

TONGARIRO FOREST KIWI SANCTUARY ANNUAL REPORT

July 2011 – June 2012

RUAPEHU AREA OFFICE, TONGARIRO / WHANGANUI / TARANAKI
CONSERVANCY



Ngati Hikairo Ki Tongariro



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Cover Photo: Clockwise from top left: Ruapehu Biodiversity assets team 2011/12; moonrise over Mt Ngaruahoe (from Te Koinga's territory); kiwi chick foot prints in a sand bunker at Wairakei Golf + Sanctuary; Gu5 . Photos provided by the Department of Conservation

PARTNERSHIPS

Partnerships between the Department of Conservation and Ngati Hikairo, The National Kiwi Trust at Kiwi Encounter, Maungatautari Ecological Island Trust, Project Tongariro, and the Bank of New Zealand Save the Kiwi Trust continue to be an essential part of the work in the Tongariro Forest Kiwi Sanctuary. This year six kiwi chicks (from Southern Ruapehu) were crèched at Wairakei Golf + Sanctuary.

THE NATIONAL KIWI TRUST AT KIWI ENCOUNTER

The National Kiwi Trust at Kiwi Encounter plays a crucial role in the success of the Tongariro Forest Kiwi Sanctuary, through incubating and hatching lifted eggs. Twenty two viable eggs were taken to there this season, all of which hatched.

NGATI HIKAIRO

Ngati Hikairo plays an important part in the Tongariro Forest Kiwi Sanctuary and has a role and responsibility as kaitiaki for the enhancement of Western North Island brown kiwi within their rohe. Ngati Hikairo support recovery efforts by the Department of Conservation and are intent on kiwi conservation goals and objectives being met within Tongariro Forest.

PROJECT TONGARIRO – TONGARIRO NATURAL HISTORY SOCIETY

Project Tongariro are involved in ecological projects throughout Tongariro National Park and surrounding areas. Their volunteers assist the Tongariro Forest Kiwi Sanctuary regularly with work such as small mammal indexing and transporting kiwi eggs to The National Kiwi Trust at Kiwi Encounter.

MAUNGATAUTARI ECOLOGICAL ISLAND TRUST

Maungatautari is a forested volcanic cone in the Waikato, and is the site of an ecological restoration project headed by the Maungatautari Ecological Island Trust, aiming to eliminate all mammalian predators and re-introduce native species, including kiwi. Tongariro Forest Kiwi Sanctuary and Ngati Hikairo gifted kiwi to Maungatautari and Ngati Koroki-Kahukura to be part of a founder population there. Since 2010, 14 kiwi (the offspring of some of the original founders) have been released into Tongariro Forest Kiwi Sanctuary.

WAIRAKEI GOLF + SANCTUARY

Wairakei Golf + Sanctuary is a privately owned golf course situated north of Taupo. A five kilometre “Xcluder” fence has been installed around the golf course perimeter. An extensive pest eradication program was completed in 2010 and the sanctuary officially opened in 2011. There have been many species of animal released into the sanctuary including mixed colour pheasant and four fallow deer. Other initiatives include the re-planting of around 25,000 native trees and 5000 exotics.

During the 2011/12 season, with support from Ngati Rangi, six kiwi chicks from Rangataua Forest were released into Wairakei Golf + Sanctuary. Three of these birds were then released into Waimarino Forest with Waimarino hapu. It is hoped that Wairakei will continue to be utilised as a crèche for Operation Nest Egg™ in the future. DOC staff are responsible for monitoring the kiwi who reside at Wairakei with assistance from Wairakei Golf + Sanctuary staff.

EXECUTIVE SUMMARY

Tongariro Forest Kiwi Sanctuary (TFKS) was established in 2000 for the development of kiwi protection techniques, namely the use of BNZ Operation Nest Egg™ (O.N.E) and aerial 1080. TFKS aims to achieve and maintain a representative sample of 200+ pairs of Western North Island brown kiwi by 2017, and to involve the community and enhance public awareness.

Twenty one adult male kiwi and six adult female kiwi were monitored in TFKS in 2011/12. There were two monitored adult kiwi deaths this season; one of these was confirmed as a ferret predation. This brings the total number of monitored dead adult kiwi in TFKS since 2009 to 26. There have been no adult kiwi deaths since the September 2011 aerial 1080 operation.

There were 26 nests this season, with a total of 28 eggs. Twenty two viable eggs were taken to The National Kiwi Trust at Kiwi Encounter (to help ensure a sample size of at least 16 kiwi chicks was achieved), and three eggs hatched in the wild.

Eighty eight O.N.E sub-adult kiwi have been released into TFKS since 2000. Of these, 77 have been closely monitored, along with 43 wild hatched sub-adults. The survival rate as at the end of the 2011/12 season was 58%, with a higher mortality in females than males. The average age of first breeding is four years old. The dispersal of sub-adults released on the western side of TFKS revealed previously unknown pockets of kiwi. Twenty five sub-adults are currently monitored.

Kiwi chicks were monitored in TFKS as part of an ongoing study to assess whether aerial 1080 possum control operations can benefit kiwi populations through secondary poisoning of stoats. Aerial 1080 operations were carried out in September 2006 and 2011. Twenty five chicks were monitored this season. The survival rate was 44%, compared to 19% last season (pre-1080), with a similar number of mustelid predations to the 2006/07 (post-1080) season.

