Operation Ark

Three year progress report

October 2007

Department of Conservation
Te Papa Atawhai

Operation Ark

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Foreword

Hon. Chris Carter.

In the summers of 2001 and 2002 predator plagues in some South Island beech forests led to a dramatic drop in the remaining Canterbury populations of kākāriki karaka, or orange-fronted parakeet, and big declines in mōhua (yellowhead), blue duck (whio) and both long- and short-tailed bats (pekapeka).

These populations had been in gradual decline but their distribution became thinner over time and then suddenly big gaps appeared, followed by the disappearance of remaining isolated pockets.

In documenting the decline in orange-fronted parakeet, mōhua, whio and the bats, Department of Conservation scientists were also looking into the causes of the problem and into ways of dealing with it. It turned out that unusually heavy flowering and fruiting in beech trees, which occur once every few years somewhere in the South Island, led to a rise in rat populations, which in turn fuel a rise in stoat populations.

A group of DOC experts then determined that controlling rats and stoats before they reached plague proportions might be the answer. The group reported to me in mid-2003 and in September of that year I agreed to an initiative with dedicated funding called Operation Ark. Starting in June 2004, its goal was to improve the long-term survival chances of whio, orange-fronted parakeet, mōhua and bats on the mainland South Island.

Operation Ark achieved its purpose with some success, not only benefiting local populations of at-risk native species but providing much-needed information on how we can further develop and refine pest control methods and an early warning system. Whio numbers are increasing at the three managed sites and the Department is confident that stoat control continues to protect the resident birds. Orange-fronted parakeets, mōhua and bats have been successfully protected through the most recent 2006 rat plague where pest control measures were used. The work has also shown that the long-term success of Operation Ark will depend on larger areas of beech forest being brought under intensive pest monitoring and control.

This report documents the first three years of Operation Ark and points the way ahead for the future. It shows that we can turn the tide on the decline in native species biodiversity where intensive pest control is implemented. On a wider scale, the challenge to protect threatened populations over much larger areas remains.

Chris Carter
Minister of Conservation

1. Executive summary

1.1 BACKGROUND

Operation Ark was announced by the Minister of Conservation, the Hon. Chris Carter, in September 2003 and commenced in June 2004. Its purpose is to preserve sustainable populations of whio (blue duck), orange-fronted parakeet (kākāriki karaka), mōhua (yellowhead) and pekapeka (short and long-tailed bats) on the mainland South Island.

The objective of Operation Ark is to protect these four species from possums, stoats and rats and to mitigate the effects of predator plagues in the South Island beech forest sites where the species occur.

The 10 sites that are operational are:

- Wangapeka-Fyfe (Kahurangi)
- Hawdon-Poulter (North Canterbury)
- South Branch Hurunui (North Canterbury)
- Oparara-Ugly (Kahurangi)
- Landsborough (South Westland)
- Dart-Caples (Western Otago)
- Catlins (South-East Otago)
- Eglinton (Fiordland)
- Blue Mountains (Southland)
- Clinton, Arthur, Cleddau (Fiordland)

The Operation Ark budget has been $1.24m per annum from Vote Conservation for the three financial years 2004-07. In 2006-07 an additional $400,000 of Department funding (from other deferred biodiversity projects), enabled aerial 1080 operations to be undertaken to control rats in the Dart-Caples, Hawdon-Poulter and the South Hurunui sites. The ability to add additional funds during rat plagues is essential to the success of the programme and will continue to be a challenge.

The existing level of funding is sufficient to maintain the current level of infrastructure, stoat control and threatened species and predator monitoring.

Completion of stoat trapping lines and rat control bait station grids at the ten Operation Ark sites will require a significant injection of additional funds.

1.2 PREDATOR CONTROL

Stoat control

Stoat control through parallel traplines set along the river valley floors has been demonstrated to be effective for protecting whio in these types of ecosystems. Effective stoat control has been in place over the last three years at mōhua and orange-fronted parakeet sites. The Landsborough provides a good example of mōhua recovery where stoats are controlled and no rat plagues have been experienced.

At the Poulter, Dart-Caples and Catlins sites the proposed stoat control network is still incomplete. Additional establishment of stoat control lines will extend the protected habitat available for mōhua and orange-fronted parakeets.

Rat control

The Department undertook rat control in five sites (South Hurunui, Hawdon-Poulter, Dart-Caples, Eglinton and Catlins) to counter a rat plague that started in autumn 2006 and finished in winter 2007. By the end of the 2006/07 summer, successful rat control techniques had been implemented at four out of the five sites.

Development of different baits has enabled improvements in rat control and reduced the likelihood of rats becoming bait-shy or pesticide resistant.

In the Eglinton in the Walker Creek long-tailed bat area, rat numbers were not reduced until March, when Diphacinone, a new toxin was used. This was primarily due to rat re-invasion of the relatively small control area. Nevertheless, in the three Eglinton rat control areas, including Walker Creek, short and long-tailed bat populations continued to grow and mōhua over-summer mortality was low.

Two techniques have proved successful at controlling rats during beech mast induced rat plagues. 1080 can be dropped from the air to knock rat numbers down and they can then be maintained at low levels through the use of bait stations loaded with anticoagulant poison. Alternatively only bait stations, with 1080 or anticoagulant poison, are used, but the bait stations are placed very close together. Traps set for rats on their own have proved ineffective.

Aerial 1080

Aerial 1080 has been shown to be an essential tool to knock down growing rat numbers, to almost undetectable numbers, in a plague situation where bait stations are not preventing an increase. This is particularly important when managing populations of birds that have been decimated by previous rat plagues and are barely surviving through natural breeding.

