



Securing Blue Duck in the Central North Island

Technical Report No.4, 2007 - 2008

TONGARIRO / TAUPO AND WANGANUI CONSERVANCIES



Department of Conservation
Te Papa Atawhai

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Blue duck populations in the central North Island	

Summary

- In 2007/08 predator trapping and population monitoring (established in 2004/05) continued in the Manganui o te Ao treatment area.
- Predator trapping was set up for the first time on the Mangatepopo and Whakapapa Rivers. An aerial 1080 operation (affecting the Mangatepopo and Whanganui Rivers) was carried out in September 2007.
- Forty-six pairs of blue duck were resident in the study area during the breeding season. Thirty-one of these pairs are now protected under a predator trapping regime. Pair numbers increased on all rivers except the Manganui o te Ao.
- Adult survival was high for both females and males. In total 13 birds were lost, losses were due to predation and emigration from the study area.
- Productivity was very high on all rivers, the Manganui o te Ao had 2.3 juveniles per breeding pair, the Whakapapa had 1.8 juveniles per breeding pair, the Mangatepopo had 3.1 juveniles per breeding pair, and there were 2.0 juveniles per breeding pair on the Whanganui.
- A successful aerial 1080 operation was carried out in Pukepoto Forest/ Mangatepopo, and this probably contributed to the successful blue duck breeding season on the Whanganui River. Predator trapping (and the 1080 operation on the eastern Mangatepopo) probably contributed to the success on the Mangatepopo and Whakapapa.
- Data from the first year of predator trapping on the Mangatepopo and Whakapapa Rivers, and from five years of trapping on the Manganui o te Ao, show dramatic increases in whoio productivity.
- In 2008/09 existing predator control will be maintained on the Whakapapa River. Predator trapping will commence for the first time on the Whanganui, and existing predator trapping regimes on the Mangatepopo and Manganui o te Ao Rivers will be extended.

Introduction

Blue duck (whio) are regarded by the IUCN as Endangered and in New Zealand as nationally endangered (Molloy et al. 2002). The latter is the second highest category of threat in the country and puts blue duck in a group of species for which conservation action is imperative. The central North Island remains a stronghold of the species and securing key populations in this region will be an important contribution to securing the long-term future of blue duck nationally. Blue duck population declines have been reflected in some parts of the central North Island, although reaches of some rivers retain productive populations. Threats to blue duck include habitat loss, predation, lahars, competition, flooding and disturbance. In response the Tongariro / Taupo and Wanganui conservancies produced a 'Conservation Strategy for Blue Duck in the Central North Island' (Etheridge and Peet 2004).

The goal of this strategy is;

“to maintain, expand existing and establish new self-sustaining blue duck populations on key central North Island river systems”.

This strategy identified 4 objectives to allow the two conservancies to reach the stated goal:

- Secure a minimum population of 40 interrelating pairs in prescribed management sites
- Monitor change in blue duck populations on three key central North Island rivers
- Develop and test translocation tools for population recovery
- Work with iwi and local communities to further blue duck conservation

The project detailed in this report has been established to meet the first of these objectives by addressing control of introduced predators, particularly mustelids, which are a key threat to blue duck.

PROJECT AIMS

The aim of the project is consistent with the strategy and is;

‘to secure a combined minimum population of 40 interrelating pairs of blue duck on key rivers in the western central North island, namely the Whakapapa, upper Whanganui, Mangatepopo and Manganui o te Ao’.

The project will test whether the implementation of predator control regimes will secure self sustaining blue duck populations on these rivers. It will run for 5 years from 2004/05 onwards. On a section of each river blue duck productivity and survival will be monitored with and without predator trapping (Table 1). Trapping will target mustelids but a bycatch of other potential predators of blue duck is expected. Trapping involves

three lines of traps per river over established study areas where birds are banded and monitored. The experimental programme has been designed as follows:

TABLE 1: PROPOSED PREDATOR CONTROL AND MONITORING PROGRAMME FOR CENTRAL NORTH ISLAND RIVERS.

	2004/05	2005/06	2006/07	2007/08	2008/09
Whakapapa	no trapping monitor productivity & survival	no trapping monitor productivity & survival	Aerial 1080 monitor productivity & survival	Trapping monitor productivity & survival	Trapping monitor productivity & survival
Upper Whanganui	no trapping monitor productivity & survival	no trapping monitor productivity & survival	no trapping monitor productivity & survival	Aerial 1080 monitor productivity & survival	Trapping monitor productivity & survival
Mangatepopo	no trapping monitor productivity & survival	no trapping monitor productivity & survival	Aerial 1080 monitor productivity & survival	Aerial 1080 and trapping monitor productivity & survival	Trapping monitor productivity & survival
Manganui o te Ao*	Trapping monitor productivity & survival	Trapping monitor productivity & survival	Trapping monitor productivity & survival	Trapping monitor productivity & survival	Dependent upon review

* Note that data without trapping already exists on the Manganui o te Ao and so a non-trapping period is unnecessary.

A set of performance measures has been established for the project as follows:

Primary measure

1. A combined minimum of 40 territorial pairs are maintained on the Whakapapa, upper Whanganui, Mangatepopo, and Manganui o te Ao rivers.

Secondary measures

1. Predator control results in an increase in the number of territorial pairs where space is available.
2. Predator control results in higher overall survival of territory holding adults.
3. Predator control results in higher annual productivity.

As the density of pairs increases it is possible for survival and productivity to drop as a result of density dependent processes.

Sites

Treatment / proposed treatment areas are defined as those which currently have or will have predator trapping in place. The treatment areas / proposed treatment areas referred to in this report are:

- Manganui o te Ao - a 10 km section of river between Hoihenga Bridge and Ruatiti Domain
- Whakapapa - a 7km stretch of river between the Whakapapa intake and the Otamawairua Stream confluence.
- Upper Whanganui - a 14.5km stretch between the Whanganui intake and 1.5km below the Mangatepopo confluence.
- Mangatepopo - a 6.5km stretch between the Mangatepopo intake and the Whanganui confluence.

These sites are detailed below and in Figure 1.

MANGANUI O TE AO

The Manganui o te Ao flows from the western slopes of Mt Ruapehu and is a major tributary of the Whanganui River. It flows for approximately 80 km and has a total catchment area of about 620km² (Cudby and Strickland 1986). The river has a relatively stable bed dominated by large rounded volcanic boulders. The river is prone to frequent but generally brief floods during which considerable quantities of silt are moved downstream. Some movement of the river bed also occurs but pools and riffles generally remain in similar positions for many years. Water quality is high and water temperatures generally remain moderate even during summer. However, during periods of low flow and warm temperatures extensive periphyton growth occurs on the river bed.

Treatment area

The treatment area, where predator control was in place, ran for 10 km from the Hoihenga Road Bridge downstream to the Ruatiti Domain (Figure 1). Through this section the river descends 90-100m through over 50 pool and riffle systems. The river valley is narrow with the channel flanked by small flats or bluffs usually with a thin margin of mixed native and exotic forest. The major land use is sheep farming. The study area is also used extensively by recreational trout fishers.

Monitored only areas

Some population monitoring was carried out along two reaches of the river outside the trapped area. However neither was as intensively monitored as the treatment area and the data obtained were limited. Monitored area 1 was between the bridge at the end of the Manganui Valley Road and Hoihenga Bridge (Figure 1). This section of river is primarily gorge characterised by steep walls and well vegetated banks and the river descends 6.7km through

43 pool and riffle systems (Williams 1991). Monitored area 2 was between the Ruatiti Domain and Makakahi Road Bridge (Figure 1). This section of approximately 9.6 km is characterised by long deep pools, a shallow gradient and was fringed by open farmland and extensive river flats as well as steep bluffs. Monitored area 3 Makatoke/ Manganui o te Ao “V” this section was walked from below State Highway 1 down the Makatoke and up the Manganui by R. Bristol as a recreational activity in his weekends. It is deeply gorged with deep pools and large boulders.

W H A K A P A P A

The Whakapapa River is formed from the confluence of two headwater tributaries, the Whakapapaiti and Whakapapanui streams, both of which originate on the north to north-western slopes of Mt Ruapehu. The Whakapapa flows north until it meets the Whanganui River at Kakahi.

Treatment area

The section of the Whakapapa detailed below has been subject to intensive population monitoring only in 2004/05 and 2005/06. An aerial 1080 operation was carried out in September 2006. Predator trapping began in 2007/08, and runs from the Whakapapa intake to the confluence of the Otamawairua Stream (Figure 1).

The monitored reach is characterised by steep sides bordering the river with high bluffs dominated by regenerating and mature podocarp-hardwood forest. It has a moderately steep channel gradient. Permanent pools and riffles dominate the instream habitat and the substrate is generally coarse (Don 1995). Most of the monitored reach lies at an altitude of 670m a.s.l. The Whakapapa is a flashy river, rising and falling rapidly in response to rainfall events, and is subject to significant flood events.

The Whakapapa is a flow-regulated waterway. The monitored reach is downstream of an intake structure that is part of the western diversion of the Tongariro Power Development. It takes water from the Whakapapa into the Whakapapa-Tawhitikuri-Whanganui tunnel, diverting it into Lake Te Whaiau. When the Whakapapa intake was commissioned in 1972 the minimum flow requirement below the intake was 0.6 cumecs. That flow remained until September 1992 when the minimum flow was raised from 0.6 to 3 cumecs (Collier & Henderson 2000). The natural mean flow of the Whakapapa (in the monitored reach) is 15.3 cumecs, and the mean flow under the current flow rules is 5.1 cumecs, representing a 67% flow reduction (Genesis 2000).

U P P E R W H A N G A N U I / M A N G A T E P O P O

The Whanganui River drains the western slopes of Mt Tongariro. It flows through a variety of landscapes including tussock grassland, scrubland, indigenous forest, production pine forest and farmland, eventually flowing

into the Tasman Sea at Wanganui. Significant blue duck populations reside on both the upper Whanganui and its tributaries, in particular the Mangatepopo Stream.

Treatment area

The upper Whanganui / Mangatepopo reaches detailed below has been subject to intensive population monitoring only in 2004/05 and 2005/06. An aerial 1080 operation was carried out in September 2006 on the western side of the Mangatepopo Stream. Another aerial 1080 operation was carried out on the eastern side of the Mangatepopo in September 2007. Predator trapping also began on the Mangatepopo during 2007/08, and runs from the Mangatepopo intake to the confluence of the Whanganui River, a distance of 6.5 km (Figure 1). The Whanganui River was not treated with 1080 in 2006, but was treated in September 2007. Thus, trapping is not planned on the Whanganui until 2008/09. The proposed treatment section of the Whanganui River is from the Whanganui intake to 1.5km downstream of the Mangatepopo Stream, a distance of 14.5 km. The study area is at approximately 480 m a.s.l.