Following the 2011 aerial 1080, small mammal indexing showed that rats were knocked down to just 3%; they were tracking at 60% or greater prior to the operation. The mustelid tracking rate peaked at 27% in January 2011, but none were detected in any of the tunnels after the aerial 1080 (0% tracking rate).

The percentage of fantail nests which successfully produced fledglings in the 2011/12 breeding season was 29%, compared to 12% in the 2010/11 season (pre-1080). Five-minute bird count monitoring was also carried out in 2011/12.

INTRODUCTION

Tongariro Forest Kiwi Sanctuary (TFKS) is a 20,000ha area in the central North Island (Figure 1) established in 2000 for the protection and recovery of Western North Island brown kiwi (*Apteryx mantelli*). It is one of five sanctuaries set up throughout the country to maintain significant populations of the different kiwi taxa, and to develop and improve techniques in kiwi protection, specifically aiming to increase the survivorship of young kiwi (Robertson 2004).

One of the key current research projects in TFKS is the assessment of the effect of a large scale 1080 operation on kiwi chick survival. This involves determining survival rates of kiwi chicks before and after aerial 1080 operations carried out in September 2006 and 2011. These were Animal Health Board operations as part of their regional TB-vector/possum control regime, but done in conjunction with the Department of Conservation for kiwi protection research. This research has national importance, indicating whether 1080 can be used as an effective tool for maintaining kiwi in large and/or relatively inaccessible areas throughout the country (McLennan 2006).

In addition to this research, other work includes ongoing monitoring of adult kiwi for survival and breeding purposes, and sub-adult kiwi survival, dispersal and breeding monitoring. Additionally, monitoring of mustelid and rodent numbers through tracking tunnels (small mammal indexing), and passerine monitoring (including fantail monitoring and five-minute bird counts) are also carried out within TFKS. This report presents results from these key areas of work for the 2011/12 financial year.



FIGURE 1: LOCATION MAP FOR TONGARIRO FOREST KIWI SANCTUARY, TONGARIRO-WHANGANUI-TARANAKI CONSERVANCY

SANCTUARY OBJECTIVES

1. To achieve and maintain a representative sample of 200+ pairs of western North Island brown kiwi in Tongariro Forest by 2017.
2. To answer three important management questions
 - Do aerial 1080 operations benefit kiwi chick survival?
 - If so, what frequency of aerial 1080 application is needed to maintain and expand the kiwi population?
 - Can aerial 1080 operations (at the required frequency) benefit other forest birds preyed upon by rats?
3. To involve local communities and associates in the management of the TFKS where practical.
4. To enhance public awareness and support for kiwi conservation.

ADULT KIWI MONITORING AND NESTING

Tongariro Forest Kiwi Sanctuary aims to keep 30 male kiwi monitored for breeding outcomes. The male kiwi are fitted with ‘smart’ mortality transmitters, known as chick timers. These transmitters provide an ‘output’ (information on kiwi activity levels which can be graphed) which informs the user if a kiwi is incubating or not, and for how long, in addition to other information such as when there is a hatch event and what time the male emerged from the nest the previous night. This technology lets us make very accurate assessments as to when to lift eggs or intercept chicks.

Egg lifts took place at 55 days. Lifted eggs were taken to The National Kiwi Trust at Kiwi Encounter. This was done to help ensure a sample size of at least 16 chicks was achieved (kiwi eggs have a higher hatch rate in captivity than in the wild). The resulting chicks were fitted with chick mortality transmitters and returned to their natal territory in TFKS at hatch weight (approximately two weeks of age).

Chick interceptions were timed to intercept both chicks (this can usually be ascertained by assessing the birds activity output), with the aim of intercepting the oldest chick between 5 and 10 days (a second chick will usually hatch within one week of the first). Chicks intercepted in the wild were fitted with chick mortality transmitters and left in the nest.

A total of 26 adult kiwi were monitored in TFKS in 2011/12, consisting of 21 males and six females. There were two adult mortalities this season. The carcasses were sent to Massey University and causes of death were ascertained to be ferret predation and possible pig predation. Since 2009 there have been 26 adult kiwi deaths; 13 of these confirmed ferret predations, and, although we suspect the majority of the “unknown” deaths were due to ferret predation, in some cases the condition of the carcass meant that the cause of death was unable to be confirmed. This was an unusual event and a real set back for TFKS. Fortunately, there have been no further adult deaths since the aerial 1080 operation in September 2011. Survivorship and life expectancy has decreased significantly as a result of the ferret predation events (Table 1). “Pre-ferret” figures are different from those listed in last season’s annual report as two previously overlooked adult kiwi deaths are now included in the analysis.

TABLE 1: ADULT SURVIVORSHIP AND LIFE EXPECTANCY. CALCULATED USING THE MAYFIELD METHOD

	Pre-ferret	Current
Annual survival rate (%)	97	92
Annual mortality rate (%)	3	8
Life expectancy	35 years	12 years

One adult kiwi’s transmitter failed in 2011/12 (Hiver); we are currently trying to re-catch him using a kiwi indicator dog (we still have a transmitter on his mate Snorkel). There are still five other adult male kiwi to re-catch; the result of failed and dropped transmitters from previous seasons. No kiwi dropped their transmitters in the 2011/12 season.

Two females were caught with males this season; Ngahere in June (a transpondered kiwi who had previously dropped her transmitter in 2007) and Canoodle in April (an unknown adult). Both kiwi were fitted with transmitters, as we want to closely monitor adult survival in the aftermath of the ferret predation event.

