control, advocacy, kohanga kiwi - and then allocate resources to one or more types of management.

ONE facilities generally do not charge the full costs of their services to the recovery projects, and rely on additional sources such as organisational funding, visitor revenue associated with their wider business, and sponsorship and donations, to cover their costs. Any costs charged back to the recovery projects are likely to be less than the total cost to harvest a wild egg or chick and put it through ONE.

We divided the projects' reported annual operating expenditure on ONE-related tasks (which we assumed was a mean annual figure) by:

- Mean annual numbers of wild eggs and chicks collected, which is a measure of the total effort required to undertake ONE.
- Mean annual numbers of juveniles returned to the wild, which is a measure of the main desired outcome of ONE - to increase the survival of kiwi chicks to 'stoat-safe weight'.

Factors that would result in over-estimation and under-estimation of actual costs include:

- Organisational budgets not allocating or tracking ONE-related costs separately from other project costs.
- The difficulty in pro-rata allocation to ONE-related tasks of project costs that are shared across multiple project work areas e.g. administration and management.
- Organisational sensitivity about reporting commercial and employment-related costs.
- Omission, and/or difficulty, of pricing the costs of maintaining crèche facilities in a predator-free state - these often involve large capital and operating costs that are borne by other organisations, and which are generally not recovered by charging the recovery projects that use them.

Operational factors that appear to have a significant potential influence on ONE costs include:

- Location of a project's kiwi population relative to the project's base.
- Relative difficulty of terrain, mode of access, and climate within the project site and crèche site.
- Proximity of ONE facilities and crèches relative to the project base and the wild kiwi population.

- Field work effort required for different ONE tactics e.g. conventional transmitters and on-ground telemetry, SkyRanger aerial telemetry, use of ChickTimer transmitters.
- Productivity of the ONE source kiwi population/taxon/species.
- Knowledge and capability available to each recovery project to maximise the cost-effectiveness of their operations through project management and implementation of the ONE process.
- The size of a project in terms of numbers of eggs and chicks harvested, and available funding per annum, which may influence economies of scale.

Table 9: Indicative costs of ONE projects.

Project	\$/Egg or Chick Collected	\$/Juvenile Released	Comment
Haast Tokoeka Sanctuary	\$16,360	\$22,722	Source: Haast Tokoeka Sanctuary questionnaire response, (J. Livingstone, pers. comm.). Steep, remote, climatically challenging project site; widely dispersed source site, ONE and crèche facilities; likely to include substantial non-ONE related costs; highly resourced project at least partly due to Haast tokoeka threat classification of Nationally Critical.
Tongariro Kiwi Sanctuary	c.\$3,000	c.\$3,500	This is based on Tongariro Kiwi Sanctuary's rough estimate of 1 FTE per annum, plus operating costs. Used the data from 2010-2011 and 2011-2012 because numbers collected per annum have varied so much. Tongariro chicks are released wild at 3 weeks of age.
Rowi Sanctuary	\$10,700	\$12,306	Source: project questionnaire response, (J. Livingstone, pers. comm.). Widely dispersed project site, ONE and crèche facilities; highly resourced project at least partly due to rowi threat classification of Nationally Critical; likely to include substantial non-ONE related costs.
Waimarino Forest	\$3,049	\$4,348	
Project Kiwi Kuaotunu	?	\$1,806	\$1,806/juvenile released, compared to \$1,260 per chick surviving to safe weight through trapping only (from Gillingham 2010).
Whirinaki	\$1,316	\$1,471	
Maungataniwha	\$654	\$1,111	Predator control costs are included in the overall operational expenditure per annum, but the costs of crunching at Cape Kidnappers are probably excluded.
WHLF BHCT TLC (ONC)	\$1,090	\$1,090	WHLF's own estimate. Possibly doesn't factor in the costs of maintaining Limestone as a pest-free crèche?
Paparoa Wildlife Trust	-	c.\$5,000	This is PWT's own estimate.

- The level of funding available to a project, particularly the Department of Conservation-managed kiwi sanctuaries, which may also reflect research needs/minimum required sample sizes, as well as threat classifications (e.g. the Nationally Critical Haast tokoeka and rowi attract greater funding than other kiwi taxa).