The Mangatepopo Stream is highly channellised and is affected by significant flood events. It is relatively small and shallow with an annual flow of 2.07 m³/s (Genesis 2000). It has a fairly steep gradient and high channel stability. It flows through limestone deposits which assists in benthic invertebrate production (Don 1995).

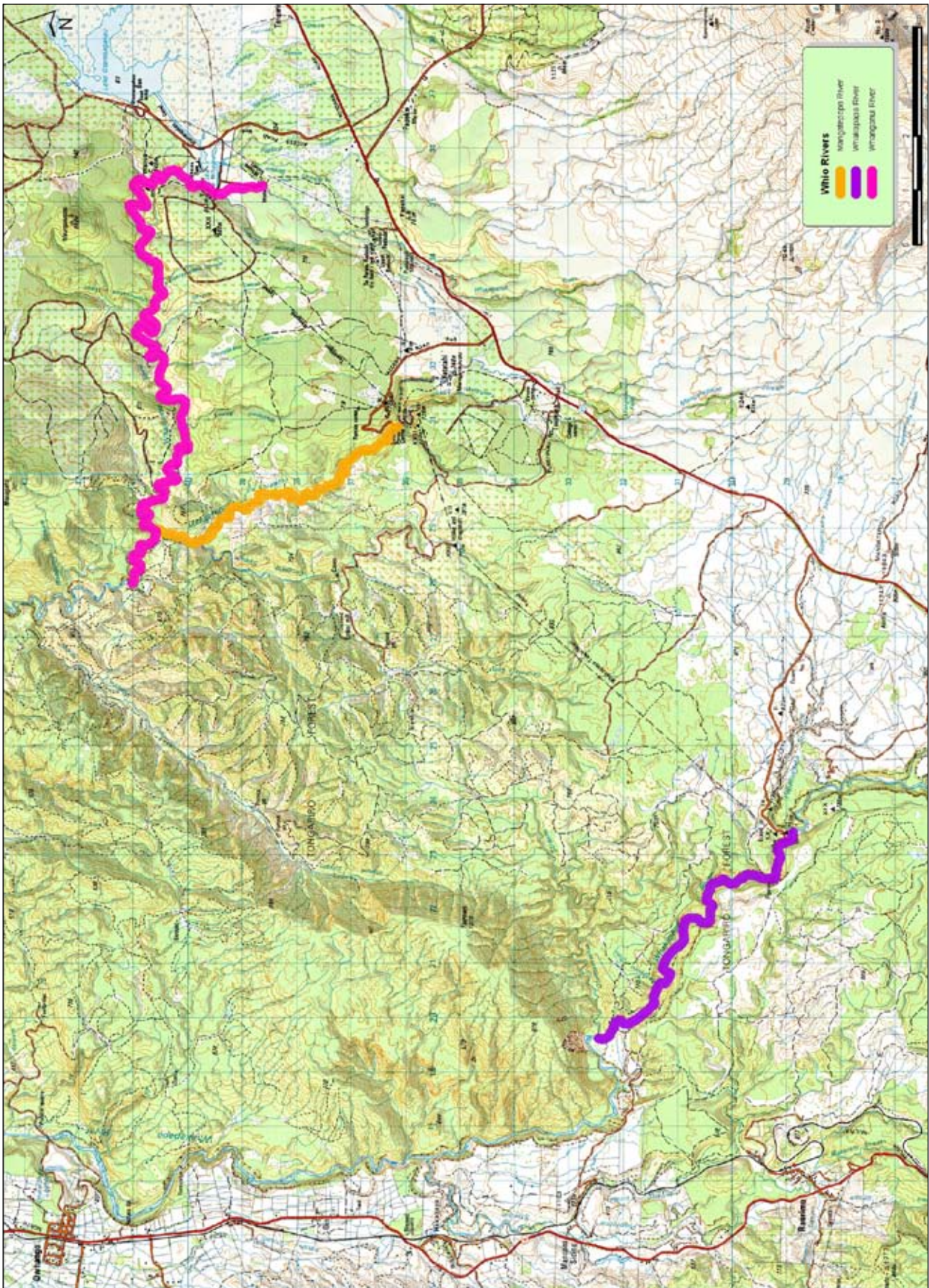
Like the Whakapapa, the flows on the Whanganui and Mangatepopo are diverted as part of the western diversion of the Tongariro Power Development. The western diversion begins on the upper Whakapapa where the Whakapapa intake diverts water into a tunnel. The tunnel travels north with a number of smaller intakes feeding into it including intakes on the Okupata and Mangatepopo streams. The headwaters of the Whanganui River are diverted separately into the Te Whaiiau Stream. The Whanganui intake was commissioned in 1971 and the Mangatepopo intake in 1972 (Don 1995).

In February 1993 a minimum flow requirement on the Whanganui came into effect. This minimum flow rule stated that between December and May the intakes on the western diversion must operate in a way that maintains a 29 cumec minimum flow at Te Maire on the Whanganui. Until December 2004 virtually all of the flow on the upper Mangatepopo was intercepted to the extent that there was no flow downstream of the intake except during freshes (Genesis 2000). From December 2004 new minimum flow requirements of 0.5 cumecs below the Mangatepopo intake and 0.3 cumecs below the Whanganui intake were established.

BLUE DUCK POPULATIONS IN THE CENTRAL NORTH ISLAND

For a detailed breakdown of population monitoring on the four study rivers from 1980 onwards see Appendix 5.

B. WHAKAPAPA TREATMENT AREA, MANGATEPOPO TREATMENT AREA AND UPPER WHANGANUI PROPOSED TREATMENT AREA



Methods

DUCK MONITORING

In all treatment / proposed treatment areas birds were colour and metal banded to allow individuals to be identified. In the Manganui o te Ao treatment area monitoring was carried out 15 days a month from mid-August to 31st January and five consecutive days per month from February to July. The Whakapapa and upper Whanganui were monitored weekly from the 3rd of September 2007 to the 28th of March 2008. During the winter regular monitoring does not occur on the Whakapapa, Mangatepopo and Whanganui, except for opportunistic sightings during trap installation and checks.

Every week of monitoring:

- The location, behaviour and identity of all birds encountered was noted on field maps or dictaphone
- Reaches were walked at different times of day with the aim of encountering every banded adult at least once (Whakapapa / upper Whanganui / Mangatepopo) or twice (Manganui o te Ao) during each monitoring period.
- Where possible nests were located and clutch size counted.
- Nests were visited more intensively at the time of hatching in order to record the number of chicks that made it to the water.
- Clutches were followed and the numbers of juveniles fledged were recorded.

In addition, several surveys of all the rivers outside of the study areas were carried out during the breeding season. On the Manganui o te Ao sections both above the study area (Garerty's Bridge to Hoihenga Bridge) and below the study area (Ruatiti Domain to Thompson's Bridge) were surveyed. On the Whakapapa, the section below the study area (Otamawairua Stream confluence to Owhango) was surveyed, and on the Whanganui the section below the study area was also surveyed (1.5km below the Mangatepopo Stream confluence to Hohotaka Rd Bridge).

PREDATOR CONTROL

Predator trapping Manganui o te Ao

Three approximately parallel lines of traps (Figure 2) were operated through the year in the Manganui o te Ao treatment area. All trap boxes were double set with either Mk6 Fenn traps or DOC 200 traps and baited with hen's eggs. Traps were checked fortnightly from September - February and monthly outside this period. Parts of "B" line were not run during lambing.

Several times during the year cat traps were set along the banks of the Manganui o te Ao River.

Predator trapping Mangatepopo and Whakapapa

This season, predator trapping began on the Mangatepopo and Whakapapa Rivers. Three approximately parallel lines of traps (Figure 3) were set-up on the Whakapapa and operated through the year, protecting a total of 7km of river. Two trap-lines (along the river and on the western side) were set up on the Mangatepopo however the line along the river was not operated for several months following a tragic loss of life in August. The eastern side was not installed this year because of the 1080 operation, but will be in 2008/09. On the Mangatepopo, 6.5km of river is now protected under the trapping regime.

All trap boxes were single-set with DOC 200 traps and baited with hen's eggs. Traps were checked fortnightly from September - February and monthly outside this period. Trap boxes on the river lines will be double-set during 2008/09 (two traps in each box).

Aerial 1080 Operation Tongariro Forest and Pukepoto/Mangatepopo

There have been two aerial 1080 operations over 2006 and 2007, which cover most of the Ruapehu Whio study area.

In September 2006, an aerial 1080 operation was carried out throughout Tongariro Forest, with the area on one side of the Mangatepopo Stream and both sides of the Whakapapa River being treated as part of the operation. See Technical Report # 3 for details of this operation.

In September 2007, an aerial 1080 operation was carried out throughout Pukepoto/Mangatepopo. This covered the east of the Mangatepopo Stream, stretching up northwards to the southern side of the Whanganui River (Figure 4). Details of the operation are: 2kg/ha of 12g prefeed (non-toxic cereal baits) were aurally broadcast throughout the operational area. Toxic (1080 at 0.15% w/w) 12g cereal baits at 3kg/ha were applied on 27th September 2007.