Katoa, a sub adult male kiwi, broke or badly dislocated his left leg (his transmitter was attached to his right leg) in November 2011. His activity level was so low it triggered the incubation output on his chick timer transmitter, so it was assumed he was nesting. When his activity returned to normal on December 1st, it was assumed that he had “abandoned” his nest. It was not until his capture (for a strap change) on January 20th that we discovered his inactivity was due to a leg injury. By this stage he was mobile and his overall condition was good, apart from his swollen leg, so he was left in the

forest (Massey University was consulted for this decision). On June 6th 2012 he was re-caught; his leg was much improved, and his condition was good. It was agreed any handling in future could compromise his welfare, so it was decided to remove his transmitter and let him go.

NESTING AND EGG OUTCOMES

There were 26 nests this season (Table 2), with 25 chicks hatching in total. Ten of these nests were unconfirmed (last season six of the 31 nests were unconfirmed).

TABLE 2: NEST AND EGG OUTCOMES FOR 2011/12

Kiwi	Eggs (not hatched)	Number of chicks	Confirmed nests	Unconfirmed nests*	Current status
LoggerRoss	-	6	3	-	Alive
Dino	-	2	1	-	Alive
Rocket	-	2	1	1	Alive
Taika	-	3	2	-	Alive
Peter Pan	1	2	1	1	Alive
Lucky	-	-	-	-	Alive
Speedy	-	-	-	-	Alive
Fluke	-	-	-	-	Dead
Doug	-	-	-	1	Alive
Te Whare	-	1	1	1	Alive
Murphy	-	-	-	1	Alive
Kratos	-	-	-	-	Dead
Fozzie	-	1	1	-	Alive
Max	1	1	1	1	Alive
Hiver	-	4	2	-	Failed tx
Tuki Tuki	-	-	-	1	Alive
Goff	-	-	-	1	Alive
Fuzzpop	-	-	-	1	Alive
Gulliver	-	2	1	1	Alive
Pumpkin	1	1	2	-	Alive
Totals	3	25	16	10	

*An unconfirmed nest was when the transmitter output indicated that the bird was nesting, but the nest was abandoned prior to being located

There were a total of 28 eggs this season (Table 2). There were 43 eggs in the 2011/12 season, and 52 eggs in the 2009/10 season; this cumulative reduction in egg output is because of the losses of radio-tagged breeding males to ferret predations over the last three seasons. Twenty two viable eggs were taken to The National Kiwi Trust at Kiwi Encounter (they all hatched), and three eggs hatched in the wild.

Three of the 28 eggs did not hatch this season. This is a very good outcome. Last season 15 of the 43 eggs did not hatch. Figure 2 shows compares egg outcomes from 2010/11 with egg outcomes from 2011/12.

Egg outcomes in 2010/11 and 2011/12

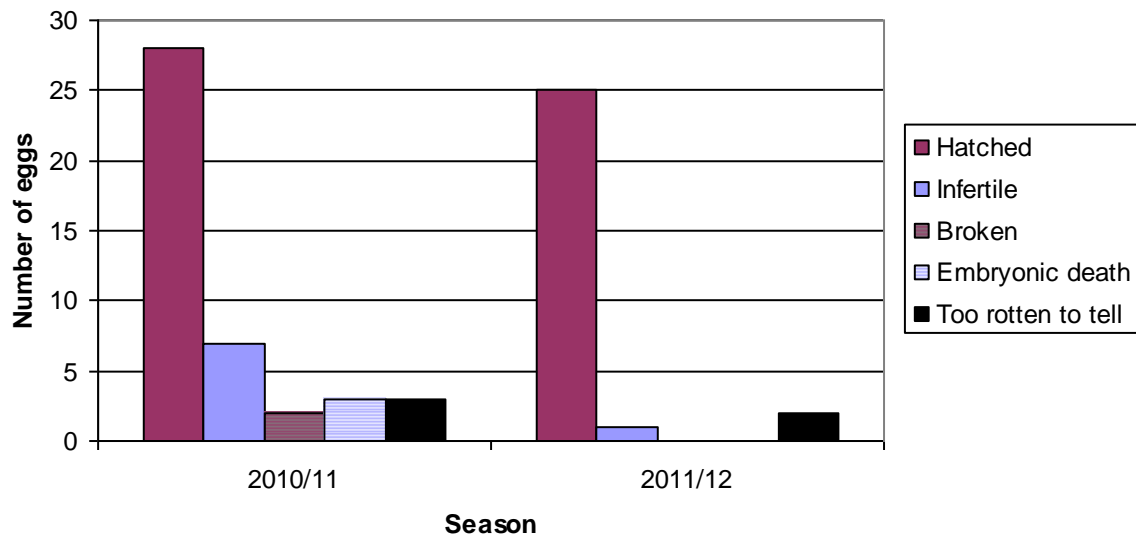


FIGURE 2: COMPARISON OF EGG OUTCOMES 2010/11 – 2011/12

KIWI CALL COUNT MONITORING

Call count monitoring was not required this season. See the 2010/11 annual report for more details.

SUB-ADULT KIWI MONITORING

Juvenile¹ and sub-adult² kiwi lifted from Tongariro Forest Kiwi Sanctuary (TFKS) as eggs, as part BNZ Operation Nest Egg™ (O.N.E), were released back into TFKS at between 1100g-1200g. A number of them have been radio-tagged to give data on the overall picture of population dynamics of kiwi (Robertson 2004), providing information on age at first breeding, survival and dispersal.