However, there is room for improvement in baiting strategies. We need to increase the level of knockdown and expand the treated areas to extend the duration of resulting rat control. A three-year research programme

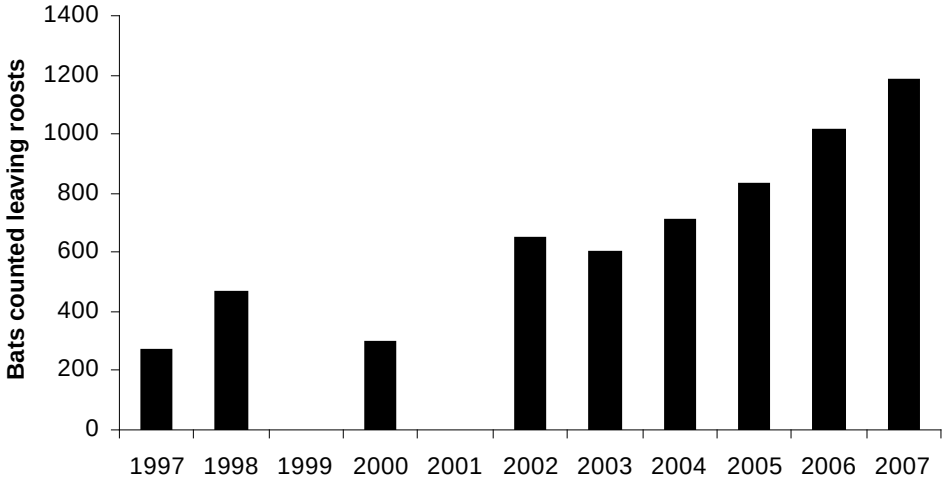
is investigating optimising aerial 1080 operations to kill multiple pest species (mainly rats, stoat and possums) and to maintain control for longer periods.

1.3 SPECIES SURVIVAL

Pekapeka (Short and long-tailed bats)

Pekapeka are a nationally endangered species whose population distribution is not well known. The Eglinton site is unique in that it includes both short and long-tailed bats and has been monitored for many years. Stoat and rat control was effective during the 2006-07 rat plague in maintaining bat population growth within the protected areas in the Eglinton Valley (see Figure 1). The rat control areas in the Eglinton are still insufficient to support viable populations of the two species of bat, and they need to be expanded. In other Operation Ark sites, pekapeka will be benefiting from rat control and monitoring should be undertaken to confirm this.

Figure 1: Counts of short-tailed bats leaving roost sites in the Eglinton Valley



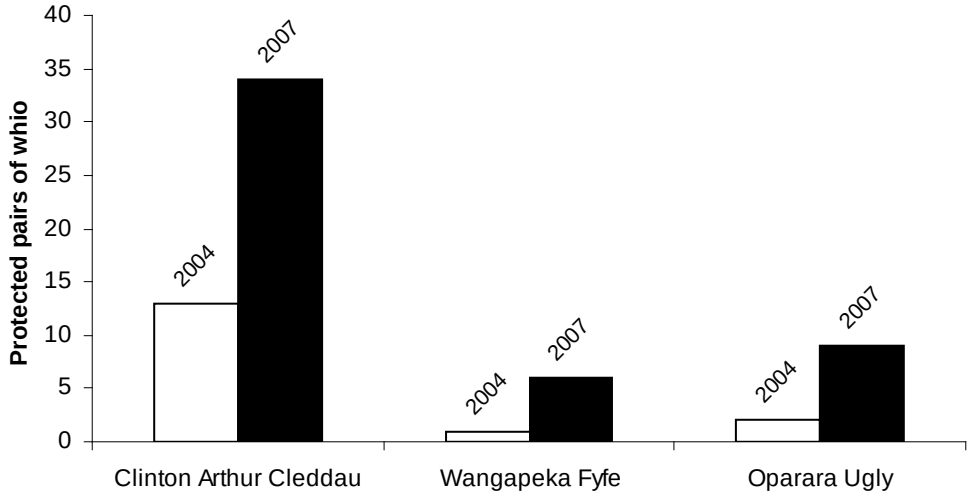
Short-tailed bat. Photo: Colin O'Donnell, Department of Conservation

Whio (Blue Duck)

Whio are a nationally endangered species whose numbers and range are decreasing. In the managed parts of the Wangapeka, Oparara and Clinton-Arthur-Cleddau sites whio numbers are increasing and the Department is confident that the stoat control being undertaken is working to protect resident birds. In the three years of Operation Ark, total whio numbers in the protected areas have grown from 16 to 49. This clear success is illustrated in Figure 2.

Whio numbers will continue to rise if the length of river valley with stoat lines in place increases. This growth rate of birds can be speeded up by use of captive rearing and egg and fledgling transfers. The three sites all have the potential to reach the Whio Recovery Group target of 50 breeding pairs, if the stoat control lines are expanded from the current 163 km to 254 km.

Figure 2: Protected pairs of whio at three whio-focused Operation Ark sites



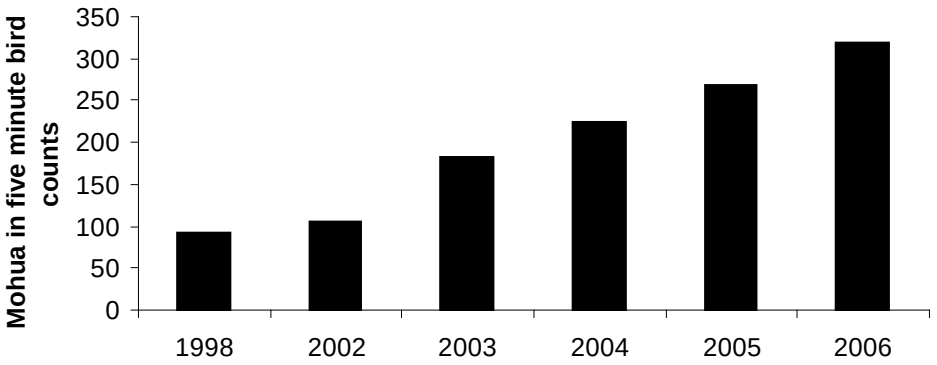
Mōhua (Yellowhead)

Mōhua are a nationally endangered species restricted to the South Island and offshore islands. Their range and numbers are decreasing on the mainland due to possum, stoat and rat predation.

Residual populations exist in Hurunui, Hawdon and Eglinton Valleys. The main Operation Ark protection sites are Landsborough, Dart-Caples and Catlins. Blue Mountains mōhua are monitored without protection. Wherever effective rat and stoat control was undertaken in the last three years mōhua numbers have stabilised or increased, eg. Landsborough Valley (see Figure 3).

The area of effective rat and stoat control will need to be expanded at most of the mōhua sites if they are to support sustainable populations. This is particularly true of the Catlins and the Blue Mountains (if a decision is taken to shift from monitoring to predator control at that site).