FIGURE 2: MAP OF STOAT LINES IN THE MANGANUI O TE AO TREATMENT AREA

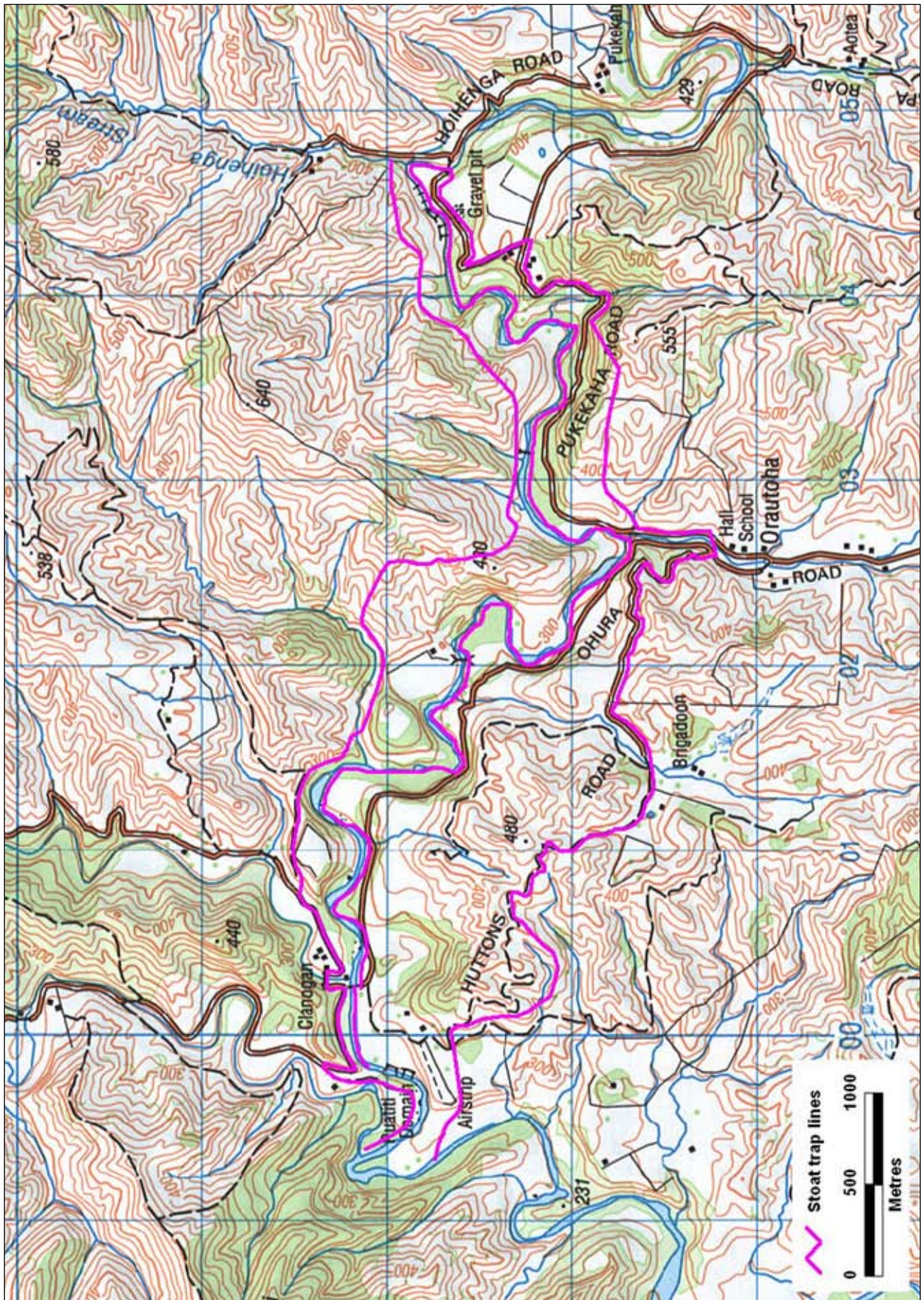


FIGURE 3: MAP OF STOAT LINES IN THE WHAKAPAPA AND MANGATEPOPO TREATMENT AREAS

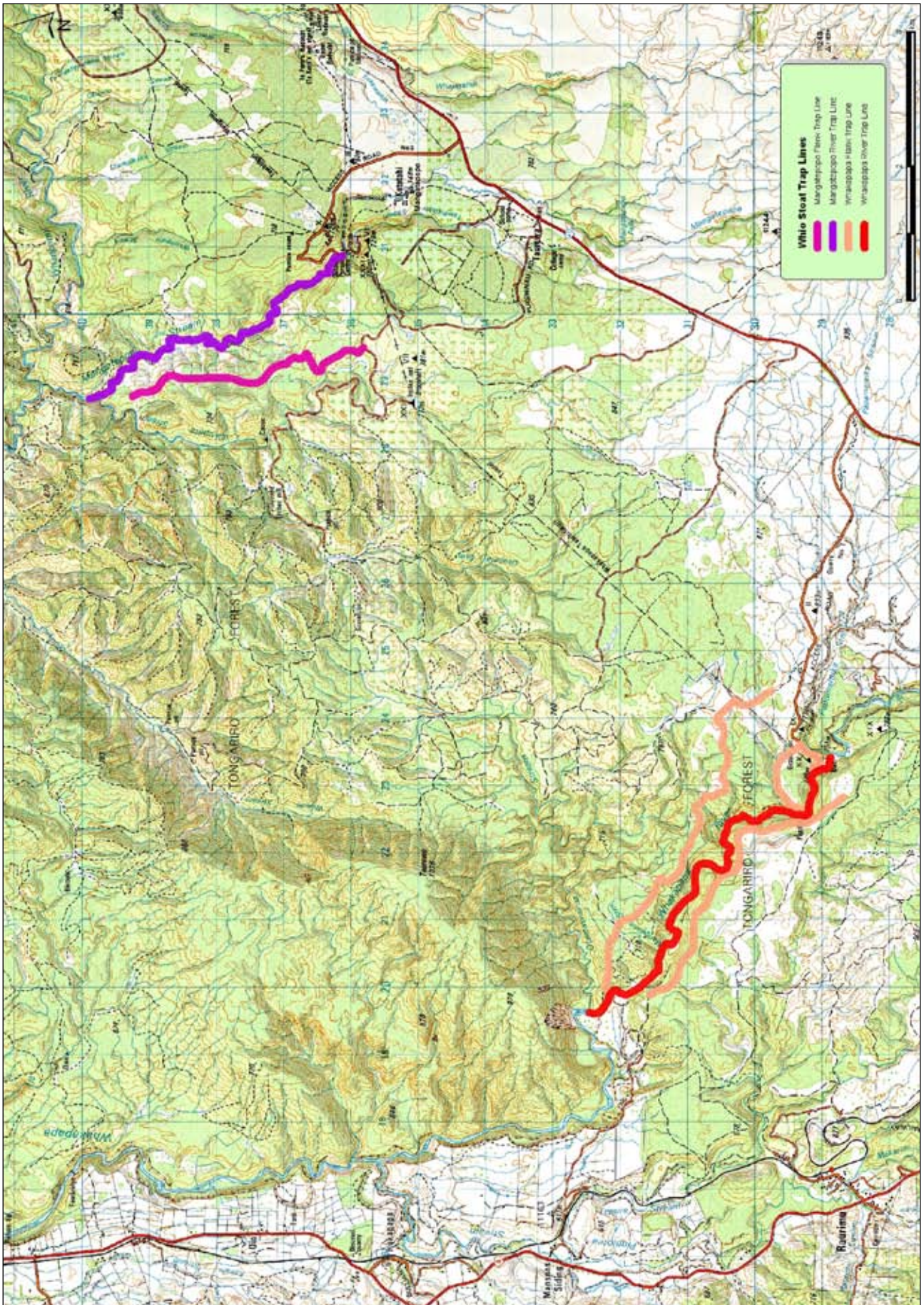
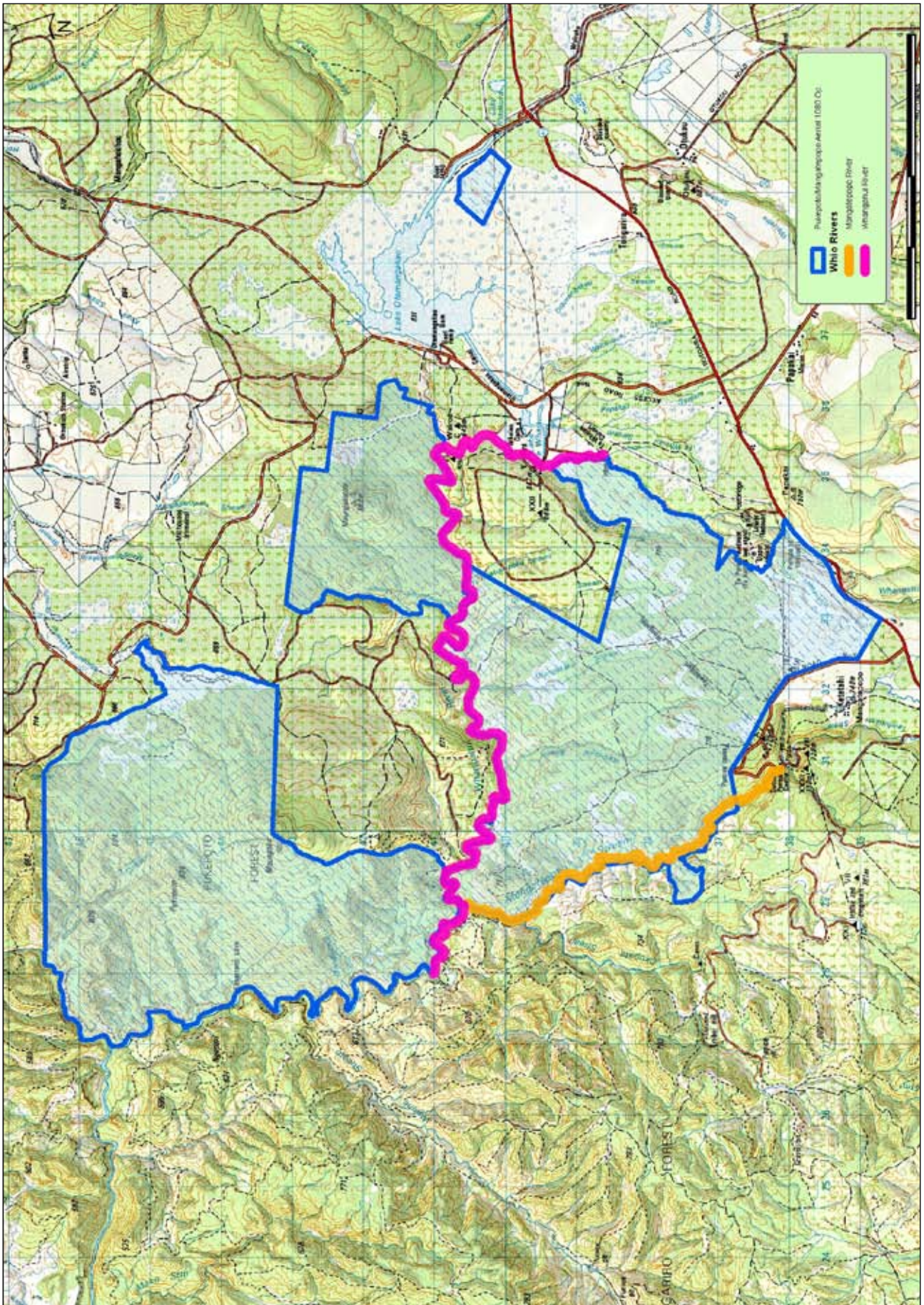


FIGURE 4: SEPTEMBER 2007 1080 OPERATIONAL BOUNDARIES.



Results

NUMBER OF PAIRS

During 2007/08 there were a total of 46 territorial pairs present within the treatment / proposed treatment areas, with 31 of these protected within a predator control trapping regime (Table 2).

On the Whakapapa in 2007/08, pair numbers increased up to 6. This is a big improvement, given that between 2004-2006 pair numbers on this river declined from 10 down to only 2 pairs.

Pair numbers also increased on the Mangatepopo from 10 to 11 pairs, and on the Whanganui from 13 to 15 pairs, during 2007/08. Pair numbers have increased on these two rivers every year since the project began.

On the Manganui-a-te-ao the number of resident pairs declined from 19 to 14 pairs.

TERRITORY DENSITY

Territory densities on the rivers ranged from 0.9- 1.7 pairs km⁻¹ with the highest density on the Mangatepopo, and the lowest density on the Whakapapa.