Eighty eight O.N.E sub-adults have been released since the creation of TFKS in 2000 (122 since the launch of O.N.E in the 1990's). Of these, 77 have been closely monitored, as well as 43 wild hatched sub-adults, which have been followed and treated as a separate sample in the study to determine if they behave differently. Twenty five sub-adults are currently monitored.

¹ 50 days < age > 183 days

² 183 days < age > 4.5 years

SURVIVAL RATE

Of the 116 (77 O.N.E., 43 wild hatched and five wild caught) continuously monitored sub-adults, 32 have died since 2000 (34 if counting two which were found dead after having been lost for a while). The causes of mortality were predation (n=12), natural causes/misadventure (n=10) and unknown causes (n=12).

This season two birds from Maungatautari Ecological Island Trust (MEIT) dropped their transmitters, one wild hatched male had its transmitter removed, and three wild-hatched males died from predation and misadventure; one O.N.E female died from misadventure. As with previous seasons, results show the survival rate of sub-adult females is comparatively low at 30.5%. O.N.E female survival rate is the lowest at 22% (95% C.I. 0.012-0.597), and interestingly, there is a higher survival rate amongst wild-hatched females (53.8%). See Table 3. Survival rate was calculated using Kaplan-Meier procedure. Nineteen males have been confirmed as reaching adulthood (4.5 years old or age of first breeding), as opposed to only three females.

TABLE 3: SURVIVAL RATE OF SUB-ADULT WITHIN THE TONGARIRO FOREST

	Survival Rate (%) (SR)	Female SR (%)	Male SR (%)	Sample size in transmitter years*
O.N.E (n=77)	61.6	22	72.6	127
Wild-hatched (n=43)	57.8	53.8	61.8	67
Wild caught (n=5)	N/A	N/A	N/A	9
Overall (n=125)	57.9	30.5	64.7	203

* Cumulated monitoring time from 2001 to 2012

TERRITORIALITY AND AGE AT FIRST BREEDING

We have sufficient information on territoriality for 40 kiwi, and age at first breeding for 21 kiwi (13 O.N.E. and eight wild-hatched). We currently monitor 25 sub-adults and two adults that have not started breeding yet.

Overall we have a sample size of 48 kiwi (29 O.N.E and 19 WH kiwi) that can give us information on age at first breeding, as long as we keep on monitoring the remaining 27 which have yet to breed.

At present, the mean age at first breeding (n=21) is four years old (3.98 years ± 0.47) with a small difference between O.N.E (4.11 ± 0.43) and wild hatched kiwi (3.76 ± 1.04). This is possibly an underestimate for O.N.E kiwi, as there are two which are over 4.5 years old, but have not yet started breeding, if they do the average would markedly increase. Also five kiwi over 4.5 years of age died before they started breeding.

The mean age of territoriality (n=40) is 1.65 ± 0.25 years old, with no difference between wild hatched and O.N.E kiwi, but a slightly higher age for females (1.84 ± 0.26) than males (1.57 ± 0.34). See Appendix 2 for more details.

Ten out of 14 MEIT kiwi (from 1.7 to 3.6 years of age), which were released last season as “O.N.E. kiwi”, are still alive and six seem settled in territories. Ten chicks from this treatment season have survived to sub-adulthood so far, only one chick has not reached sub-adulthood (not over 183 days yet).

DISPERSAL PATTERNS

The study of O.N.E sub-adult movements has shown most kiwi remain within an approximate 5000 ha area, situated in the eastern side of the forest, which is where O.N.E kiwi were initially released between 2002 and 2006 (see map in Appendix 3). Approximately 10% of kiwi have dispersed out of TFKS. The kiwi from this sample that are still alive are now adults and not likely to disperse widely anymore.

Last season, 21 radio-tagged sub-adults (fourteen from MEIT) were released from a new location on the western side of TFKS, (away from the ferret predation area on the eastern side) and have been monitored. Their dispersal patterns, along with dispersal by other sub-adults, have revealed pockets of kiwi on the western side in areas that were previously thought to be unpopulated. For example, between Top Track and Pony Club Track three kiwi appear to have settled, and two have died from misadventure (both fell into the same natural tomo, at different times, and could not get out). The southwest corner of the western side, around and south of Quartz Creek, also seems to support a kiwi population, as it has attracted four sub-adults from the eastern side (two O.N.E. and two wild-hatched) who have settled there (two have nested). Three MEIT females released last season have moved into the area also (one dropped its transmitter), and another wild-hatched male, possibly settled, dropped his transmitter in 2003 (Appendix 3).

One wild-hatched sub-adult dispersed out of TFKS this season. It seems to have settled near the confluence of the Mangatepopo and Wanganui Rivers, which suggests there is possibly a kiwi population there (this is supported by reports from members of the community and OPC staff).

KIWI CHICK MONITORING

Since 2005 Tongariro Forest Kiwi Sanctuary (TFKS) has been carrying out an experiment to assess the effect of large scale pest control operations (aerial 1080) on kiwi chick survival. Kiwi chicks are very vulnerable to stoat predation (McLennan *et. al.* 1996). Two aerial 1080 operations took place in September 2006 and 2011 respectively, and targeted possums, rats, and stoats via secondary poisoning. The 2011/12 breeding season is comparable to 2006/07; the season immediately after the aerial 2006 aerial 1080 operation.

MONITORING METHODS

Due to a ferret predation event reducing the number of radio tagged breeding male kiwi, the majority of eggs this season were lifted from nests, and hatched in captivity, in order to obtain a minimum of 16 kiwi chicks to ensure statistically viable results (eggs hatched in captivity have a higher hatch rate than eggs hatched in the wild). Chicks hatched in captivity were returned to their natal territory, or to one of three preselected release sites, at hatch-weight (approximately two weeks of age).