ONE costs are tabled below for projects where there was sufficient information on costs and ONE through-put. Given the qualifications and uncertainties surrounding the cost information provided by respondents, these costs should be treated as indicative only.

Only one project canvassed - Project Kiwi Kuaotunu - has explicitly addressed the issue of relative cost of ONE versus predator control. On a per-juvenile released basis, Project Kiwi Kuaotunu has estimated that ONE costs 43% more than trapping. However, they note (as do other projects), that ONE has ensured a minimum level of chick survival in years when trapping has failed, and that there are significant advocacy benefits that may be difficult to quantify (such as increasing donations and volunteer effort, and reducing direct human impacts such as mortality through possum traps, dogs, and vehicle strikes).

Better estimates of ONE costs, and comparisons with other management such as trapping, aerial 1080, ONC, or kohanga kiwi, could be made if projects clearly identify and code items by management type in their planned budgets and reporting of actual expenditure, keep accurate ONE data, and use a common annual business plan cycle. Guidelines/templates for recording costs could potentially be developed for ONE-related best practice manuals.

## 8. TRAINING, CAPABILITY, AND QUALITY STANDARDS

Respondents were asked whether they thought sufficient opportunities and resources were available for training. Eighteen responses were received.

Five rearing facilities provided comments. One was satisfied with the level of training. The two South Island facilities and one North Island facility considered that the candling course was not run often enough, and suggested running the course more frequently, and periodically in the South Island. It was noted that candling courses facilitated the informal exchange of discussion and skill sharing among participants on all aspects of kiwi management. Some comments were directed at recovery projects, in particular regarding gaps between best practice and implementation, and providing a basic avian first aid course for field workers and facility staff. Two facilities emphasised the highly specialised nature of their work, and the requirement for skilled staff.

The Department of Conservation projects were all satisfied with the level of training. One noted that training is often gained by assisting contractors and that those contractors, who often work between a variety of kiwi projects (and other species), can be the disseminators of best practice and improvements in techniques. Another

project commented that they were happy for less experienced practitioners to accompany staff in the field as part of training.

Eight non-Department of Conservation projects answered the training question. Responses were varied. Three projects specifically referred to the availability of training opportunities through local Department of Conservation kiwi rangers; two projects were clearly very happy with the assistance received, while the third saw room for improvement in regard to assistance and opportunities. One project used contractors and, as such, had little need for training. Another project had urgent need for a candling course. One project highlighted the lack of auditing of best practice for recovery projects. Another project believed they would benefit from assistance and advice on managing their trust. Another comment referred to the need to secure funding in order to provide staff with training. Another suggested a hui at a recovery project involving predator trapping and ONE.

## 9. STRENGTHS AND WEAKNESSES OF ONE

### 9.1 Strengths

Responses to the question “What do you believe are ONE’s strengths?” were received from 14 facilities/projects. Responses often included multiple strengths, which have been placed in four broad categories (Table 10).

Table 10: Strengths of ONE - survey responses.

ONE’s Strengths	Examples	Number of Responses <sup>1</sup>
Advocacy	Connecting people with kiwi and conservation - “seeing is believing”.	10
	Opportunities for developing relationships with stakeholders.	
Kiwi recovery	Good tool in situations with limited pest control.	7
	Allows for rapid population gains.	
	Establish new populations/translocations.	
Known, high quality results	Provides incidental ecological data and information.	4
	High success rates, hatch rates.	
	Tangible results.	
Facilities	Genetic lineages.	3
	Excellent staff and rearing facilities.	

### 9.2 Weaknesses

Twelve respondents addressed the question “What do you believe are ONE’s weaknesses?”. Not unexpectedly, half of respondents raised the issue of cost (Table 11). Interestingly, many were concerned with the potential impact of ONE on managed populations. Several also suspected they might be observing a greater level of flightiness of monitored pairs, and a movement away from monitored locations.

<sup>1</sup> The total ‘number of responses’ is greater than 14 because many respondents identified multiple strengths.

Table 11: Weaknesses of ONE - survey responses.