Pair densities increased on all rivers from the previous season, except on the Manganui o te Ao (Table 2).

Manganui o te Ao

In August 2007, early in the season, 28 individuals (14 pairs) were present in the study area, this was a drop from 17 pairs on 30th June 2007 at the very start of the 2007/08. Those 14 pairs were constant residents in the study area throughout the breeding season.

Nine pairs occupied approximately the same territories as the previous year and those pairs were relatively constant throughout the 2007/08 season. Four changes occurred due to females being predated or missing. One pair completely disappeared after a failed nest (Road Is pair). By August this pair had been replaced as had the other 3 missing presumed predated females. Pairs holding territory have stayed at 14. In contrast to last season, no pair changes took place, just replacement of lost females.

Details of each pairing, nesting attempts and territory occupied are in Appendices 1 and 2. The distribution of territories in the Manganui o te Ao treatment area is detailed in Figure 5.

FIGURE 5: BLUE DUCK TERRITORIES IN THE MANGANUI O TE AO



Whakapapa / Upper Whanganui / Mangatepopo

Pair numbers on the Whakapapa increased from two pairs at the end of the 05/06 season, to four during 06/07, and up to six pairs during 07/08. One of the new pairings was between a one-year old female from the Whakapapa and an unknown male, whilst the other new pairing was between an unknown female and a single Whakapapa male (his previous mate had got predated by a stoat in 2005).

Mangatepopo pair numbers have steadily increased each year of the study, up to 11 pairs during 07/08. Of the pairs present in the previous season, one pair disappeared completely, whilst two new pairs came into the study area (one was a new unknown pair, and the other new pairing was between a female hatched on the Mangatepopo in 04/05 and an unknown male). Amongst existing territory holders there were a high number of changes in pairings and territories- of the 11 pairs, only four had the same partners and territories as the previous year. In the case of 4 pairs, the female stayed in the same territory, but had a new male partner. In the case of one pair, the male kept the same territory, but had a new female partner.

Pairs on the Whanganui increased by two. Like on the Mangatepopo, there were also a lot of changes in pairings on the Whanganui. Three pairs disappeared completely, and there were five completely new pairings. Seven pairings and territories stayed the same. In two occasions, the female retained the same territory, but had a new male partner, and in one case the male retained the same territory but had a new female partner.

TABLE 2: THE NUMBER OF TERRITORIAL PAIRS DURING THE BREEDING SEASON AND TERRITORY DENSITY IN TREATMENT / PROPOSED TREATMENT AREAS OF FOUR CENTRAL NORTH ISLAND RIVERS IN 2005/06, 2006/07 & 2007/08.

TREATMENT AREA / PROPOSED TREATMENT	TERRITORIAL PAIRS 2005/06 <i>N</i>	TERRITORIAL PAIRS 2006/07	TERRITORIAL PAIRS 2007/08	PAIR DENSITY 2005/06 <i>KM²</i>	PAIR DENSITY 2006/07 <i>KM²</i>	PAIR DENSITY 2007/08 <i>KM²</i>	MEAN PAIR DENSITY PER <i>KM²</i>
Manganui o te Ao (10km)	14	19	14	1.4	1.9	1.4	1.5
Whakapapa (7km)	2	4	6	0.3	0.6	0.9	0.8
Upper Whanganui (14.5km)	12	13	15	0.8	0.9	1.0	0.9
Mangatepopo (6.5km)	8	10	11	1.2	1.5	1.7	1.5
Total	36	46	46	0.9	1.2	1.2	1.1

ADULT SURVIVAL

Birds were considered not to have survived once a bird was no longer present in the study area as a result of death or not having been seen for 2 months. Losses included birds that emigrated from the treatment / proposed treatment areas.

Adult survival was relatively high on all rivers, with female and male survival being equally high. Across all rivers, a total of 13 birds were lost (both because of predation and emigration from the study area) (Table 3). Survival rates for females were higher this year than the previous year. Male survival rates were similar between last season and this season (See Technical Reports No. 1-3 for details).

Manganui o te Ao

In August 2007, at the start of the 2007/08 season, 28 individuals (14 pairs) were recorded in the study area. Two nests failed with the loss of two females through the breeding period. One female was presumed predated after hatching her brood with the male raising the sole chick. Other than replacement of a predated females and one new pair, adult pairs remained constant and loyal to pair bonds.

Of 14 resident males in the treatment area all but one kept residence throughout the year. One male presumably left the area sometime after losing his mate. He was sighted regularly in various locations and is not counted as predated. No other males were predated over the season and the loss of 3 females may be a combination of predators - stoats, cats and avian.

Of 14 paired females in the treatment area, 11 kept residence throughout the year. Two females were predated on the nest, 1 breeding female went missing presumed predated soon after her chicks hatched.

Whakapapa / Upper Whanganui / Mangatepopo

On the Whakapapa, all of the six resident males and females survived the season. This contrasts with previous seasons when survival was low on the Whakapapa (Technical Report No. 1, 2004/05 & No. 2, 2005/06).

Survival was also high on the Mangatepopo, the only losses were one male and one female who emigrated from the study area.

On the Whanganui, 12 of the 15 resident males survived the season, with all three disappearing for unknown reasons. Of the 15 resident females, 3 disappeared over the winter for unknown reasons.

TABLE 3. ANNUAL SURVIVAL OF TERRITORIAL MALES AND FEMALES IN TREATMENT / PROPOSED TREATMENT AREAS OF FOUR CENTRAL NORTH ISLAND RIVERS, 2007/08. FOR MALE AND FEMALE SURVIVAL IN PREVIOUS YEARS SEE TECHNICAL REPORTS NO. 1-3.

	MALES ALIVE 1 AUG 2007 <i>N</i>	MALES ALIVE 31 JULY 2008 <i>N</i>	% TERRITORIAL MALES SURVIVING	FEMALES ALIVE 1 AUG 2007	FEMALES ALIVE 31 JULY 2008	% TERRITORIAL FEMALES SURVIVING	% TERRITORIAL ADULTS SURVIVING
Manganui o te Ao	14	14	100%	14	11	78.6%	96.4%
Whakapapa	6	6	100%	6	6	100%	100%
Mangatepopo	11	10	90.9%	11	10	90.9%	90.9%
Upper Whanganui	15	12	80.0%	15	12	80.0%	80.0%
Total	46	42	89.1%	46	39	84.8%	86.9%

PRODUCTIVITY

Out of the 46 territorial pairs in the treatment / proposed treatment areas, 40 made breeding attempts of which 29 pairs fledged 94 juveniles at a mean of 2.4 fledglings per breeding pair. This is markedly higher productivity than in any previous year (previous best year was 1.6 fledglings per breeding pair in 2004/05).

Productivity was high on all rivers (Table 4). The Mangatepopo had the highest productivity, with 3.1 fledglings per breeding pair. The Manganui o te Ao had 2.3 fledglings per breeding pair, and the Whanganui and Whakapapa were similar (2.0 and 1.8 fledglings respectively). This high productivity is in contrast to the previous year when most of the rivers only had on average approximately one fledgling per breeding pair.

Unlike last season, when half of all nest failures were attributed to floods, this season there were no nest losses to floods. Instead, 5 nests were lost to predation and 5 to unknown reasons. Nesting success was highest this year out of any year, with 79% of all nests being successful. This compares with 63% in 06/07 and just 47% in 05/06 (Table 5). In 2005/06, the Manganui o te Ao had a higher percentage of successful nests than the other rivers, as it was the only river with predator control at that time. With the implementation of predator control on the other rivers, nesting success has increased markedly (Table 6).

Once chicks reached the river, survival was relatively high when compared with last year. Last year only 48% of chicks fledged, whilst this season 72% of chicks fledged. A huge number of chicks were produced (130), with 94 of these fledging. Average brood sizes were similar on all rivers, ranging from between averages of 3.5- 4.1 chicks

The majority of chicks were lost in Class I. Chick losses were largely to unknown reasons, though some losses were to floods and also to human disturbance.

Manganui o te Ao

Twelve of the 14 pairs resident in the Manganui o te Ao treatment area made 14 breeding attempts (includes 2 re-nests - both were successful), 11 of which resulted in broods of ducklings reaching the river (Table 4). One pair managed to produce two broods. Two pairs made no breeding attempt, one probably lacked adequate territory and the other was a late pairing and may have also lacked adequate territory. Nests and broods failed for several reasons (Table 6) including predation, freshes and human disturbance.

Brood sizes on first being seen on the river were 1 (n=1), 2 (n=2), 3 (n=0) 4 (n= 5) 5 (n=0), 6 (n=2) and 7 (n=1). The average brood size was 3.6 chicks. Five broods had 100% chick survival to fledging and 3 broods only lost one chick. The major losses occurred as a result of a flood event just as two broods hatched with the loss of 11 chicks from two broods. Human disturbance over the holiday period breaking up the brood accounted for the loss of the other 3 chicks at Ruatiti Domain. Without the ill timed flood event chick success could have been as high as 86%. The final chick survival was 61%, still a very good result.

Whakapapa/Upper Whanganui/Mangatepopo

All of the six pairs on the Whakapapa made nesting attempts, with one pair making two attempts. From the seven nests, three failed, one to suspected rat predation and the other two to unknown reasons. Four broods were produced, totalling 15 chicks (Table 4), of which 11 survived to fledging (four chicks disappeared- one during a flood and 3 to unknown reasons). The 3 to unknown reasons were older chicks (Class III), and the entire brood disappeared at the same time. There is a resident falcon pair in this territory, although clearly it cannot be proved whether they preyed on these chicks. In the past two seasons the presence of avian predators have increased on the Whakapapa, including falcons, harriers, gulls and shags. Brood sizes on first being seen on the river were 5 (n=1), 4 (n=1) and 3 (n=2). The average brood size was 3.8 chicks. Productivity has been markedly higher on the Whakapapa in the past two seasons (0 and 6 chicks in the first two seasons to 16 and 15 chicks in the past two seasons).

All of the 11 pairs on the Mangatepopo successfully hatched chicks- there were no nest failures. A total of 38 chicks hatched, of which 34 fledged (3 lost to unknown reasons and one drowned in net). Brood sizes on first being seen on the river were 6 (n=1), 5 (n=3), 4 (n=2), 3 (n=1), 2 (n=2) and 1 (n=2). The average brood size was 3.5. This was a record season for the Mangatepopo in terms of nesting success, chicks hatching and chicks fledging. The previous best year was in 2004/05 when 15 chicks fledged, so the 2007/08 season has achieved double that, with 34 chicks fledging.