All chicks, whether hatched in captivity or tagged in the wild, were fitted with radio-transmitters. Signals for each chick were obtained weekly, as the transmitters give a mortality signal once they have not moved for 24 hours.

Any mortality signal was investigated as quickly as possible to increase the likeliness of being able to ascertain cause of death. At the scene, the remains were gathered and examined, notes made and photos taken. The carcass remains were sent to the New Zealand Wildlife Health Centre at Massey University for post-mortem examination (when not able to differentiate between weasels, stoats and ferrets, the family group name “mustelid” has been used - see Appendix 4)

The kiwi chicks were caught on a monthly basis for a health check, to change the transmitter strap (due to growth), and to conduct growth measurements through obtaining weights and bill lengths. In order to compare chick survival over six seasons, survival rates to 183 days were calculated for each season using the Kaplan-Meier procedure (Appendix 5), as recommended by Robertson and Westbrooke (2005), with 95% confidence intervals.

KIWI CHICK OUTCOMES AND SURVIVAL

This season, a total of 25 chicks were monitored within Tongariro Forest Kiwi Sanctuary (TFKS). Of these, 22 were hatched in captivity at The National Kiwi Trust at Kiwi Encounter, and three were intercepted at the nest and radio tagged.

The first chick was released into TFKS on September 30th 2011, and the last chick was released on June 1st 2012. The last three chicks were released or intercepted in May and June. Whilst there was some evidence of possible underlying issues (one had a reasonably high level of coccidial oocysts present, and one may have been unable to manoeuvre out of a gap in a log it had squeezed into), these chicks ultimately died of starvation and emaciation, and possibly exposure. This scenario has not been observed in other seasons (as there have not been any released later than the end of April in the past), apart from in 2001/02, when a chick released in May subsequently died of suspected hypothermia. These events do raise concern that chicks released very late in the season could struggle with wintery conditions, so in future TFKS will avoid releasing kiwi chicks into Tongariro Forest later than April 30th.

To date, one of the 25 chicks from this season is still less than 183 days of age. Ten chicks have reached sub-adult status (>183 days of age), and are no longer part of the kiwi chick survival study (Appendix 4).

Fourteen chicks died this season; four from misadventure (entanglement and possible exposure leading to starvation and emaciation), and three with 'unknown' (unable to be confirmed) cause of death by the NZ Wildlife Health Centre, although two showed evidence of scavenging, one possibly by a pig and one possibly by a harrier hawk or falcon. There were seven predations- the NZ Wildlife Health Centre positively identified six of these as mustelid predation. In one case there was only a leg remaining, so cause of death was unable to be ascertained. However, based on scene evidence (including mustelid scat); this was also classed as a mustelid predation (Figure 3). The first predation event was recorded on the 19th December 2011, and the most recent on the 3rd of May 2012 (Appendix 4).

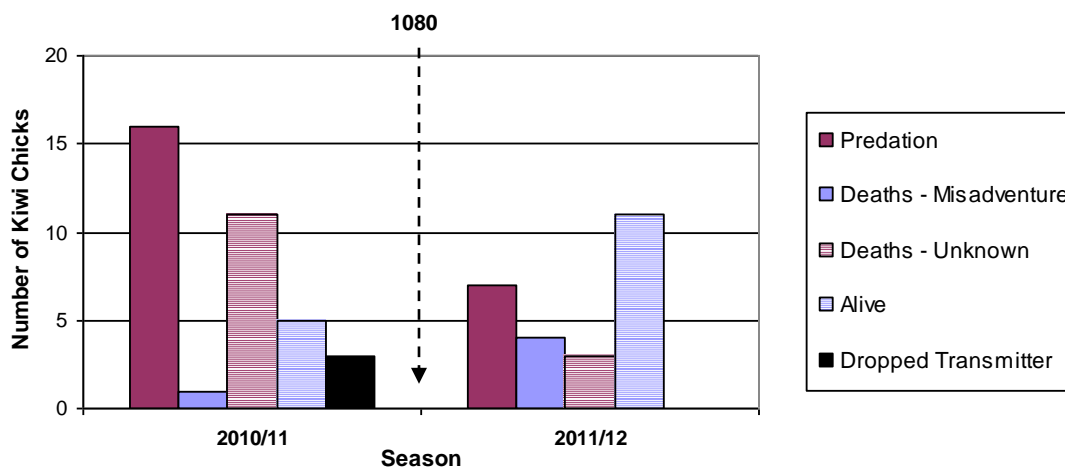


FIGURE 3: TONGARIRO FOREST KIWI SANCTUARY KIWI CHICK OUTCOMES 2011-12

Kiwi chick survival was high for two seasons following the 2006 aerial 1080 operation (Figure 4), but by 2008/09 it had returned to pre 1080 levels. (22%) Prior to the 2011 aerial 1080, the survival rate was 19%; after the 2011 aerial 1080 operation the survival rate increased to 44%.