ONE's Weaknesses	Examples	Number of Responses
Cost	Uses a lot of resources	6
	Relatively expensive compared to pest control	
	ONE costs more than ONC	
	Writing and approval of translocation plans lengthy	
Population genetics and dynamics	Specialist programme requiring high levels of training	5
	Potential genetic issues stemming from regular lifts from same pairs	
	Regular disturbance of monitored pairs	
Insufficient facilities	Possible issues for species that form family groups	2
	Space and availability of crèches and rearing facilities	
ONC vs. ONE	Lower success rate of ONC	1
Species specific	Benefits kiwi only	1
ONE is an easy choice	Some groups may choose ONE over more cost effective options as it is seen as more 'sexy'	2
	ONE has an element of security and guaranteed population growth - groups can be reluctant to move away from ONE	

### 9.3 Potential improvements to ONE

Respondents were asked what things they would like to see changed, improved, or refined for any aspect of ONE. Fourteen responses were obtained. A summary of all responses is provided, followed by the number of respondents who specified that particular answer (Table 12).

Components of ONE that were specifically mentioned in regard to establishing or improving best practices and standards were: development of rearing and crèche facilities, stocking rates, transportation, and handling. Comments relating to the need for greater oversight, monitoring and auditing of ONE processes came from two rearing facilities, one non-Department of Conservation recovery project, and two Department of Conservation recovery projects.

### 9.4 Survival of great spotted kiwi ONE birds in the wild

Several respondents raised the issue of whether ONE is an appropriate management tool for great spotted kiwi. This appears to have been first reported for the Department of Conservation's Rotoiti Nature Recovery Project (RNRP; Harper *et al.* 2013). RNRP used the concept of ONE to remove eggs from Kahurangi National Park in three consecutive years, and release resultant young kiwi into Nelson Lakes National Park (Table 13). Management of the kiwi population no longer includes ONE, as staff are of the opinion that the absence of the extensive parental input demonstrated by some monitored pairs (juveniles and sub-adults associating with parents for a year and up to more than two years) may be responsible for the high ONE mortality rate (N. Joice pers. comm.). Additionally, the operation proved very expensive for little reward.

Table 12: Recommendations for changes to ONE - survey responses.

Area for Improvement	Specific Suggestions	Number of Responses
ONE management	Need a national ONE strategy and coordinator	5
	Better monitoring and auditing of ONE processes	
	Better development of standards/best practice	
Project and facility management	Greater detail and transparency of data collection	4
	Ensure translocation proposal filled in	
	'Genetic translocations' between projects managing same taxon	
	Improve methods of transferring knowledge between kiwi practitioners working with different species	
	Requirement for annual reporting and analysis	
Facilities and transport	Improvements in the carriage of eggs from the wild to rearing facilities	3
	More managed crèche sites	
	Purpose-built facility for large-scale husbandry and crèches of kiwi	
Research	Research into ONE great spotted kiwi (from a North Island project)	2
	Research into success of releasing low weight chicks	
No weaknesses		3

The findings of the RNRP may be at least partly responsible for the decisions made by some community-led great spotted kiwi recovery projects. For example, Friends of Flora (Kahurangi National Park, Nelson) reported that they had “made a conscious decision not to use ONE to boost our population because of the mixed success of the technique for this taxon when trialled by other projects”.

Paparoa Wildlife Trust has focused on releasing ONE great spotted kiwi back into the wild, and has almost met their original goal of releasing 25 individuals (Table 13). However, they have not monitored the survival of released birds. Consequently, their project does not yet provide any information of the suitability of ONE for great spotted kiwi (the trust’s focus has now changed to determining whether ONE kiwi are surviving to breed).

The Hawdon/Hurunui/Nina project provides the most data on the survival of ONE birds in the wild (Table 13). In total, 35 eggs were lifted over four seasons, and 15 birds released. Of the 15, 11 were still alive after one year; most were between 2.5-4.5 years old when last observed. The four birds that died lived to 1-2 years of age.

Table 13: Great spotted kiwi outcomes using ONE.