Of the 15 pairs on the upper Whanganui 11 pairs made nesting attempts, with 8 of those successfully hatching chicks. Three nests failed, all for unknown reasons. A total of 33 chicks hatched. Of the 33 chicks, 22

fledged (Table 4) with all lost to unknown reasons, except one that was found predated by a stoat. Brood sizes on first being seen on the river 7 (n=1), 5 (n=2), 4 (n=3), 3 (n=1) and 1 (n=1). The average brood size was 4.1 chicks. This was the most successful season yet for the Whanganui in terms of number of nests, chicks hatching and chicks fledging. The previous best year for wild-hatched chicks was in 2004/05 when 5 chicks fledged, so the 2007/08 season has achieved quadruple that number, with 22 chicks fledging. However, the Whanganui had the lowest chick survival of the 3 Ruapehu rivers (67%, compared with 89% on the Mangatepopo and 73% on the Whakapapa) (Table 7).

TABLE 4 SUMMARY OF BREEDING ATTEMPTS BY BLUE DUCK IN THE TREATMENT / PROPOSED TREATMENT AREAS OF FOUR CENTRAL NORTH ISLAND RIVERS, 2007/08.

	RESIDENT PAIRS <i>N</i>	PAIRS BREEDING <i>N</i>	PAIRS FLEDGING YOUNG <i>N</i>	TOTAL FLEDGED <i>N</i>	FLEDGLINGS PER BREEDING PAIR 2006/07	FLEDGLINGS PER BREEDING PAIR 2007/08	MEAN FLEDGLINGS PER BREEDING PAIR
Manganui o te Ao	14	12	10	27	1.2	2.3	2.0
Whakapapa	6	6	3	11	4.7	1.8	2.3
Mangatepopo	11	11	10	34	1.0	3.1	1.8
Upper Whanganui	15	11	6	22	0.6	2.0	1.0
Total	46	40	29	94	1.4	2.4	1.8

TABLE 5: PERCENTAGE OF SUCCESSFUL NESTS ON FOUR CENTRAL NORTH ISLAND RIVERS, 2005/06 & 2006/07. FOR DETAILS ON THE CAUSES OF NEST FAILURE IN THESE YEARS SEE TECHNICAL REPORT NO. 3

	SUCCESSFUL <i>N</i> (%) 2005/06	SUCCESSFUL NESTS (%) 2006/07
Manganui o te Ao	9 (60%)	12 (57%)
Whakapapa	1 (50%)	3 (100%)
Mangatepopo	4 (44%)	6 (75%)
Upper Whanganui	2 (25%)	3 (50%)
Total	16 (47%)	24 (63%)

TABLE 6: FATE OF BLUE DUCK NESTS IN THE STUDY AREAS OF FOUR CENTRAL NORTH ISLAND RIVERS, 2007/08.

	FRESH <i>N</i>	PREDATION <i>N</i>	UNKNOWN <i>N</i>	SUCCESSFUL <i>N</i> (%)	TOTAL <i>N</i>
Manganui o te Ao	0	3	0	11 (78.5%)	14
Whakapapa	0	1	2	4 (57%)	7
Mangatepopo	0	0	0	11 (100%)	11
Upper Whanganui	0	0	3	8 (73%)	11
Total(%)	0	4	5	34 (79%)	43

TABLE 7: SURVIVAL OF DUCKLINGS THROUGH AGE CLASSES IN THE TREATMENT / PROPOSED TREATMENT AREAS OF FOUR CENTRAL NORTH ISLAND RIVERS 2007/08. FOR SURVIVAL OF CHICKS IN 2004/05, 2005/06 & 2006/07 SEE TECHNICAL REPORTS NO. 1, 2 & 3.

	SURVIVAL THROUGH CLASS I	SURVIVAL THROUGH CLASS II	SURVIVAL THROUGH CLASS III	SURVIVAL THROUGH CLASS IV	TOTAL
Manganui o te Ao	27 of 44 (61.4%)	27 of 27 (100%)	27 of 27 (100%)	27 of 27 (100%)	27 of 44 (61.4%)
Whakapapa	14 of 15 (93.3%)	14 of 14 (100%)	11 of 14 (78.6%)	11 of 11 (100%)	11 of 15 (73.3%)
Mangatepopo	37 of 38 (97.4%)	36 of 37 (97.3%)	35 of 36 (97.2%)	34 of 35 (97.1%)	34 of 38 (89.5%)
Upper Whanganui	29 of 33 (87.9%)	25 of 29 (86.2%)	23 of 25 (92.0%)	22 of 23 (95.7%)	22 of 33 (66.7%)
Total	107 of 130 (82.3%)	102 of 107 (95.3%)	96 of 102 (94.1%)	94 of 96 (97.9%)	94 of 130 (72.3%)

DISPERSAL

Manganui o te Ao

A number of sightings of banded birds were made outside the study area. Dispersal was upstream, downstream and on tributaries of the Manganui o te Ao, e.g. the Ruatiti Stream. All birds were within a 15km radius from their natal territories (straight line distance). As in previous years, study area pairs used the Orautoha stream especially during high water up to approximately 1km from their usual territory. Two banded individuals were located on the lower reaches of Manganui o te Ao outside of the study area.

Banded birds were seen but not identified on the middle reaches of the Whanganui River.

As in previous years, some juveniles from previous years settled back in the treatment area as part of territorial pairs including 1 year old females which bred with mixed success. Traditionally the younger breeding females have smaller clutch sizes and less nesting success. (see table 8 Securing Blue Duck in the Central North Island Technical Report No. 3 2006-07)

Whakapapa/Upper Whanganui/Mangatepopo

Various juveniles from the previous season's cohort (06/07) were sighted (but not identified) throughout the season. In 06/07 and 07/08, juveniles were banded with a metal band and just a single colour band, rather than full colours, as juveniles disperse too widely to maintain regular band checks on. Some juveniles from the 07/08 season were re-caught later in the season (March), the maximum dispersal distance in a couple of months was 7km.

A juvenile banded in the Whanganui catchment this season was sighted on the Tongariro River in July 2008 (an approximate distance of 30km).

This is the first time a bird has been confirmed dispersing between the Whanganui and Tongariro catchments, and is a big distance for such a young bird.

Eight juveniles from the 2004/05, 2005/06 & 2006/07 cohorts have paired up and established breeding pair bonds within the study area (Table 8), all are female. Seven of these birds bred during 2007/08, producing 15 fledglings. These juveniles have dispersed a range of distances from their natal territories (100m- 15km). Most of the juveniles who have paired up originated from the Mangatepopo, and established either on the Mangatepopo or the lower Whanganui (below the Mangatepopo confluence).

Over the last four years a low percentage of banded juveniles have been seen again, supporting the widely suspected notion that juvenile blue duck mortality is high.

TABLE 8: JUVENILES FROM THE 2004/05, 05/06 & 06/07 COHORTS WHO HAVE ESTABLISHED BREEDING PAIR BONDS WITHIN THE PROPOSED TREATMENT AREA, AND THEIR NESTING SUCCESS.

DATE BANDED AS JUVENILE ON	RIVER ORIGINATED ON	RIVER SETTLED	DIRECTION DISPERSED	SEX	APPROX. METRES FROM NATAL AREA	NESTING OBSERVATIONS 07/08
12/04	Mangatepopo	Mangatepopo	Downstream	Female	4000	Hatched 3, fledged 3
01/05	Whanganui	Whanganui	Upstream	Female	100	Hatched 1, fledged 1
01/05	Mangatepopo	Whanganui	Downstream	Female	350	Nest failed, unknown reason
01/05	Mangatepopo	Whanganui	Downstream	Female	1600	Hatched 7, fledged 7
01/05	Mangatepopo	Mangatepopo	Downstream	Female	1000	Hatched 1, fledged 1
12/05	Whanganui	Whanganui	Downstream	Female	200	Hatched 3, fledged 3
12/06	Whakapapa	Whakapapa	Upstream	Female	1500	Nest failed, unknown reason
04/07	Whakapapa*	Whanganui	Across- Upstream	Female	15,000	No nesting attempt

* This bird was a WHIONE (Whio Operation Nest Egg) bird taken as an egg from a nest on the Whanganui, then released as a juvenile on the Whakapapa River, then she flew back to the Whanganui a few months later.

MONITORING OUTSIDE OF TREATMENT / PROPOSED TREATMENT AREAS

Manganui o te Ao

A total of 10 pairs were counted outside the treatment area.

Between Manganui Valley Road (Garety's Bridge) and Hoihenga Bridge, 7 pairs made a minimum of 6 breeding attempts and fledged a maximum of 25 juveniles at a minimum of 3.6 fledglings per breeding pair. This is a very good result. It should be noted that several feral cats were removed from the lower part of this survey area.

Downstream between the Ruatiti Domain and Thompson's Bridge, 3 plus pairs made 3 breeding attempts and fledged a possible number of 5 juveniles. Three single adults were also sighted. With limited surveys these figures are indicative only.

The usual survey in the section of the Manganui o te Ao and Makatote rivers approximately 15 kms upstream of the treatment area was curtailed this year due to unpredictable weather during the proposed survey times. At least a further 3 pairs are resident on the Ruatiti Stream, a tributary of the Manganui o te Ao.

Including the treatment area and the surveyed tributaries (Makatote and Ruatiti) 39-41 pairs were recorded with at least a further 10 single birds.

For further details see appendices 3 & 4.

Whakapapa / Upper Whanganui / Mangatepopo

Whakapapa River- Otamawairua Stream confluence to Owhangō

This river stretch is surveyed twice annually in December by Enviro Research Ltd as monitoring as part of the resource consent requirements for Genesis Energy. The reach is downstream of the proposed treatment area. For the past three seasons just one single bird has been found on this reach, compared with 4 pairs in 2004/05.

Whanganui- Mangatepopo Stream confluence to Hohotaka

This reach is also monitored twice annually by Enviro Research for Genesis Energy. Outside of the study area starting from 1.5km below the Mangatepopo confluence to the Hohotaka Rd bridge (20.5km) there were 24 pairs, 28 single adults and 46 unfledged chicks from 16 broods (Enviro Research unpubl data). In the past two seasons, productivity has increased hugely on this reach (Table 9). The Tongariro Forest and Pukepoto/Mangatepopo aerial 1080 operations have covered large parts of this reach over the past two season.

TABLE 9: SURVEY RESULTS FROM 2004- 2008 ON THE WHANGANUI RIVER DOWNSTREAM OF THE PROPOSED TREATMENT AREA (1.5KM DOWNSTREAM OF THE MANGATEPOPO STREAM CONFLUENCE TO THE HOHOTAKA RD BRIDGE).

SEASON	PAIRS N	SINGLE ADULTS N	UNFLEDGED CHICKS N	BROODS N
2004/05	14	8	20	6
2005/06	15	10	13	5
2006/07	21	5	67	17
2007/08	24*	28**	46	16

*Five additional pairs identified during April 2008.