Figure 3: Mōhua recorded in five minute bird counts in the Landsborough Valley

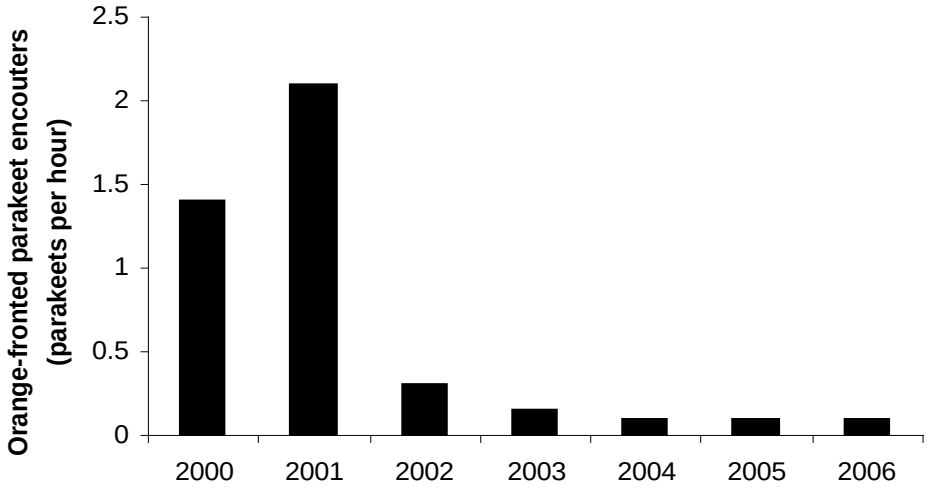


At three sites, Eglinton, Hawdon and South Branch Hurunui, mōhua numbers are so low that even with effective predator control there is a risk that the populations will become locally extinct, either during a particularly severe winter, or through loss of fertility due to inbreeding. Translocation of mōhua from other sites may be necessary.

Orange-Fronted Parakeets (Kākāriki karaka)

Orange-fronted parakeets are critically endangered and have declined in numbers and range to such an extent that they naturally occur only within the Hawdon-Poulter and Hurunui Operation Ark sites and are estimated to number between 150-300 individuals. They were severely affected by the 2000-01 rat plague and have not yet recovered (see Figure 4).

Figure 4: Orange-fronted parakeet abundance in the South Branch of the Hurunui



During the 2006-07 rat plague a combination of rat traps, bait stations and aerial 1080 operations as well as individual nest protection were used to maintain the population of birds. Monitoring of the more abundant yellow-crowned parakeets in the summer of 2006-07 has indicated that the protection measures will have been successful for orange-fronted parakeets.

A self-sustaining off-shore population of orange-fronted parakeets has been established by taking eggs from the wild and using a captive breeding programme at Peacock Springs (Isaac Wildlife Trust). The fledged birds have been transferred to Chalky and Maud Islands. This has meant that the risk of species extinction has been averted; however the mainland population remains in a critical condition.

Predator control regimes are now in place in large parts of the orange-fronted parakeet sites (Hawdon, Poulter and South Hurunui Valleys), though they need changes to bring them up to the most cost effective standard (e.g. better and more bait stations, bigger control area, optimised aerial poisoning).

Orange-fronted parakeets are now so rare at these sites that even with effective predator control there is a risk that the populations will become locally extinct during a particularly severe winter or through loss of fertility due to inbreeding. Protecting individual orange-fronted parakeet nests, captive breeding and supplementation from offshore islands all remain important tools for orange-fronted parakeet management for the foreseeable future.

1.4 WHAT WE HAVE ACHIEVED

Whio have been saved from slow decline by the use of stoat traps in the three Operation Ark sites and their total number in protected sites has tripled in three years. This has been achieved by more successful breeding, Operation Nest Egg and extensions to the areas covered by stoat control.

The maintenance of mōhua and pekapeka numbers in predator-controlled areas through the 2006-07 rat plague was a major success. Further localised extinctions were prevented by the control programmes that were used.

Orange-fronted parakeets have been successfully protected through a major rat plague and a self-sustaining population has been established on Chalky Island and expanded to Maud Island.

1.5 WHAT WE HAVE LEARNT AND NEED TO DO

Aerial 1080 has been demonstrated to be an effective tool for reducing rat numbers to very low levels in South Island beech forests. However, we need to develop this method further to extend the duration of effective control. Until these improvements are made, ongoing rat control will require ground-based poisoning.

The best methods for controlling rats and the optimal timing, duration and scale over which to apply them to effectively protect mōhua and orange-fronted parakeets, are still developing. In three years Operation Ark has moved from rat trapping, to bait station grids and aerial 1080

in search of the most effective rat control. Continued research and monitoring around these issues will result in further improvement.

In sites where the mōhua, orange-fronted parakeet and pekapeka are too rare to provide sustainable breeding populations, early intervention to prevent rat population increases will continue. If the birds are to achieve sustainable local populations, more individual nest monitoring and protection and possibly bird translocations to the sites will be required.

Whio populations can be successfully protected and expanded by stoat trapping and Operation Nest Egg transfers. The target of 50 breeding pairs at the three sites is achievable if these stoat lines are extended.

Operation Ark intervention in the last three years has successfully protected its target species in areas of intensive predator control. While the techniques require further refinement, the primary limitation on success is the intensity and range of control at the sites. At most Operation Ark sites, the area in which predators are controlled is less than that required to support sustainable populations of whio, mōhua, pekapeka and orange-fronted parakeet and needs to be increased. Current levels of funding are insufficient to achieve this goal.

2. Background

2.1 OPERATION ARK PURPOSE

Operation Ark was announced by the Minister of Conservation, the Hon. Chris Carter, in September 2003. Its purpose is to preserve sustainable populations of five key species on the mainland South Island. Regionally coordinated funding and oversight of the project commenced in June 2004.

Its operational objective is to ensure integrated management and protection of the species on the sites and to counter the effect of predator plagues in beech forests in the South Island. The species which are protected through Operation Ark are:

- kākāriki karaka (orange-fronted parakeet) [*Cyanoramphus malherbi*]
- mōhua (yellowhead) [*Mohoua ochrocephala*]
- whio (blue duck) [*Hymenolaimus malachorhynchos*]
- pekapeka (short-tailed bat) [*Mystacina tuberculata tuberculata* (South Island)] in the Eglinton Valley
- pekapeka (long tailed bat) [*Chalinolobus tuberculata* (South Island)] in the Eglinton Valley.