Year	Number of Eggs/ Chicks Lifted	Deaths at Facility <sup>1</sup>	Deaths at Crèche	Number Released to Wild (% of Eggs Lifted)	Survival Notes
<b>Hawdon/Nina/South Branch</b>					
2008-9	9	4	0	5 (56%)	One still alive at 2y, one still alive at 4.5y <sup>4</sup> , three died c.1-1.5y
2009-10	8	2	1	5 (63%)	All alive at ≥ 3y
2010-11	11	3	5	3 (27%)	One died at 2y, two alive at 2.5y
2011-12	7	3	2	2 (29%)	Alive at c.1y
<b>Paparoa Wildlife Trust</b>					
2007-8	4	2	1 <sup>2</sup>	1 (25%)	Died at c.1y
2008-9	9	2	0	7 (78%)	Five died within 7d, two not observed again
2009-10	9	3	1	5 (56%)	Fate unknown
2010-11	9	1	3	5 (56%)	Fate unknown
2011-12	9	4	0	5 (56%)	Fate unknown
2012-13	13	4	1	-	Eggs/chicks still at facility and crèche
<b>Rotoiti Nature Recovery Project</b>					
2009-10	3	0	Hard released <sup>3</sup>	3 (100%)	One died within 10d, two survived and grew well
2010-11	3	1		2 (67%)	One died within 14d, the other within c.45d
2011-12	4	2		-	Two to be released (Sept 2012)

<sup>1</sup> Includes eggs that were dead on arrival or infertile.

<sup>2</sup> Transmitter failed on Adele Island; fate unknown.

<sup>3</sup> Birds released at approximately 700-1,200 g directly into the wild.

<sup>4</sup> May have attempted to breed in 2012-2013.

## 10. FUTURE DEMAND FOR ONE

### 10.1 Estimated future demand from kiwi recovery projects

Based on questionnaire responses, interviews, and available ONE data, the estimated annual demand on ONE facilities could be around 160-260 wild-collected eggs and chicks per annum (see Table 14). Overall, this is lower than the last five years (c.300-350 eggs and chicks collected per annum), and mainly reflects the following:

- Several North Island brown kiwi projects (including Whirinaki, Waimarino, Whakatane Kiwi Project, Taranaki Kiwi Trust, Rimutaka Forest Restoration Trust, Te Potae Awarua (Ruahines), and Tongariro Kiwi Sanctuary) are phasing out or reducing their current level of ONE effort, which has averaged c.100 wild-collected eggs/chicks per annum over the last five years (c.30% of the total ONE harvest).

- All great spotted kiwi projects have either phased out or are planning to phase out ONE (possibly Paparoa Wildlife Trust will continue, pending improved knowledge of wild fates of ONE kiwi, and adequate funding).
- The Haast tokoeka and rowi sanctuaries will both seek to maximise their ONE effort for the next few years at least.
- Other current ONE users will maintain their existing effort.

## 10.2 Capability of ONE facilities and crèches to meet future demand

Overall it appears that there is sufficient capacity in the existing network of ONE facilities and crèches to meet estimated future demand. The maximum estimated annual demand of 260 wild-collected eggs and chicks is considerably less than the maximum actual annual demand (c.350 in 2010-2011), and the combined capacity of all existing ONE facilities (>400 eggs/chicks per annum). It should be noted that the ability of ONE facilities to operate at maximum capacity is highly dependent on funding levels, which are sourced from a combination of organisational baseline funding, sponsorship/external funders, donations, and cost recovery from kiwi recovery projects.

West Coast Wildlife Centre and Auckland Zoo will likely continue to operate at or near capacity, and the remaining facilities will likely continue to operate below capacity for the foreseeable future.

In the South Island, both the West Coast Wildlife Centre and the NZCT Kiwi Breeding Centre noted that their workload is largely dependent on the requirements of the Department of Conservation kiwi recovery plans. The latter facility, in particular, has lost a great deal of ONE throughput with the establishment of a rearing facility nearer the Department of Conservation Okarito rowi and Haast tokoeka projects, and the discontinuation of the local Waimakariri Area Office's great spotted kiwi ONE work.

In the course of this research, no other South Island projects were identified that were likely to begin use of ONE for kiwi recovery. Four projects, Rotoiti Nature Recovery Project (RNRP), Arthurs Pass Wildlife Trust, Friends of Cobb, and Friends of Flora (all great spotted kiwi recovery projects), were contacted. RNRP, while strictly employing translocations rather than ONE (eggs were taken from Kahurangi National Park, raised at NZCT Kiwi Breeding Centre, then released at the site), found ONE to be a relatively unsuccessful and expensive method for great spotted kiwi recovery and had discontinued use of the tool. Friends of Flora reported the "mixed success of the technique for this taxon when trialled by other projects" as a key reason for not using ONE. The remaining two projects noted the success of their trapping operations, and had no need to use ONE.