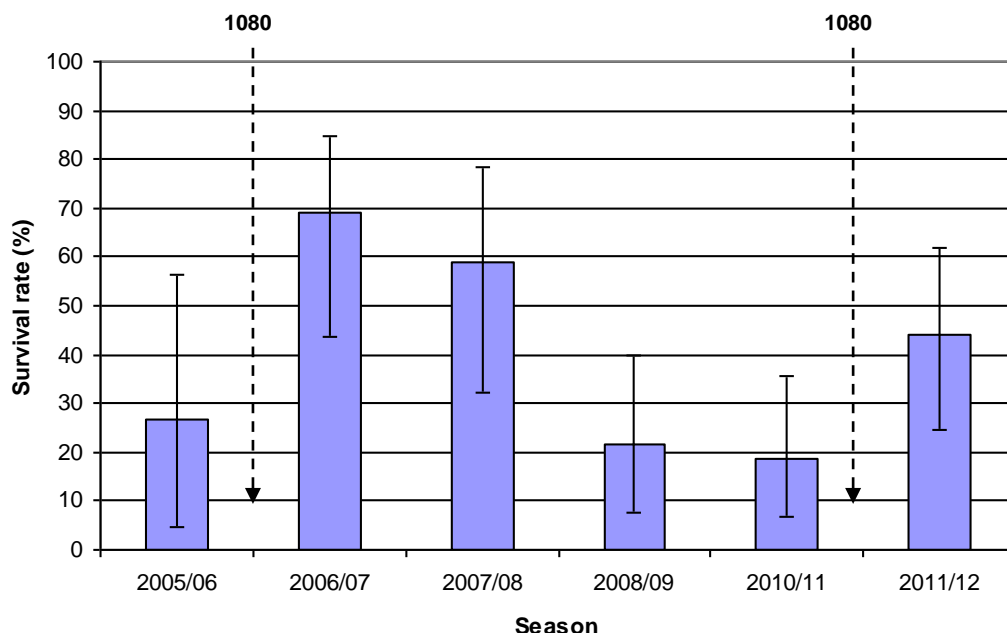


FIGURE 4: KAPLAN-MEIER KIWI CHICK SURVIVAL ESTIMATES FOR THE SIX BREEDING SEASONS, 2005-2012*

*Data from the 2009/10 season is not included as chicks were crèched in Warrenheip, a 16ha predator proof fenced area of bush near Cambridge, Waikato.

FUTURE DIRECTIONS

Another season of chick survival monitoring in Tongariro Forest Kiwi Sanctuary is planned for 2012/13. These results will allow further comparison of kiwi chick survival before and after treatment (pre and post aerial 1080)

SMALL MAMMAL INDEXING (SMI) USING TRACKING TUNNELS

Tracking tunnels for indexing rodent and mustelid (weasel, stoat and ferret) abundance were run on the 'Operation Ark' timing (i.e. January, February, August and November) to catch the peak in stoat abundance. Methodology follows current DOC best practice (Gillies & Williams 2001). There are 15 lines within Tongariro Forest Kiwi Sanctuary (TFKS); each line is 450m long with ten tunnels, giving a total of 150 tunnels. Tracking tunnels have been run in TFKS since 2001.

TRACKING TUNNEL RESULTS AFTER AERIAL 1080 OPERATIONS

In September 2011 TFKS was aerially treated with 1080. The result was a major decrease in both rat and mustelid tracking rates (Figure 5), rats were knocked down to 3.3%; they were tracking at 60% or greater prior to the operation. The mustelid tracking rate peaked at 27% in January 2011, but none were detected in any of the tunnels after the aerial 1080 operation (0% tracking rate). Conversely, the mouse tracking rate, which was low since rats returned to pre 1080 levels in May 2008 (1.5 years after the 2006 aerial 1080 operation), increased rapidly with reduced rat numbers. Similar results were seen following 2001 and 2006 aerial 1080 operations (Figure 5).

However, it appears rats are re-colonising the forest faster (36% in May 2012) than was the case following previous operations (6.4% in May 2007 and 17.2% in May 2002). On the contrary, stoats have not shown any sign of recovery yet (0% in May 2012 as opposed to 9% in May 2007).

The previous operations showed rats returned to high numbers within 1.5 years (following the 2006 operation) to 2.5 years (following the 2001 operation), while the mustelid population recovered more slowly and increased steadily over time. It appeared to take five years after the 2006 operation for stoat abundance to reach a threshold where they have a controlling effect on the rat population (rat tracking rates went from about 80% to about 60%).

It is worth adding TFKS has gathered a huge data set, with 11 years of small mammal indexing data. This supports and increases our knowledge and understanding of small mammal population dynamics in relation to aerial 1080 use.