These threatened species previously extended across the South Island and are now restricted to as little as 3% of their former ranges. Offshore island populations exist only for mōhua and the bats, though recent attempts to establish island populations of the orange-fronted parakeet have been initially successful. Whio cannot be secured on offshore islands as no island is big enough.

Rats, stoats and possums are the main predators to be controlled to prevent further decline. Although large scale predator control is possible, it is expensive. Therefore the Department has prioritised control in 10 sites, throughout the range of the key species for maximum conservation benefit. An eleventh site (Moeraki) was also considered but not formally created. See Map 1 for site locations.

Within the sites there has been a selection of predator control, species recovery and/or monitoring programmes established using both Operation Ark and other funding sources. The ten sites, their pest control programmes and their targeted protected species are outlined in Table 1.

MAP 1: OPERATION ARK SITES

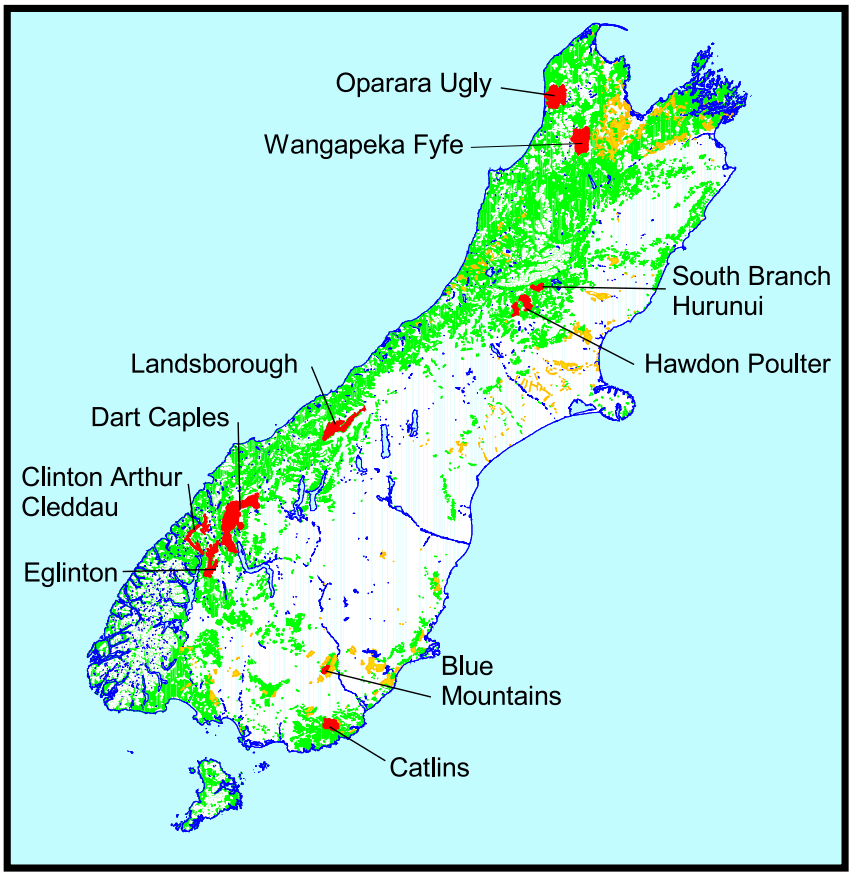


TABLE 1: OPERATION ARK SITES, PREDATOR CONTROL AND TARGETED PROTECTED SPECIES

SITE	PRIMARY PREDATOR CONTROL	TARGET PROTECTED SPECIES
Wangapeka-Fyfe (Kahurangi)	Stoat trapping, AHB possum control	Whio
Hawdon-Poulter (Canterbury)	Stoat trapping, bait station and aerial 1080 rat control, possum control via aerial 1080	Orange-fronted parakeet, Mōhua
South Branch Hurunui - Mainland Island (Canterbury)	Stoat trapping, bait station and aerial 1080 rat control, possum control	Orange-fronted parakeet, Mōhua
Oparara-Ugly (Kahurangi)	Stoat trapping	Whio
Landsborough (Sth Westland)	Stoat trapping	Mōhua, Whio
Dart-Caples (Western Otago)	Stoat trapping, bait station and aerial 1080 rat control, possum control	Mōhua
Catlins (South-East Otago)	Stoat trapping, bait station rat control, AHB aerial 1080 possum control	Mōhua
Eglinton (Fiordland)	Stoat trapping, bait station rat control, aerial 1080 possum control	Mōhua, Pekapeka (short-tailed and long-tailed bats)
Blue Mountains (Southland)	Monitoring only	Mōhua
Clinton, Arthur, Cleddau (Fiordland)	Stoat trapping, aerial 1080 possum control	Whio, Mōhua

Extensive beech flowering and seeding follows warm summers in the previous year. Rat plagues followed heavy beech seeding (mast) events in most sites in 1999-2000 and 2006 and in Canterbury in 2004. The increased food supply from seeds, insects and mice increased stoat and rat numbers which then reduced populations of the key species by up to 90% in some unprotected areas. The seasonal relationship between beech seed, rat and stoat numbers and bird seasonal cycle is shown in Figure 5.

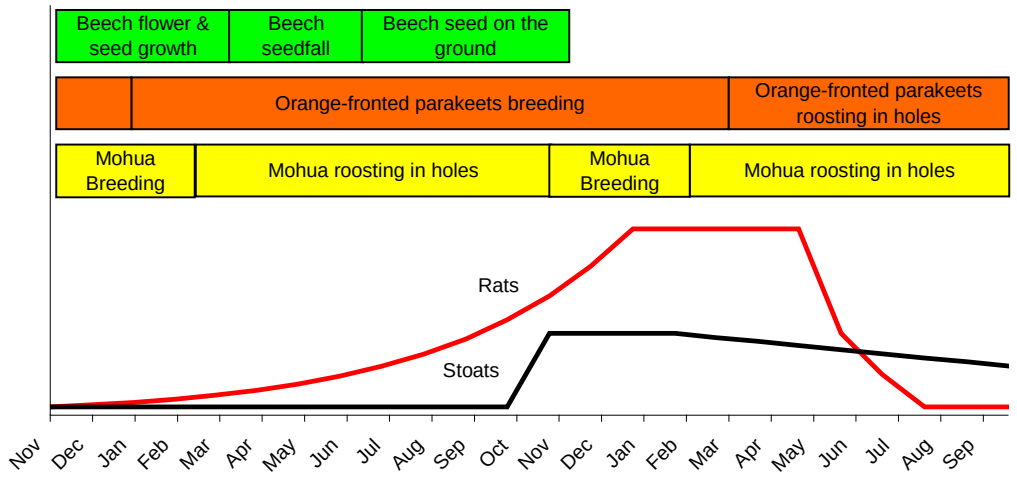


Figure 5: Seasonal response of beech, rats, stoats, mōhua and orange-fronted parakeets during a typical beech-mast cycle

In response to this cyclical predator threat, all sites (except the Blue Mountains monitoring site), have continuous stoat control and contingency funding is used to respond to rat irruptions where and when they occur.