Table 14: Future demand for ONE facilities from Kiwi Recovery Projects.

Project	Future Intentions for ONE	Likely Eggs/Annum
<b>Northland brown kiwi</b>		
Whangarei Heads Landcare Forum	Plan to continue at current levels of effort using ONC only.	(10-20)
Whangarei Kiwi Sanctuary	Plan to continue at up to 32 eggs per year.	25-30
<b>Coromandel brown kiwi</b>		
Project Kiwi-Kuaotunu	Plan to continue transferring a mix of eggs and chicks to Kiwi Encounter at current levels.	10-15
Moehau Kiwi Sanctuary	2007-2008 was the last year using ONE.	0
<b>Eastern brown kiwi</b>		
Boundary Stream Mainland Island		0
Lake Waikaremoana Hapu Restoration Trust		0
Maungataniwha	Plan to continue ONE until project goals are met.	40-60
Omataroa		5-10
Otanewainuku Kiwi Trust		5-10
Whakatane Kiwi Project	Will use ONE as emergency back-up only.	1-5
Whinray Reserve Trust and Crèche		1-2
Whirinaki	Phasing out: lack of funding.	0
Ruahines	No longer doing ONE?	0?
Hinepukohurangi	Ceased collecting eggs in 2009-2010.	0
Save Our Kiwi Hawke's Bay / ECOED	This figure does not include their annual crop of ONC chicks.	5-10
<b>Western brown kiwi</b>		
Karioi Rahui		5-10
Tongariro Kiwi Sanctuary	ONE 6-8 eggs per annum for the next few non-1080 years, mainly as an advocacy tool.	6-8
Waimarino Forest	Phasing out: planning to use Maungatautari as kohanga kiwi, by transferring 30 breeding adults, and harvest juveniles annually for return to Waimarino.	0
Taranaki Kiwi Trust	Until the kohanga kiwi model is producing enough progeny to export (estimated as being 2018), ONE will be utilised to release a small number of juveniles on Mt Taranaki (for genetic reasons), and then phased out.	1-5
Rimutaka Forest Park Trust	Ceasing ONE as it is now considered they have a sufficient founder population to be sustained by trapping.	0
Paparoa Wildlife Trust	Possibly will phase out ONE once goal of 25 birds released has been achieved.	5-10
Waimakariri-Hawdon, Hurunui, Nina	Have phased out ONE.	0
Haast Tokoeka Sanctuary	ONE will be the major management tool for next 10 years, alongside ONC.	25-30
Okarito Rowi Sanctuary	ONE will continue to be the major management tool for rowi, until a successful predator control prescription is developed.	25-50
<b>Total Estimated Future Annual Demand on ONE Facilities</b>		<b>c.160-260</b>

## 11. FINDINGS

### 11.1 Overall

- ONE has functioned successfully for nearly two decades, and made a substantial contribution to recovery of threatened kiwi taxa, especially rowi and Haast tokoeka (both Nationally Critical). Approximately 3,000 wild-collected eggs and chicks have passed through ONE to date.
- Twenty-four kiwi recovery projects have used ONE to boost their kiwi populations in recent years. These kiwi recovery projects currently utilise seven ONE facilities, of which Kiwi Encounter and West Coast Wildlife Centre are the largest, and thirteen crèche sites.
- ONE has been applied to recovery of great spotted kiwi at a smaller scale compared to the other taxa. Great spotted kiwi projects that have used ONE reported mixed results and most, if not all, have indicated they are phasing out ONE.
- Progress has been achieved on some ONE-related objectives in the existing Kiwi Recovery Plan (e.g. the ONE best practice manual), but not others (e.g. development of a national data set, a ten-year ONE national plan, and national coordination of ONE).

Discussion of specific areas of this situation analysis is presented in the sub-sections below.