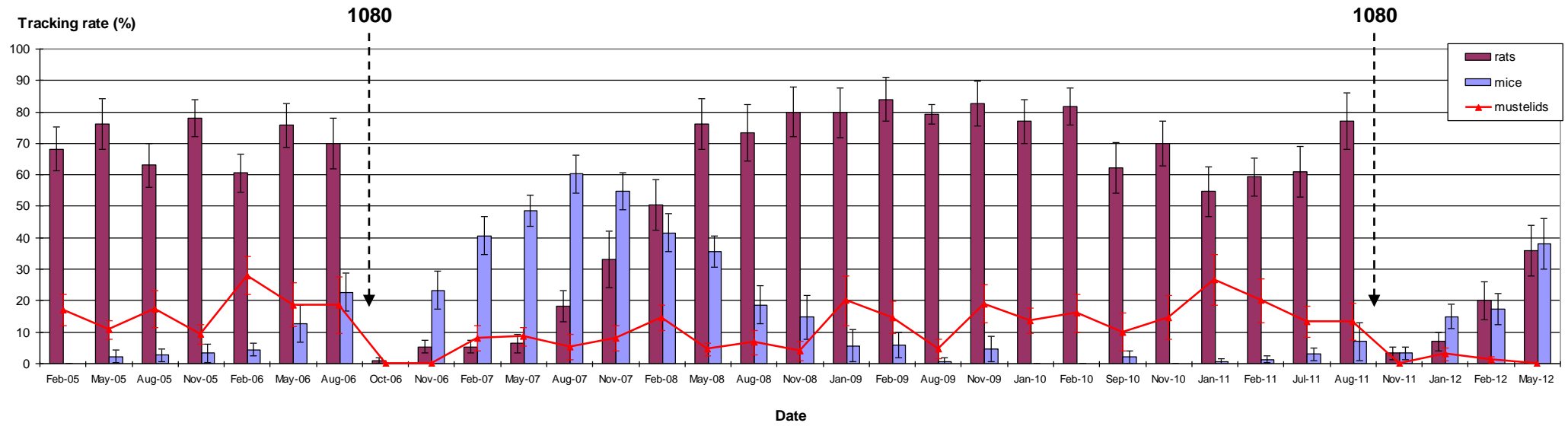


FIGURE 5: SMALL MAMMAL INDEXING RESULTS, TONGARIRO FOREST KIWI SANCTUARY, FEBRUARY 2005 – MAY 2012

FANTAIL NEST MONITORING & FIVE-MINUTE BIRD COUNTS

FANTAIL NEST MONITORING

Fantail nesting success is part of the outcome monitoring following two aerial 1080 operations in Tongariro Forest Kiwi Sanctuary (TFKS). Rats take passerine eggs and nestlings, and are also large enough to kill adults of forest birds (King 1990).

It was hypothesised the aerial 1080 operations in September 2006 and 2011 would benefit fantails and other forest birds preyed upon by rats. The percentage of fantail nests which successfully produced fledglings in the 2011/12 breeding season was 29%. This was calculated using Kaplan-Meier procedure. This was a significant increase from last season (pre-1080) when the nest success rate was 12% (Figure 6).

Nesting success rates more than doubled following the 2006 and 2011 aerial 1080 operations, and the second season following the 2006 aerial 1080 appears to be even more successful than the first (Figure 6).

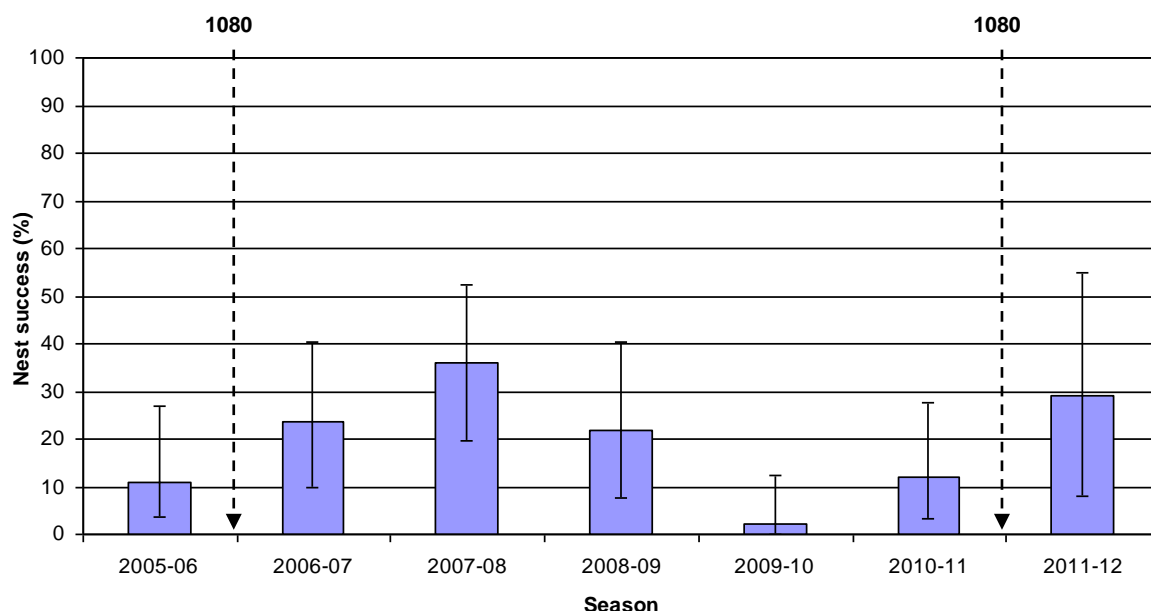


FIGURE 6: TFKS FANTAIL NESTING SUCCESS RATE 2002 – 2012 USING KAPLAN-MEIER

A total of 19 fantail nests were located during the season, but only 14 of them were active and could be used in the results. The first nest was found on 21st September 2011 and the last on 2nd February 2012 (Table 4).

TFKS was monitored in two parts, Tongariro Forest East (East) and Tongariro Forest West (West). As in previous years nests were harder to locate on the Eastern side than the Western side, resulting in a lower sample size on the East (Table 4).

TABLE 4: TFKS WEST AND EAST FANTAIL NEST OUTCOMES FOR 2011-12

	West	East	Total
Abandoned before laying	4	1	5
Abandoned after laying	0	0	0
Nest failures	7	1	8
Successful nests	3	3	6
Total	14	5	19

No signs of predation were detected at any of the fantail nests monitored this season. In previous years, video footage recorded long-tailed cuckoos preying upon fantail nests and these cases were all 'clean takes' (no physical evidence left). This, coupled with the low tracking rates of rats in the SMI monitoring, indicates a number of this season's 'clean takes' were likely to be long-tailed cuckoo predation.