A Departmental coordinating committee of scientific and technical experts has been established to provide advice to the project coordinator and to the site managers. The 'Review of predator control in Operation Ark', initiated by the Minister in 2005, recommended changes to Operation Ark coordination to enable more effective decisions on when to introduce rat control to sites and what techniques to use (Parkes *et al.* 2005). The review recommendations have been implemented.

2.2 KEY SPECIES

Orange-fronted parakeet (Kākāriki karaka)

The orange-fronted parakeet (*Cyanoramphus malherbi*) is now only known to occur naturally in three North Canterbury valleys. These are the Hawdon and Poulter Valleys of Arthur's Pass National Park and the South Branch of the Hurunui River in Lake Sumner Forest Park. These three valleys are Operation Ark sites.

There are no accurate estimates of the total numbers, but a best estimate places it between 150–300 individuals. Of the other two species of parakeet that were once common on the South Island, the red-crowned (*C. novaezelandiae*) is all but extinct on the mainland, while the yellow-crowned (*C. auriceps*), although still found in considerable numbers in large tracts of indigenous forest, has undergone range contraction and fragmentation. As the birds will breed for much of the year they are particularly vulnerable to predation on nests.

A small off-shore population of orange-fronted parakeets has been established by taking eggs from the wild and using a captive breeding programme at Peacock Springs (Isaac Wildlife Trust). The fledged birds have been transferred to Chalky Island, (where they are already breeding) and Maud Island. This has meant that the risk of species extinction has been averted; however the mainland population remains in a critical condition.

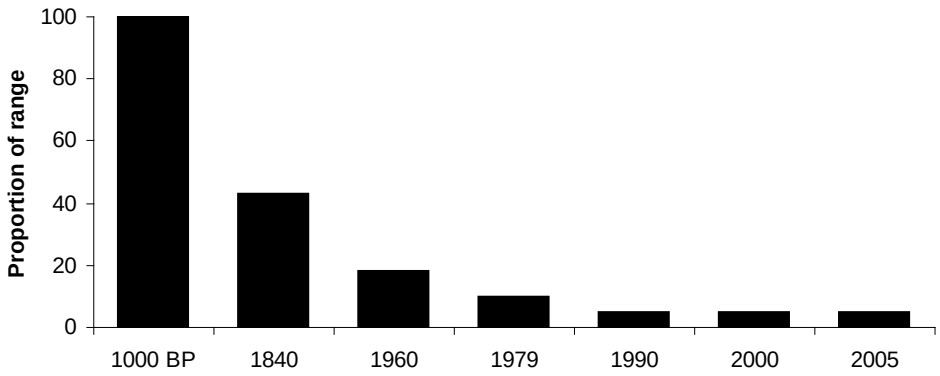
Mōhua (Yellowhead)

The remaining core populations of mōhua (*Mohoua ochrocephala*) are fragmented. Small outlying populations persist in the Hurunui, Poulter, and Hawdon Valleys in the Arthur's Pass-Lewis Pass area and until recently (December 2000), on Mt Stokes in the Marlborough Sounds. Most mōhua now occur in the eastern valleys of Aspiring and Fiordland National Parks, in the Takitimu and Longwood Ranges, the Landsborough Valley in South Westland, the Blue Mountains and the Catlins.

Mōhua now occupy less than 3% of their original range and are classified as nationally endangered, as illustrated in Figure 6.

Mōhua are hole users and are very vulnerable to predation both while nesting and roosting in holes. Their numbers are very low in the South Branch Hurunui, Hawdon, Poulter, Clinton and Eglinton valleys following rat population explosions in 1999-2000 and 2004. Elsewhere, estimated population numbers are: Dart/Caples (>3000), Catlins (>1000), Blue Mountains (>500), Landsborough (>500). The Mōhua Recovery Group rank these four sites as their top priorities for protection.

Figure 6: Mōhua range contraction (Source C. O'Donnell, 2005)



Whio (Blue duck)

Whio is classified as a nationally endangered species, with current populations declining in unprotected areas. A recent estimate, based on surveys and site records, provided a national figure of approximately 2500 individuals (O'Connor *et al*. 2004). Unlike some endangered bird species, blue ducks cannot simply be transferred to off-shore islands to ensure their viability, because they rely on large areas of quality, fast flowing riverine habitat. The continued survival of this species is therefore largely dependent on the protection of secure source populations throughout mainland New Zealand.

Blue ducks are protected in one or more rivers at four of the Operation Ark sites (Wangapeka-Fyfe, Oparara, Landsborough and Clinton-Arthur-Cleddau). The primary method of protection is stoat control and populations being supplemented by Operation Nest Egg (ONE) techniques. These involve the transfer of eggs from breeding pairs, their rearing in captivity and subsequent release back into the wild.

Whio are not significantly affected by rats and possums. Work in Operation Ark and other whio sites has demonstrated that stoat trapping lines along the edge of the rivers is the most effective method of reducing stoat numbers and ensuring breeding success.

Short and long-tailed bat (pekapeka)

One Operation Ark site (Eglinton Valley) has been chosen to protect short and long-tailed bats as well as mōhua and other species (eg, kaka and parakeet). Both the southern short-tailed bat and the long-tailed (South Island) bat are listed as nationally endangered.

The lesser short-tailed bat is the only member of its family, known to still survive. It is found only at a few scattered sites and is divided into three sub-species. The southern short-tailed bat (*Mystacina tuberculata tuberculata* (South Island)) which is in the Eglinton, is also found on Codfish Island and in the northwest Nelson and Fiordland areas.