### 11.2 Reasons for using ONE, and phasing out of ONE

- The most common reason given for undertaking ONE was that existing levels of predator control were insufficient to achieve project goals.
- For Haast tokoeka and rowi, ONE remains the primary tool for taxon recovery.
- A number of projects whose kiwi populations have benefited from long-term management now report that the main reason for continuing with ONE is for advocacy purposes.
- Eleven projects have recently ceased ONE, or substantially scaled back their effort, or plan to use it only as a contingency measure. The main reasons given were achievement of ONE objectives - usually population recovery/security - or cost.

### 11.3 Capacity and demand

- There do not appear to be critical capacity issues with existing ONE crèche facilities, mainly because current ONE activity appears to be flattening-off or declining for some taxa.

- There does not appear to be a strong need at this stage for additional ONE facilities.
- Northland and Coromandel brown kiwi: ONE and ONC numbers per annum will remain steady as long as recovery projects can fund their ongoing activities. Arguably, Northland and Coromandel kiwi numbers have recovered to the extent that ONE is no longer an essential population recovery tool, and its main function is advocacy.
- Eastern brown kiwi: ONE and ONC numbers are likely to remain steady.
- Western brown kiwi: ONE numbers will decline, and the harvesting of “kohanga kiwi” back to source populations, will increase.
- Rowi and Haast tokoeka: ONE numbers are likely to be maintained - at least at current levels for the foreseeable future - although there may be harvesting of “kohanga kiwi” from newly-established island populations over time.
- The existing decentralised system for planning ONE effort and volumes appears to be adequate for matching supply and demand. A major change to match ONE services more closely to kiwi recovery projects has occurred recently with the shift of Haast tokoeka and rowi ONE work from Willowbank to WCWC. It is not clear whether a formal ONE strategy is required in order to manage demand.

#### 11.4 Training, capability, and quality standards

- In general, respondents considered the provision of training to be adequate, although some felt that candling courses could be held more frequently, especially at South Island locations.
- Development of expertise in community-run projects is made easier when there is ready and/or informal access to science/technical/expert practitioner advice. Such access is unlikely to be available equally to all projects.
- There is scope for more oversight and auditing of performance standards than currently occurs; the ONE best practice manual assists this by defining those performance standards.

#### 11.5 Data collection, management, and reporting

- A central database should be established and maintained, in order to have accurate and reliable data on ONE activity and outcomes at taxon/species/recovery plan levels.
- Current systems of collection and reporting on ONE data do not appear to achieve this, which is a situation similar to that described in the Kiwi recovery Plan in 2008. Collation of summary ONE facility data has occurred since 2008-2009, but this captures only part of the picture.
- There is variation between the data held by recovery projects, ONE facilities, and captive coordinator summaries, and in the way that reporting is undertaken.

- There is considerable scope to improve the process of collecting and storing ONE data, especially by:
  - Ensuring that the responsibility for data collection lies with the recovery projects, with assistance from ONE facilities.
  - Requiring that all ONE recovery projects use a centralised database or standard spreadsheet format to collect a minimum set of data on every wild-collected egg and chick that goes through ONE and ONC.
  - Defining key measurables and formats for producing standardised reporting.
  - Ensuring that any permit requirements regarding data collection and reporting are met.

## 11.6 Costs of ONE

- There is wide acceptance that ONE costs more - per chick surviving to safe weight - than predator control. However, it is also widely held that ONE is a very effective advocacy tool, but that the benefits of this advocacy role are difficult to quantify in dollar terms.
- The comment in the Recovery Plan that the “comparison of cost versus benefit of...Operation Nest Egg versus predator control is not widely understood”, remains current, based on the cost information reviewed over the course of this situation analysis. This comment also applies to comparisons of ONE with ONC and kohanga kiwi.
- Clearer identification of ONE costs would rely on improved collection and reporting of operational data and budget expenditure data by recovery projects. This could possibly be achieved through the development of best practice guidelines and making them a required performance standard for all ONE projects, or at least a representative sample.

## 11.7 Strengths, weaknesses, and areas for improvement - reported by respondents

- The main strengths identified were tangible results, higher juvenile recruitment rates, and advocacy value.
- The main weaknesses identified were higher costs, potential for lowering of population genetic diversity, and that the technique is better suited to some taxa than others.
- Areas for improvement include better national coordination and strategic planning for ONE, stronger auditing of performance standards and quality assurance, ongoing development of best practice standards and dissemination among practitioners, and more within-taxon translocations to address genetic issues.