**25 additional singles seen during April 2008.

PREDATOR CONTROL

Predator trapping Manganui o te Ao

The trapping programme ran successfully in the Manganui o te Ao over 2007/08. In 2006/07 trap boxes were shifted off stock routes and this year stock disturbance was greatly reduced. This may have influenced the increase in hedgehog numbers. This years drought is considered to have an effect on the increase in rats caught. Stoat numbers remained fairly static around 60, very similar to other years. There is also an increase in traps sprung but that may be due to data input or the other traps being sprung when caught in the double sets. A total of 1080 predators were killed over the season.

Table 10 illustrates the total number of animals trapped during 2007/08.

Table 10 illustrates the total number of animals trapped during 2007/08.

TABLE 10: TOTAL CATCHES FOR THE YEAR 2007/08. OTHER INCLUDES BOXES STOLEN, STOCK AND ROAD WORKS INTERFERENCE, DELIBERATE ACTIVATIONS AND INTERFERENCES.

Stoats	56	Trap sprung	418	Cat	13
Rats	386	Hedgehog	171	Rabbit	29
Mice	0	Weasel	6	Other	11

These data are similar to previous years; Trapping and duck data over the five year programme will be summarised in a forthcoming report. The trends from this and previous seasons indicate successful of who survival of both adults and young. These data strongly indicate that this trap line recipe is effective in removing enough predators to enhance blue duck populations.

In addition to the trap line, separate cats traps were set in groups when sightings suggested cats had been dropped or strays were on the increase. Several landowners also had cat and stoat traps around their dwellings. Approximately 12 cats were caught over the season any several more by other individual landowners.

There was an increase in the number of stoats trapped in January which coincided with the time when juvenile stoats disperse and rabbit numbers peak (Figure 6). There was little difference in the number of stoats or cats on the different trap-lines (line A along river and lines B and C through farmland, but more analysis is required to understand individual trap patterns (Figure 7).

FIGURE 6: TRAP CATCH DATA FOR STOATS, RATA, HEDGEHOGS AND CATS IN THE MANGANUI O TE AO TREATMENT AREA 2007/08.

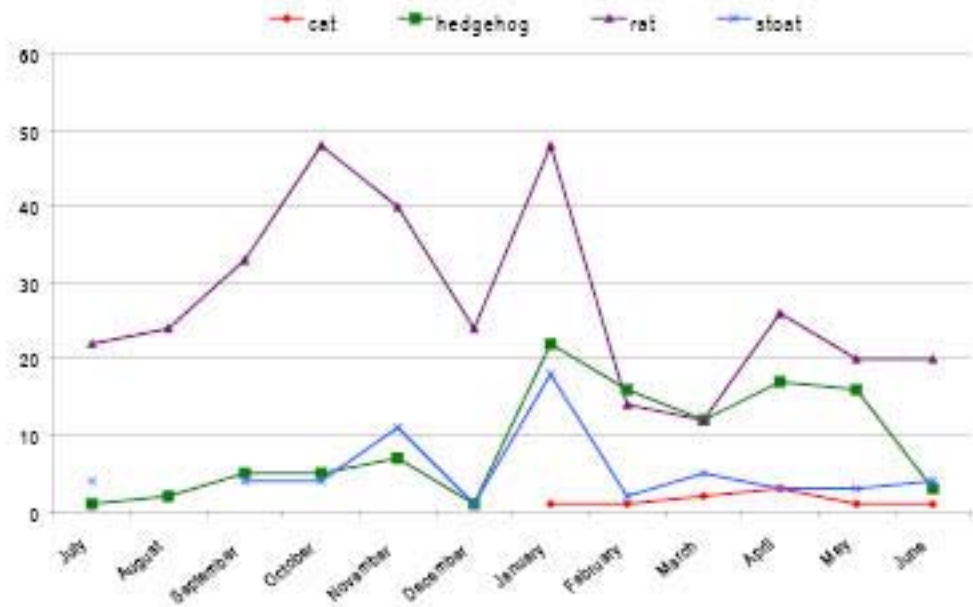
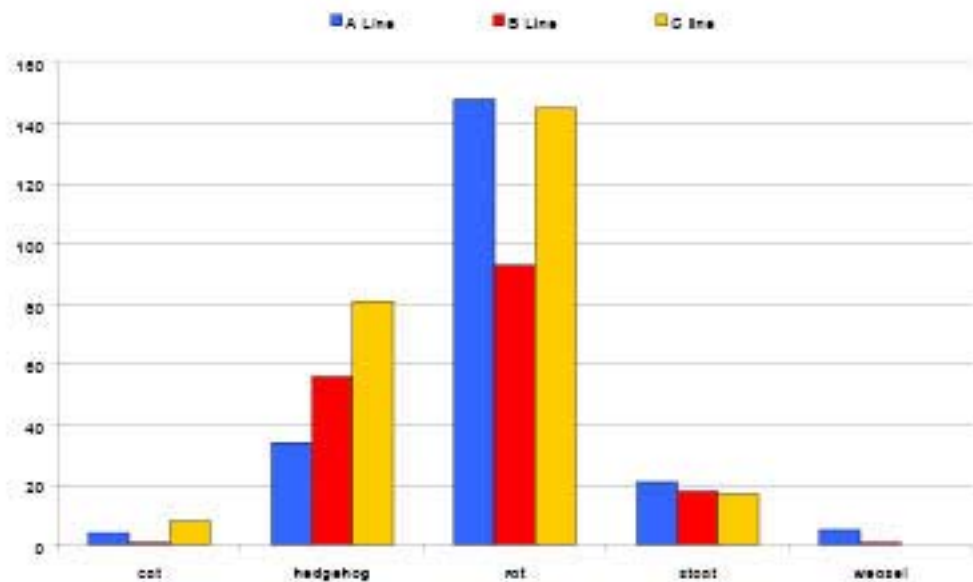


FIGURE 7: TRAP CATCH DATA BY LINE. LINE A ADJACENT TO RIVER AND LINES B AND C THROUGH FARMLAND.



Predator Trapping Whakapapa and Mangatepopo

This season, predator trapping began on the Whakapapa River and Mangatepopo Stream. Three lines were installed on the Whakapapa River, one down the river itself and then a line either side of the river, approximately 1km back from the river, but utilising current tracks where possible. The Mangatepopo had two lines set up this season, one down the river itself and one on the western side approximately 1km back from the river (the eastern side was not set up this season because of the 1080 operation on this side).

The Mangatepopo river trap line was not checked for a period of Tangawhenu place a rahui over the river following the tragic drowning of seven people on the Mangatepopo on April 14th 2008 during autumn and early winter 2008, follow due to the rahui placed on the river.

All traps were fully operational by September 2007, so the analyses below are for the period September 2007 to July 2008. A large number of stoats and rats were trapped (Table 11).

TABLE 11: TOTAL CATCHES FOR THE YEAR 2007/08 (SEPTEMBER TO JULY).

Stoats	118	Trap sprung	75	Ferret	1
Rats	408	Hedgehog	76		
Mice	1	Weasel	43		

Initial catches were high, as to be expected, then numbers dropped off as the predators were killed (Figure 8). Stoat numbers began to climb in January and February, coinciding with the time when juvenile stoats disperse. This is a similar pattern to what has been seen on the Manganui o te Ao. Predator numbers decreased in the wintertime.

There were differences between catches on the different lines. The two river lines (Mangatepopo and Whakapapa) both caught higher numbers of rats than the flank lines, although the eastern flank line on the Whakapapa (B line or Longpoint) also caught very high numbers of rats when compared to the other flank lines (Figure 9). Interestingly, stoat numbers were highest on the Whakapapa River, over double the amount on the Mangatepopo. This corresponds with where the largest declines in ducks have been seen over the years, indicating that stoat numbers may be higher on the Whakapapa, perhaps due to its beech/podocarp vegetation (compared with podocarp/broadleaf on the Mangatepopo). Hedgehog numbers were highest on the farmland (two flank lines run through farms), and weasels were also highest in numbers on the flank lines, but also present on the rivers. The one ferret trapped was on farmland.

FIGURE 8. COMBINED TRAP-CATCH DATA FROM SEPTEMBER 2007- JULY 2008 FOR RUAPEHU STUDY AREA (WHAKAPAPA AND MANGATEPOPO LINES).

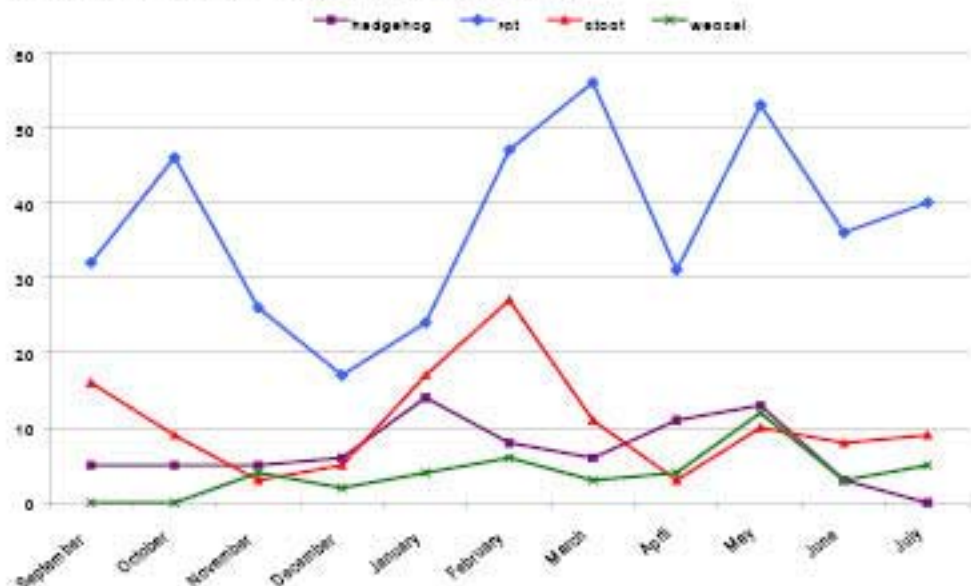
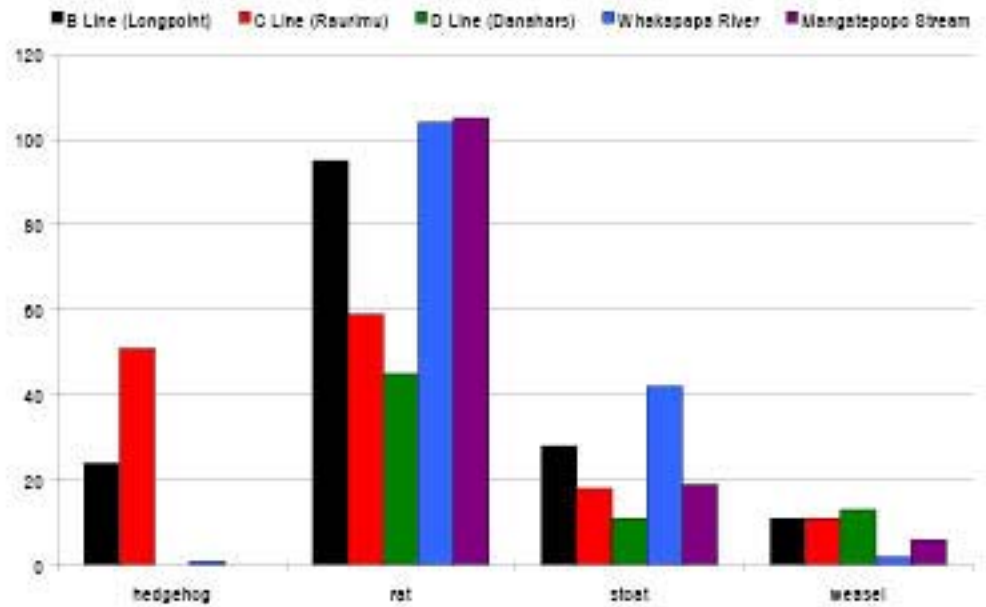


FIGURE 9. TRAP-CATCH DATA BY LINE, FOR SEPTEMBER 2007- JULY 2008. THE WHAKAPAPA RIVER HAS AN EASTERN FLANK LINE (B LINE OR LONGPOINT) AND A WESTERN LINE (C LINE OR BAURIMU). THE MANGATEPOPO STREAM HAS A WESTERN FLANK LINE (D LINE OR DANAMARS).