Historical records and surveys since 1990 show that long-tailed bats are now rare or absent at many sites where formerly they were common on the North and South Islands. They still occur on Stewart Island, Kapiti Island, Little Barrier and Great Barrier islands and in the Eglinton (*Chalinolobus tuberculata* (South Island)).

Research work in the Eglinton has focused on determining where the bats roost and feed. They range over >145 km^2, focussing their use in the oldest red beech forest well into the forest interior. The Department has also been monitoring population size and responses in the population to pest control. Preliminary findings have confirmed a population size of >1000 bats, all of which live in <30 roost trees in the central valley.

2006-07 rat control programmes in the Eglinton have focussed on three sites. They are 400 ha in the lower valley for long-tailed bats, 200 ha in the mid-valley for short-tailed bats and a 400 ha site in the upper valley to protect mōhua. Bats are also to be found in the Dart-Caples and Catlins sites where they will be benefiting from stoat and rat control.

2.3 BUDGET

The Operation Ark budget has been $1,245,000 per annum, from Vote Conservation for the three financial years 2004-07. This does not include Conservancy resources, other species or pest control funding, sponsorship and captive breeding contributions to site work.

The Department shifted an additional $400,000 of funds to Operation Ark (from other deferred biodiversity projects), for the duration of 2006-07 to combat the rat and stoat plague. This enabled aerial 1080 operations to be undertaken to control rats in the Dart-Caples, Hawdon-Poulter and the South Hurunui sites. This additional funding reflected a commitment to achieve the purpose of the Ark programme; to maintain sustainable populations of the four species on the mainland of the South Island. The ability to boost funding in rat plague years is an essential component of the programme.

The current level of funding is sufficient to maintain the current level of infrastructure, stoat control and species and predator monitoring. Its full utilisation for the establishment of limited additional control areas will place greater reliance on external funding injections during rat plagues. Completion of stoat trapping lines and rat control bait stations at the ten Operation Ark sites will require a significant injection of additional funds.

2.4 2006-07 BEECH MAST AND RAT PLAGUE

There was intense beech flowering in most South Island beech forests in the summer of 2005/06. This was followed by very high levels of beech seed in autumn 2006 at all Operation Ark sites.

As rat numbers increased through spring 2006, intensive rat control was initiated in the five sites containing mōhua, orange-fronted parakeets and pekapeka (bats). These are South Hurunui, Hawdon-Poulter, Dart-Caples, Eglinton, Catlins - see Map 2. Rat control continued into winter 2007 until rat numbers dropped in each site.

The low residual populations of mōhua and orange-fronted parakeets in the three Canterbury Valleys has meant that the Department has aimed to keep rat numbers as close to undetectable thresholds as possible and used aerial 1080 as a precautionary measure to ensure this goal.

In the Dart-Caples and Catlins sites, with larger mōhua populations, overall rat numbers have been higher and rat control has focussed on protecting core bird breeding areas. In the Eglinton Valley rat numbers also climbed to very high levels and rat control work concentrated on protecting three key breeding sites for mōhua, short-tailed and long-tailed bats.

Nests of parakeets and mōhua have been monitored in the Canterbury Valleys, the Catlins and the Dart Valley. Adult survival is also being measured using banded individuals. Comparison of sites where predator control has or has not been undertaken, has demonstrated the success or failure of the pest control.

Whio breeding is not significantly affected by rats, but is reliant on stoat control. Whio (supplemented by Operation Nest Egg) have expanded their populations in the 2006-07 summer, at four monitored sites (Wangapeka River (26 more birds), Fyfe River (14 more birds), Oparara (7 more birds) and Clinton/Arthur/Cleddau (Milford) (9 more birds)).

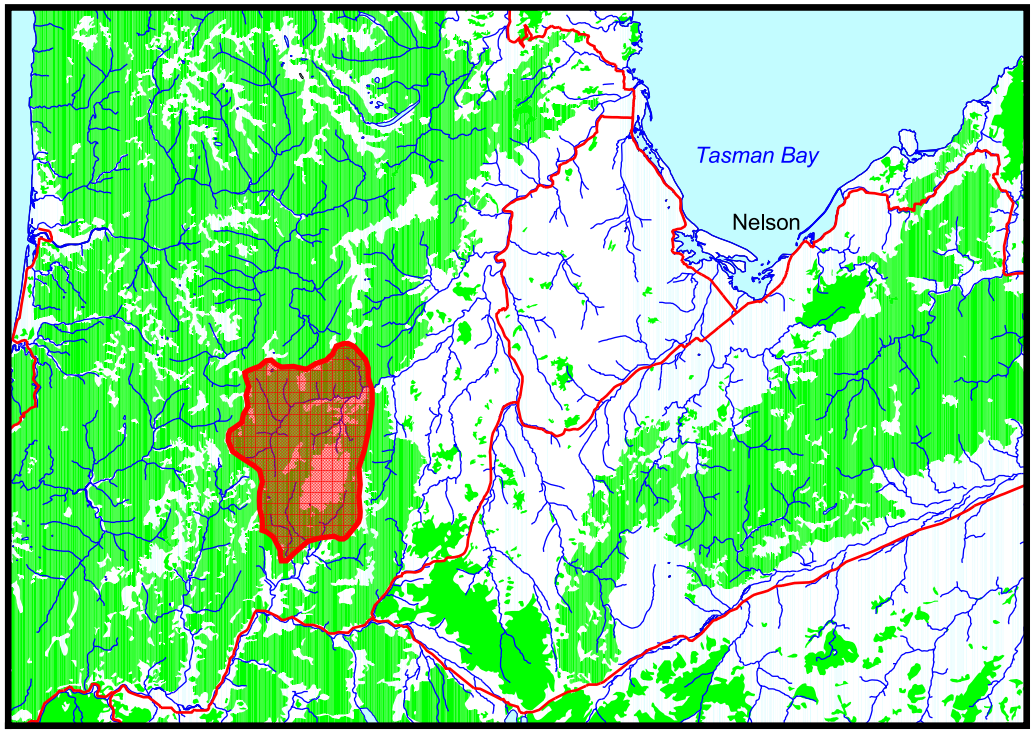
Other species to benefit from Operation Ark include kaka, yellow-crowned parakeet, kiwi and the more common forest birds.

3. Wangapeka-Fyfe

3.1 SITE DESCRIPTION

The Wangapeka-Fyfe Operation Ark site (Map 2) comprises about 30,000 ha of native forest in Kahurangi National Park about 60 km south-west of Nelson.