There were also a number of fledglings and juveniles seen around TFKS in areas, or at times, not consistent with any of the nests being monitored. This shows there were successful nests this season that were not located.

A video camera, using an infrared sensor triggered by motion detection, was set up to record the fate of a fantail nest in early December. The nest failed in late December, mid stage chicks were found dead on the ground and in the nest. The ultimate cause of the nest's failure (believed to be a branch falling on the nest) was not captured on the images recorded by the camera.

This season nests of two other species were found while searching for fantail nests. These nests were also monitored to determine their outcome. A tomtit nest was located in December, about two metres from a fantail nest that was active at the time. Both the fantail nest and the tomtit nest were successful. A blackbird nest was found in late January and was also successful.

FIVE-MINUTE BIRD COUNTS

Five-minute bird counts in Tongariro Forest Kiwi Sanctuary (TFKS) began in 2001/02. The methodology used was as per Dawson & Bull (1975). The 51 listening stations, spread over the eastern and western sides of TFKS, are divided into four loops, with listening stations 200m apart. In the past, 100 counts were carried out in September and 200 in February. This season (as with the last two seasons), bird counts were only carried out in February.

The bird counts fluctuate widely between years, and it is difficult to draw concise conclusions from the results (Appendix 5), however some trends can be observed. The most abundant bird species' appear to be tui, bellbird, whitehead, grey warbler, silvereye and tomtit. The abundance of long tail cuckoo's has increased over time, which supports the fantail nest monitoring hypothesis of increased long tailed cuckoo predation on fantail nests.

Following the 2006 aerial 1080 operation, there were two years of increased fantail nest success, but this phenomenon was not observed in the bird count data.

TONGARIRO FOREST KIWI SANCTUARY 2006 AND 2011 AERIAL 1080 OPERATION RESULTS AND OUTCOME MONITORING

Kiwi and fantails benefited for two seasons following the Tongariro Forest September 2006 aerial 1080 operation (Figure 8). Kiwi chick survival and fantail nest success rates increased in the 2006/07 season, and remained high for a second season (2007/08). Between 2008 and 2011 rates dropped back down to pre-1080 levels as mustelid and rat populations recovered. However, following the aerial operation in September 2011, both rates more than doubled.

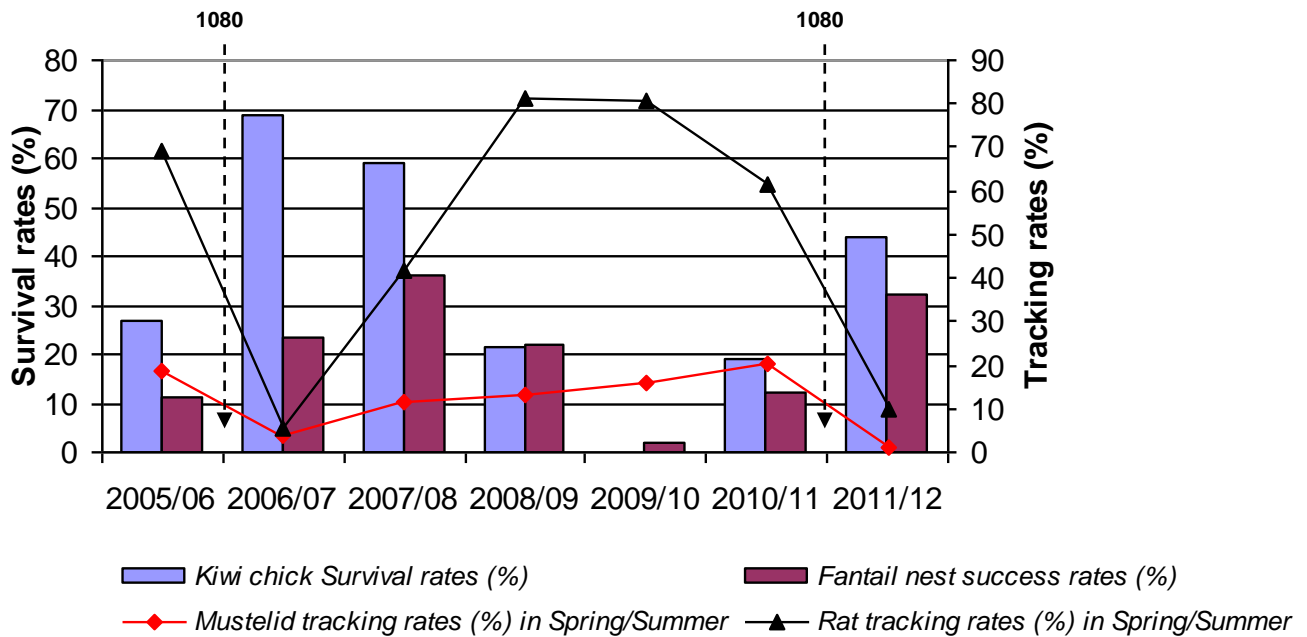


FIGURE 8: SMALL MAMMAL INDEXING TRACKING RATES, WITH KIWI CHICK SURVIVAL AND FANTAIL NEST SUCCESS, BEFORE AND AFTER AERIAL 1080*

*Kiwi chick survival data from the 2009/10 season is not included, as chicks were crèched in Warrenheip, a 16ha predator proof fenced area of bush near Cambridge, Waikato.

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