Discussion

Forty six pairs of blue duck were resident during the breeding season in the treatment / proposed treatment areas of the four rivers. It is a significant milestone that thirty one of these on 23 kilometres of river are now within an area with predator trapping. This means two-thirds of the population is protected.

Results from five years of intensive whoio monitoring on the Manganui o te Ao and four years on the Whakapapa/Whanganui/Mangatepopo show how the whoio populations have benefited from predator control. Results suggest that both trapping and aerial 1080 can control predators to levels where blue duck populations will respond positively.

1080 operation

In the past two seasons, aerial 1080 operations have been carried out over areas around the Mangatepopo, Whanganui and Whakapapa Rivers. Results from both years suggest that the operations contributed to increased productivity. In the year of the 1080 operation, the Whakapapa River produced 14 fledglings, a dramatic improvement on its average of 2.5 fledglings from the two previous years.

The Mangatepopo also has benefitted from aerial 1080, with record numbers of chicks hatching in the year of the first 1080 operation, however chick survival was poor that year, with many chicks disappearing later in the season, perhaps killed by re-invading stoats, or by avian predators. In the last year the Mangatepopo has been doubly protected by both a 1080 operation on one side of the river, and trapping. The benefits of this have been plain to see, with double the number of broods and chicks fledging.

The Whanganui had the most apparent increase in productivity after the 1080 operation this year. In the three years without predator control an average of just 4 wild-hatched chicks fledged. In the year of the 1080 operation, 22 chicks fledged.

Although other factors obviously influence whoio breeding success, 1080 operations have clearly been a big factor in the whoio breeding successes of the past two seasons on Ruapehu rivers. Results show that aerial 1080 can be used as a tool to protect whoio populations, even when only one side of the river is treated.

Predator numbers have been much higher on the Whakapapa River, this corresponds with where the biggest declines in ducks have been. Stoat catches have been particularly high on the middle reaches of the Whakapapa, which is where all the females disappeared from between 04-06 (10 pairs to just 2). Pair numbers on this river are now up to 6.

Ground control of predators – Manganui o te Ao, Whakapapa and Mangatepopo

Predator trapping has had huge benefits for whio on the Manganui o te Ao, with the number of pairs doubling since predator trapping started, and the number of juveniles fledged increasing three-fold. Results indicate that with a trapping regime in place the number of pairs resident in a 10 km stretch of the river is twice that for years with no trapping.

For the first year of predator trapping on the Mangatepopo and Whakapapa Rivers, results have been excellent. On the Whakapapa, there were 11 fledglings (compared with 2.5 fledglings in absence of predator control). The Mangatepopo benefitted twice over from both a 1080 operation and trapping, and had a record season.

Whilst it is difficult to demonstrate that trapping is the cause of these changes in the whio populations, the data are highly suggestive of the benefits of control. These results are consistent with similar results from predator control elsewhere in the country, namely Te Urewera and Fiordland.

PROJECT MILESTONES AND PERFORMANCE MEASURES

In line with the project proposal the following milestones were achieved during the fourth year of the project.

- Monitoring programme with banded birds maintained in all treatment / proposed study treatment areas
- Predator trapping continued on the Manganui o te Ao
- Predator trapping began on the Whakapapa and Mangatepopo
- Aerial 1080 operation in Pukepoto/ Mangatepopo
- Reporting requirements met

The primary performance measure was

1. A combined minimum of 40 territorial pairs are maintained on the Whakapapa, upper Whanganui / Mangatepopo and Manganui o te Ao rivers.

Forty six pairs were present in the study areas during the breeding season.

In 2008/09 trapping will continue on the Manganui o te Ao with extensions to the River line (A) upstream and downstream. All landowners have been contacted and are supportive of the increased protection work.

Predator control will also continue on the Whakapapa, and Mangatepopo, and will occur for the first time on the Whanganui River.

Secondary measures

1. Predator control results in an increase in the number of territorial pairs where space is available.

Pair density has increased each year on the Manganui o te Ao, except for this year, perhaps due to a lack of space. With predator control currently being expanded up and downstream of the study area, a larger area of protected river will be available for birds to disperse to. Pair numbers increased on all the other rivers.

2. Predator control results in higher overall survival of territory holding adults.

Adult survival was high this year. A small number of female losses were attributed to predation. Most of the other birds probably simply emigrated from the study areas. It is common for banded birds to turn back up in the study area after years of absence. Adult survival now seems likely to be a poor indication of success in improving the security of populations, as we are monitoring small parts of open populations.

3. Predator control results in higher annual productivity.

Productivity has increased dramatically on all rivers with predator trapping or aerial 1080.

PROGRAMME FOR 2008/09

- Operational predator control lines will be maintained and extensions both up and downstream activated on the Manganui o te Ao.
- Predator control (trapping) is continued on the Whakapapa, and the Mangatepopo will be fully set-up (eastern flank line installed).
- Predator trapping will be set up on the upper Whanganui (an additional 14.5km and 15 pairs of ducks protected).
- Monitoring of resident pairs and their productivity will continue in all study areas
- In line with national Whio Best Practice, juveniles will no longer be banded in the study areas. Only territorial adults will be banded, as their bands can be checked every 1-2 years for wear and tear.
- Data from the 5 year trial of blue duck protection on the Manganui o te Ao River will be summarised.

References

- Bristol, R., Campbell, J., Peet, N. (2004) Blue duck conservation on the Manganui o te Ao monitoring and predator control pilot study. Department of Conservation Wanganui Conservancy.
- Collier, K.J. & Henderson, R. 2000. Assessment of flow characteristics and blue duck distribution on some streams of the Tongariro Power Development scheme. NIWA client report ELE90239. National Institute of Water and Atmospheric Research, Hamilton.
- Cudby, E.J. and Strickland, R.R. (1986). The Manganui o te Ao River fishery. Fisheries Environmental Report no. 14. Ministry of Agriculture and Fisheries, Turangi.
- Don, G.L. 1995. Study 14: Blue ducks in the Western Diversion area. Bioresarches, Auckland.
- Etheridge, N & Peet N.B. (2004). Conservation strategy for the blue duck (whio) *Hymenolaimus malacorhynchos* in the central North Island 2004-2009. Department of Conservation Tongariro / Taupo and Wanganui Conservancies.
- Genesis 2000. Tongariro Power Development Assessment of Environmental Effects. Genesis Power Ltd, Turangi.
- Molloy, J, Bell, B., Clout, M., de Lange, P, Gibbs, G., Given, A, Norton, D., Smith, N., Stephens, T. 2002. Classifying species according to threat of extinction. A system for New Zealand. Threatened species occasional publication 22, 26pp.
- Peet, N.B., Campbell, J., Gembitsky, M. and Bristol, R. (2002). Blue duck survey Manganui o te Ao 2002. Unpublished report, Department of Conservation, Wanganui.
- Technical Report No.1 2004-2005. Securing blue duck in the Central North Island. Wanganui & Tongariro/Taupo Conservancies, Department of Conservation.
- Technical Report No.2 2005-2006. Securing blue duck in the Central North Island. Wanganui & Tongariro/Taupo Conservancies, Department of Conservation.
- Veltman, C.J., Collier, K.J., Henderson, I.M & Newton, L. 1995. Foraging ecology of blue ducks on a New Zealand river: implications for conservation. *Biological conservation* 74:187-194.
- Williams, M. 1991. Social and demographic characteristics of blue duck . *Wildfowl* 42:65-86.

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This report was edited by Alison Perfect and formatted by Peter Lock. The maps were produced by Sue Jones and Simon Mills.

Appendix 1

BLUE DUCK TERRITORIES IN THE MANGANUI O TE AO TREATMENT AREA THROUGH THE 2007/08 BREEDING SEASON AND PRESENT IN JULY 2008.

	PAIR JULY 2007	BREEDING PAIR		JUNE 2008
Hoihenga Bridge	YG BM RY BM	Pair moved upstream out of study area early in season		Survived
Hoihenga Point	Unknown female WL BM	Male moved - territory absorbed		
1. Hoihenga Gate	BM YL LO BM	BM YL LO BM		Not sighted last survey - presumed still present
2. Wattle Point	BM GO Unbanded	BM GO Unbanded	Hatched 4 chicks - fledged 2	Not sighted last survey - presumed still present
3. Meyer's Bridge	M WW YY BM	M WW YY BM	Non Breeding?	Pair still present
4. Fern Pool	M RG OL YM	M RG OL YM	2 attempts - 2nd hatched 6 - flooded - fledged 1 juv	Not sighted last survey - presumed still present
5. Orautaha	M YG BM WY	M YG BM WY	2 attempts - 2nd hatched 6 - flooded - fledged 4 juv	Pair still present
6. Cage			First sighted May/ June 08.	M OO Unbanded male
7. QEII	M GW Unbanded male	M GW Unbanded male	1/11 Hatch 4 chicks, failed brood by 28 Dec	Pair still present
8. Road Island	M WG WR BM	M WG WR BM	Failed nesting attempt - female presumed predated	Male left territory - survived.
9. Ram Paddock	YM BR L38980 BR YM L38984	YM BR L38980 BR YM L38984	Hatch 2 chicks - 1 chick and female predated early - solo male - 1 juv fledged	New female - Pair still present
10. Bot Ram Paddock	BM YG Unbanded	BM YG Unbanded	Hatch 4 chicks, 4 juvs fledged	Pair still present
11. Slip sign	M B WO YM L38988	M B WO YM L38988	Female lost in incubation	Male still present - new unbanded female
12. Domain	BM WB LY BM	BM WB LY BM	Hatched and fledged 1 chick	Pair still present
13. Bot. Domain	M LY WB BM	M LY WB BM	Hatched 7 chicks - fledged 7	Pair still present
14. Top of Ruatiti Mouth		OM YY	Non Breeding pair Unbanded	Late pairing - small territory
15. Ruatiti Mouth	RY YM RG BM	RY YM RG BM	Hatch 4, 1 juv fledged	Pair still present

Appendix 2

BLUE DUCK PAIR DENSITY AND ESTIMATED BREEDING SUCCESS IN TWO MONITORED STRETCHES (NO PREDATOR CONTROL) OF THE MANGANUI O TE AO.