MAP 2: WANGAPEKA-FYFE OPERATION ARK AREA (RED BORDERED AREA)



The operational area comprises a mosaic of red beech (*Nothofagus fusca*) at low altitudes in the valley floors and silver (*N. menziesii*) and mountain (*N. solandri var. cliffortiodes*) beech elsewhere. A more important feature of the site is that it contains approximately 100 km of river which is suitable habitat for whio.

3.2 KEY SPECIES

The Wangapeka-Fyfe is one of four areas in the South Island identified by the Whio Recovery Group as being a key site for whio conservation. The rivers within the site support a remnant population of whio. There is sufficient habitat to support more than 50 pairs of birds which is the intended outcome of the predator control.

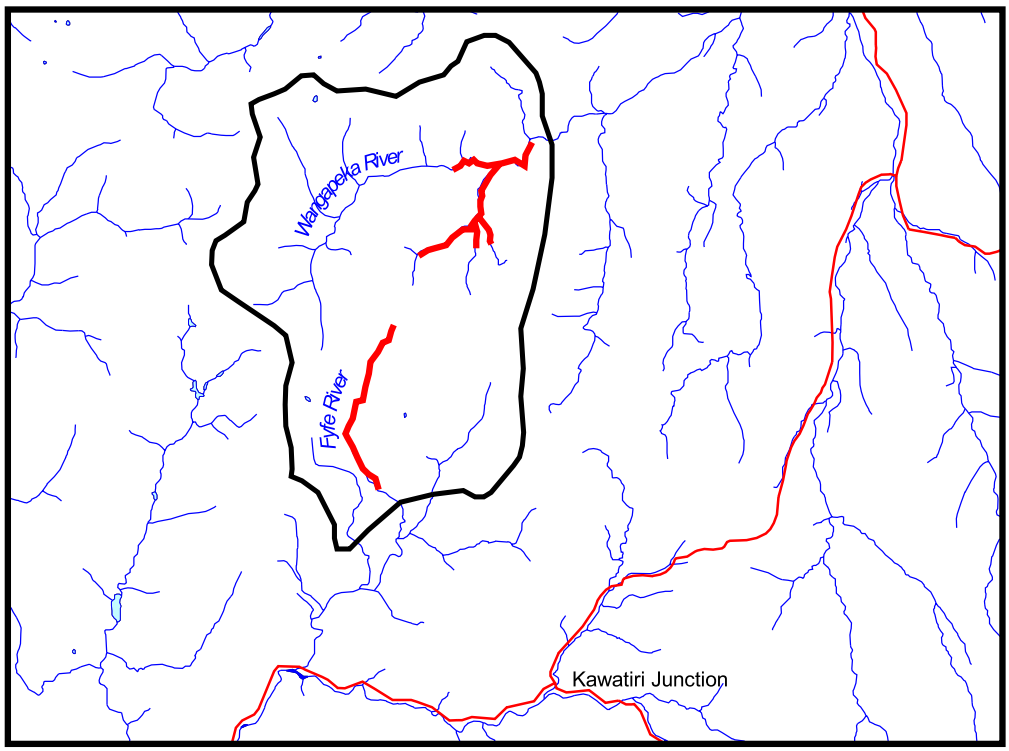
3.3 PRE-OPERATION ARK MANAGEMENT

Before Operation Ark commenced there was a 5 km network of trap lines with traps placed at 100 m intervals for stoat control.

3.4 STOAT CONTROL

Stoat traps have now been set at 100 m intervals along tracks beside approximately 20 km of river (map 2). The traps along the Fyfe River were put in place in 2006, with funding assistance from BDG Synthesis.

MAP 3: STOAT TRAP LINES (THICK RED LINES) IN THE WANGAPEKA-FYFE OPERATION ARK AREA



3.5 OPERATION NEST EGG

To increase the rate at which the whio population increases, eggs from whio nesting in the wild which have little chance of being raised because of high rates of predation, have been harvested. These eggs are hatched and the ducklings raised in captivity, and when old enough to be self-supporting, they have been released back into the wild within the Wangapeka-Fyfe Operation Ark area. So far 34 juveniles have been released back into the wild, 22 of these into the Operation Ark site (Table 2).

TABLE 2: HAND-RAISED WHIO RELEASED INTO THE WANGAPEKA-FYFE OPERATION ARK SITE

YEAR	YOUNG WHIO RELEASED
2003/04	4
2004/05	0
2005/06	11
2006/07	7

3.6 WHIO POPULATION SIZE

Two surveys of whio in the Operation Ark area made in 1998-99 and 2006 show that there have been good increases in whio in the two areas where predator control and releases of Operation Nest Egg whio have been undertaken. In the unmanaged parts of the area, where no predator control was undertaken, there has been an overall decrease in the number of whio (Figure 7).

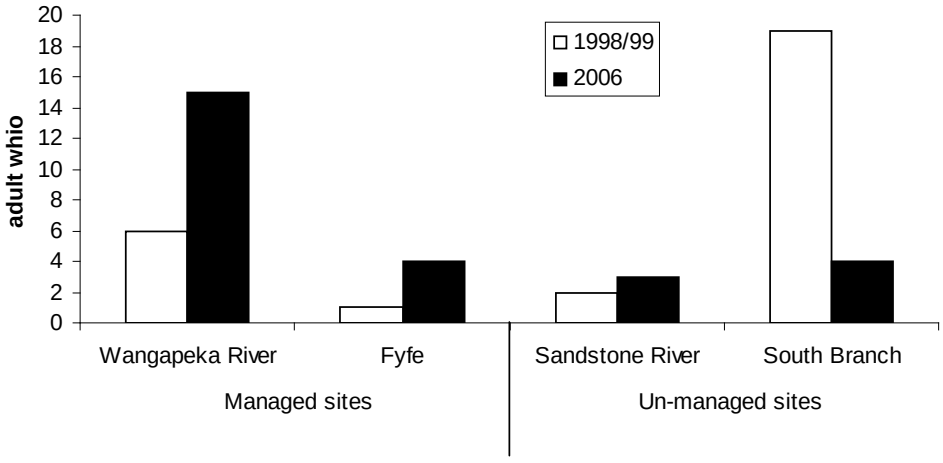


Figure 7: Changes in whio abundance inmanaged and unmanaged parts of the Wangapeka-Fyfe Operation Ark area between 1999 and 2006.