## 11.8 National coordination

National coordination of ONE is an objective in the current Recovery Plan. The situation analysis we have undertaken suggests national coordination would be beneficial for the following areas:

- Collation and maintenance of a single national ONE dataset.
- Facilitation of training and dissemination of skills and knowledge across all ONE users and practitioners, including maintenance and updating of best practice documents.
- Ensuring that an adequate level of performance standard auditing occurs, and the net result is an improvement in operational effectiveness and cost-effectiveness of ONE.
- Maintaining oversight of the various Department of Conservation permits under which ONE users operate, and ensuring that permit conditions work to resolve outstanding issues identified in the Recovery Plan and this Situation Analysis.
- Providing advice where needed/sought on a project by project basis on ONE-related issues, including strategic decisions by kiwi recovery projects on commencement/ending/changing of ONE effort.

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## ONE QUESTIONNAIRE

### OPERATION NEST EGG SITUATION ANALYSIS Survey questions

The Situation Analysis of BNZ Operation Nest Egg™ (ONE) is the first national summary and assessment of the ONE tool since it was first developed 18 years ago. This analysis has a number of objectives, including the following:

- To provide the first summary of the activities of all the projects and facilities involved in ONE to date, and the costs and outcomes associated with different aspects of the ONE process.
- To identify issues and challenges facing past, present, and future ONE participants.
- To evaluate future needs, for example, greater centralised planning or coordination, greater level of support.

Wildland Consultants Ltd has been contracted by Kiwis for Kiwi to undertake the Situation Analysis. Our contact details can be found at the end of this questionnaire.

The following survey questions are divided into the various stages of ONE: kiwi recovery projects, rearing facilities, and crèche facilities. You will only need to respond to questions that apply to your project or facility. Questions at the start of this questionnaire apply to all projects and facilities.

You can answer questions within this document by typing underneath each question (this would help us to collate responses more quickly and easily), or you may prefer to answer the questions by phone or skype. Let us know if you would prefer the latter, and we can organise a time to suit. We hope to conduct some of these surveys in person. If there are aspects that you think we have missed and that warrant discussion, please note them down and we can follow them up in person or on the phone.

The information provided by respondents (including outcomes, costs, opinions, and recommendations) will be used for the purposes of this analysis only.

#### All projects and facilities

1. Which of the following applies to your organisation?
  - a. Kiwi recovery project:
  - b. ONE captive rearing facility:
  - c. ONE crèche:
2. What is the name of your facility or project?
3. What year did you commence operation?

4. What species do you work with?
5. What led to your involvement with ONE?
6. Do you have a written strategy and/or plan? If so, what timeframe does it cover?
7. What are the vision and/or goal(s) of your facility or project? What progress have you made?
8. How do you coordinate with the various recovery projects, rearing facilities and crèches you are involved with (e.g. MoUs, planning logistics and workflow, exchange of information and advice)?
9. How do you engage the community, public, iwi, Department of Conservation (DOC) and other agencies in your ONE work (e.g. online information, newsletters, public ONE chick releases, public access to ONE rearing and crèche facilities)?
10. How important is ONE to your project's overall advocacy and community relations strategy?
11. How are you planning to use ONE over the next 10 or so years (e.g. continue use, phase out, wild chick collection using egg timers i.e. Operation Nest Chick or ONC)?
12. What records do you keep and in what format? Please provide a detailed summary, or send us a file or report if this is easier.
13. Have you undertaken analysis or reporting of the data?
14. How many part and full time staff/volunteers/contractors are involved (you could express this either as Full Time Equivalents, or number of hours per annum), including administration and management roles? Is this sufficient for your present and planned requirements?
15. Do you think there are sufficient opportunities and resources for training and capability-building?
16. What do you believe are ONE's strengths?
17. What do you believe are ONE's weaknesses?
18. Please tell us what things you would like to see changed/improved/refined about any aspect of ONE.

## **Kiwi Recovery projects**

19. Please provide a brief summary of the project, specifically:
  - a. Project type e.g. fenced sanctuary, island, or pest control:
  - b. Approximate size (hectares):
  - c. Year of project initiation (i.e. fencing completed, pest control commenced):
  - d. The estimated size of the kiwi population within your project area:
20. What tools are you using to achieve project goals (e.g. ONE, predator control, advocacy)? How do they rank in terms of importance to your project?
21. How many pairs have you monitored annually since starting with ONE?