YEAR	LOCATION	RESIDENT PAIRS <i>N</i>	PAIR DENSITY <i>KM²</i>	BREEDING PAIRS <i>N</i>	PAIRS FLEDGING BROODS <i>N</i>	JUVENILES FLEDGED <i>N</i>	FLEDGLINGS PER BREEDING PAIR
2004/2005	Manganui o te Ao (monitored area 1)	11	1.6	min. 8	max. 7	min. 12	min. 1.5
2004/2005	Manganui o te Ao (monitored area 2)	3	0.31	3	min.2	min.4	min. 1.3
2005/2006	Manganui o te Ao (monitored area 1)	8	1.19	5	min. 3	max. 11	2.2
2005/2006	Manganui o te Ao (monitored area 2)	5	0.5	min. 2	min. 2	min. 6	0.85
2006/2007	Manganui o te Ao (monitored area 1) upstream	7	1.4	5	6	24	4.8
2006/2007	Manganui o te Ao (monitored area 2) downstream	4	0.4	3	3	5	1.6

Appendix 3

MANGANUI O TE AO RIVER SURVEYS OUTSIDE THE STUDY AREA.

DATE	WHERE	PAIRS	SINGLE	BROODS	CHICKS/JUV
13/11/07	Gar. To Hoi	7	11	6	4+5+3+2+6+2
17/12/07	Gar. To Hoi	7	1	5	5+3+7+4+5
15/11/07	Dom. To Thompson	4	4	3	1+1+3
14/01/08	Dom. To Thompson	4	3	3	2+1+1+1

Garerty's bridge to Hoihenga Bridge (Monitored area 1)

Two surveys were carried out above the study area from Garerty's bridge to Hoihenga Bridge, a distance of approx 6-7 kilometres.

With a degree of confidence, 7 pairs were recorded on this stretch with 5 broods successfully hatched onto the river. Up to 15 adult individuals were sighted and the mid December survey count of juveniles totalled 24. All of these juveniles are thought to have fledged. Even with limited data available these figures are considered to be reliable. Six banded birds from the study area were recorded in this territorial stretch. The high fledgling per pair numbers may be due to the lack of large floods and freshes (drought) at crucial times.

Ruatiti Domain to Thompson's Bridge - Occasional surveys (Monitored area 2)

This river section is downstream from Ruatiti Domain with habitat similar if not a little more open to that of the study area. The length of the section is approx km. With the focus on the study area only two surveys of this stretch were undertaken. The best estimate of pairs shows 3-4 resident pairs of which 3 had broods, had successfully bred up to 5 juveniles. Only one banded individual was present.

Makatoke / Manganui o te Ao River "V" - Below State Highway 4

The survey starts at the Makatoke Viaduct and heads down the Makatoke River to just below the junction with the Waimarino Stream, then back up to Highway 4 via the Manganui o te Ao River.

This survey was not undertaken this year due to at staff availability critical times and other priorities. It is expected there are still good pair numbers on this section and it is recommended that it is resurveyed more regularly through the 2008/09.

Appendix 4

BLUE DUCK POPULATIONS IN THE CENTRAL NORTH ISLAND

Blue duck populations on rivers in the western central North Island are regarded as being part of a western central North Island meta-population (Etheridge and Peet 2004). There is likely to be some exchange of birds between individual populations (found on individual river systems) but dispersal processes are poorly understood and evidence of widespread movement is currently lacking. Habitat fragmentation, predation and dispersal attributes will affect the ability of birds to move between population units (effectively rivers) or to occupy habitat between existing populations.

Up until 2004/05, previous research effort on rivers in the western central North Island has focussed on monitoring of key populations on the Manganui o te Ao, Whakapapa, Mangatepopo and Whanganui Rivers.

Appendix 5

BLUE DUCK POPULATIONS IN THE CENTRAL NORTH ISLAND

Blue duck on the Manganui o te Ao

The blue duck population on the Manganui o te Ao has been the subject of a number of studies. Through the 1980s and early 1990s an extensive research programme investigated the ecology and population dynamics of the population between Hoihenga Bridge and Ruatiti Domain (Veltman et al. 1995, Williams 1991). Though the late 1990s and early 2000s annual surveys provided a snapshot of the size of the population and an estimate of annual productivity (Table A5.1).

TABLE A5.1. SUMMARY OF BLUE DUCK POPULATION CHARACTERISTICS 1980-2003/04 BETWEEN HOIHENGA BRIDGE AND RUATITI DOMAIN. THIS CORRESPONDS TO THE CURRENT TREATMENT AREA. (DATA FROM WILLIAMS 1991, WILLIAMS UNPUBLISHED, PEET ET AL. 2002, BRISTOL ET AL. 2004).

	TERRITORIAL PAIRS <i>N</i>	NO. OF BREEDING ATTEMPTS <i>N</i>	NUMBER OF JUVENILES FLEDGED <i>N</i>	FLEDGLINGS PER BREEDING ATTEMPT
1980-1995	mean 6.9	mean 5.8	mean 8.2	mean 1.4
1998/99	7	-	-	-
1999/00	5	-	-	-
2001/02	7	-	-	-
2002/03	10-13	-	-	-
2003/04	22	19	9	0.47

The number of territorial pairs remained relatively stable between 1980 - 2001 but with a large increase in 2002/03 when 22 pairs held territory. Productivity has been erratic with the number of fledglings per breeding attempt only exceeding 2 young in four of seventeen years. 1980-1995 saw no predator control at the site but in 2003/04 a single line of Mk 6 Fenn traps was operated along the river.

There are fewer data for the section of river between the Manganui Valley Road Bridge and Hoihenga Bridge (Monitored area 1) (Table A5.2). Productivity was even more erratic than in the treatment area with nests vulnerable to predation (and associated disturbance), spring floods and suitable habitat limited by prolonged high water.

TABLE A5.2. SUMMARY OF POPULATION DATA FOR BLUE DUCK 1984-2002/03 FROM MANGANUI VALLEY ROAD BRIDGE TO HOIHENGA BRIDGE. CORRESPONDS TO MONITORED AREA 1.

YEAR	TERRITORIAL PAIRS N	FLEDGLINGS PER BREEDING ATTEMPT
1984/85	6	-
1985/86	7	-
1986/87	8	
1987/88	11	0
1988/89	14	1 brood, estimated 0-0.3
1989/90	12	1 brood estimated 0-0.3
1999/00	2	0
2002/03	7	-

Blue duck on the Whakapapa and Upper Whanganui / Mangatepopo

Whakapapa

Annual walk-through surveys have been conducted on the Whakapapa monitored reach twice every December from 1989 to 2003, giving a “snapshot in time” of all adults and any unfledged chicks present on the river each season.

Between 1989 and 2003 the Whakapapa supported a relatively dense population of blue duck with an average of one pair per kilometre of monitored river. The number of resident pairs on the Whakapapa declined after 1996 (Table A5.3), reaching a low of five pairs in 2001. Pairs increased in 2002 and reached 10 in 2003. Productivity has always been erratic. However the Whakapapa has been historically known as a relatively productive river, with chicks recorded every year except 1998 when floods probably wiped out all nests.

TABLE A5.3. BLUE DUCK POPULATION DATA FROM ANNUAL SURVEYS OF THE WHAKAPAPA MONITORED REACH 1989-2003. THIS CORRESPONDS TO THE PROPOSED WHAKAPAPA TREATMENT AREA.

YEAR	TERRITORIAL PAIRS N	NUMBER OF PAIRS WITH BROODS N	NUMBER CHICKS N
1989	6	2	7
1990	6	3	7
1991	5	3	13
1992	8	3	5
1993	8	2	8
1994	8	3	11
1995	7	7	20
1996	8	2	5
1997	8	4	4
1998	6	0	0

YEAR	TERRITORIAL PAIRS <i>N</i>	NUMBER OF PAIRS WITH BROODS <i>N</i>	NUMBER CHICKS <i>N</i>
1999	6	3	14*
2000	6	1	5
2001	5	1	1
2002	7	3	7
2003	10	2	6

*Four of these chicks were transferred to Taranaki

Upper Whanganui/Mangatepopo

Annual walk-through surveys were carried out twice every December between 1989 and 2003 on a section of the current upper Whanganui and Mangatepopo study area. This old monitoring area was around the Mangatepopo Stream, Okupata Stream (a tributary of the Mangatepopo Stream) and Whanganui River confluences. This short section of river represented a 3km stretch of the current monitored study area.

The number of territorial pairs on the Mangatepopo/Okupata/Whanganui monitored reach was 8 in 1996 with a density of 2.67 pairs per kilometre of river. Numbers declined after 1996 to 3 pairs in 2003 (Table A5.4).

Breeding has been particularly erratic between years (Table A5.4). In some years, most or even all of the resident pairs were observed with broods at the time of survey. However, in other years none of the pairs were observed with chicks. The years 1997, 1999 and, 2002 were the “big” breeding years in terms of chick production, with 12, 13, 10 chicks respectively but other years have had fairly low chick production. The years 1998, 2000 and 2003 were total breeding failures with no broods being observed at the time of survey.

TABLE A5.4. BLUE DUCK POPULATION DATA FROM ANNUAL SURVEYS OF MANGATEPOPO/OKUPATA/WHANGANUI MONITORED REACH 1989-2003. THIS CORRESPONDS TO A 3KM SECTION OF THE PROPOSED MANGATEPOPO/WHANGANUI TREATMENT AREA.

YEAR	TERRITORIAL PAIRS <i>N</i>	NUMBER OF PAIRS WITH BROODS <i>N</i>	NUMBER CHICKS <i>N</i>
1989	4	0	0
1990	4	0	0
1991	4	3	5
1992	4	2	7
1993	4	0	0
1994	No survey	No survey	No survey
1995	6	1	2
1996	8	1	2
1997	4	3	12
1998	6	0	0
1999	4	3	8

YEAR	TERRITORIAL PAIRS <i>N</i>	NUMBER OF PAIRS WITH BROODS <i>N</i>	NUMBER CHICKS <i>N</i>
2000	5	0	0
2001	5	2	4
2002	5	2	10
2003	3	0	0

New Zealand Government