22. How do you decide which and how many breeding pairs to monitor to provide eggs/chicks for ONE/ONC?
23. Do you record the individual parentage of the eggs/chicks? If yes, how many wild pairs have provided eggs or chicks for ONE/ONC over the course of your project?
24. Can you provide us with data (or annual summaries) on ONE eggs and wild-collected chicks that you have supplied to rearing/crèche facilities and the associated individual outcomes for each bird (to whatever level you are able)? Ideally, this information will include:
  - a. Unique ID/Band number
  - b. Year of laying
  - c. Lifted as egg or chick
  - d. Parentage
  - e. Name of rearing facility
  - f. Name of crèche facility
  - g. Outcome (e.g. breeding, died-predation etc.)

Please note which individuals (if any) were transmittered and for how long. (If you have this in a spreadsheet or report, you can send this to us and we can either undertake the analysis or extract the key data if this is easier).

25. Can you provide the approximate annual cost of monitoring breeding pairs? Wage or contractor costs can be expressed as hours rather than \$ if this is sensitive information.
26. Can you provide an estimate of the cost of transporting eggs/chicks to/from rearing and crèche facilities?

(What is your total annual operational expenditure on ONE/ONC activities? If your answer is an estimate as opposed to actual figures (this will be a common situation because many projects do not track all ONE costs separately within their project budget) you can state it as a range e.g. \$7-10,000 per annum.)<sup>1</sup>

27. How do you fund ongoing project costs?
28. Do you undertake kiwi call counts or other forms of kiwi population monitoring? What have been the results to date?

## **Rearing facilities**

29. What is your current capacity for:
  - a. Incubation?
  - b. Brooding?
30. Do you have capacity issues (e.g. too many eggs, not enough brooding facilities)?

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<sup>1</sup> Inserted as question into later questionnaires in lieu of questions 25 and 26.

31. Can you provide us with data (or summarised data) on eggs that you have received and the associated outcomes of incubation and brooding? If you have this in a spreadsheet or report, you can send this to us and we can either undertake the analysis or extract the key data if this is easier. Ideally this will include:
  - a. Egg unique ID/band
  - b. Year of laying
  - c. Origin of egg (kiwi recovery project)
  - d. Parentage
  - e. Outcome (e.g. hatched/failed to hatch/hatched then died)
  - f. Reason for mortality (if known).
32. Can you provide an approximate estimate of the cost of establishing and developing your captive rearing facility to its present state? This might include building cost if applicable.
33. How were the funds obtained to develop the facility?
34. How do you fund the ongoing running costs of the facility?
35. Can you provide an estimate of the cost of incubating and brooding from receipt of egg to releasing the chick to a crèche? Can you indicate what this estimate includes (e.g. staff time, operating costs) and excludes (e.g. costs borne by the projects, in-kind contributions)? Wage or contractor costs can be expressed as hours rather than \$ if this is sensitive information.
36. Do you fully or partly fund the transportation of eggs/chicks to and from your facility? If you do, can you provide the approximate cost per egg/chick?

## **Crèche facilities**

37. What is your current capacity?
38. Do you have capacity issues (e.g. too many chicks, not enough chicks)?
39. Can you provide us with data on the chicks that you have received from rearing facilities (or wild-collected chicks from donor projects, if applicable), and the associated outcomes? If you have this in a spreadsheet or report, you can send this to us and we can either undertake the analysis or extract the key data if this is easier. Ideally this will include:
  - a. Band number
  - b. Year of laying
  - c. Outcome (reached goal weight/mortality)
  - d. Reason for mortality (if known).
40. Can you provide an approximate estimate of the cost of establishing and developing your crèche facility to its present state?
41. How were the funds obtained to develop the facility?
42. How do you fund the ongoing running costs of the facility?
43. Can you provide an estimate of the cost of raising a chick in the crèche through to release size? Can you indicate what this estimate includes (e.g. fence maintenance, biosecurity monitoring)? Wage or contractor costs can be expressed as hours rather than \$ if this is sensitive information.

## Contact details

Please feel free to contact us if you have any questions.

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Thank you for your time.



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