Whio in the Rolling River tributary of the Wangapeka River have been monitored closely since 2003 when predator control started. The numbers of whio has increased dramatically (Table 3).

TABLE 3: NUMBER OF ADULT WHIO RESIDENT IN THE ROLLING RIVER

Year	Pairs	Singles	Total
2003	1	1	3
2004	1	7	9
2005	4	7	15
2006	8	12	28

3.7 SUMMARY

Stoat trap lines in 20 km of the Wangapeka-Fyfe now protect whio on about half of the rivers in the Operation Ark area. Operation Nest Egg has resulted in the release of 22 young whio into the area. These releases combined with the benefits of the stoat trapping regime have led to a substantial increase in the number of adult whio in the intensively managed parts since 1999. Outside the managed part of the Operation Ark area the number of ducks has declined by about 80% since 1999.

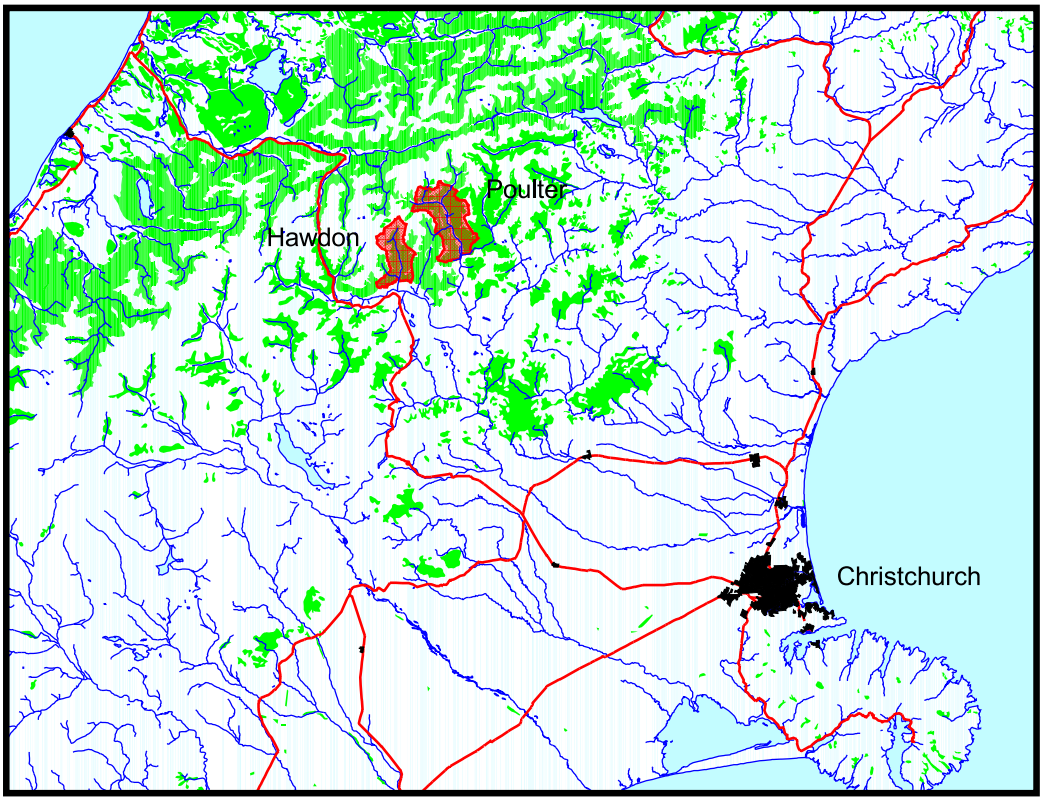
The number of whio in the managed parts of the Operation Ark area is fast approaching its carrying capacity and they will not be able to increase much further unless traplines are established in the remaining parts of the area. Stoat control is currently being extended to the South Wangapeka which has the potential for holding sufficient birds to bring the total Ark site number of whio up to the target of 50 pairs.

4. Hawdon-Poulter

4.1 SITE DESCRIPTION

The Hawdon (5750 ha) and Poulter Valleys (9925 ha) are tributaries of the Waimakariri River and part of Arthur's Pass National Park about 90 km north-west of Christchurch.

MAP 4: HAWDON AND POULTER OPERATION ARK AREA (RED BORDERED AREA)



The operational areas comprise a mosaic of red beech (*Nothofagus fusca*) at low altitudes in the valley floors, with silver (*N. menziesii*) and mountain (*N. solandri* var. *cliffortiodes*) beech elsewhere.

4.2 KEY SPECIES

The Hawdon and Poulter Valleys are two of only three areas in New Zealand with populations of the critically endangered orange-fronted parakeet and they support small populations of mōhua. These two species are the focus of conservation efforts in the site. Both species declined dramatically during a rat plague in 2001. Operation Ark aims to restore mōhua and orange-fronted parakeet populations to safe levels

by controlling predators.

Other species of note within the operational area include great-spotted kiwi, kaka and yellow-crowned parakeet. Whio have also been seen in the Hawdon Valley within the past year.

4.3 PRE-OPERATION ARK MANAGEMENT

In the Hawdon Valley there were 22 km of stoat trapping lines along the valley floor with traps placed every 100 m. 54 km of rat trap lines had been installed, running parallel to the valley floor, with 150 m spacing between trap lines and 50 m between traps. There was no predator control in the Poulter Valley before Operation Ark started.

4.4 RAT CONTROL

Fifteen lines of 10 tracking tunnels have been set up in the Hawdon Valley (Map 5) and 15 lines in the Poulter Valley (Map 6). Tracking tunnel lines are run quarterly when rats are low, but monthly when rat numbers are high.

In the Hawdon Valley bait stations have been placed along 67 km of existing rat and stoat trap lines, and 14 km of new tracks have been cut and had bait stations placed at 25 m intervals along them. There are a total of 1875 bait stations in the valley. The existing 54 km of rat trap lines in the Hawdon Valley have been maintained and checked at regular intervals. There are no rat traps or bait stations in the Poulter Valley. Target levels for rats in the valleys have been set at <5% a one night tracking tunnel operation. This low figure has been chosen because of the critical population levels of mōhua and orange-fronted parakeets at the site.

Prior to 2004 the rat control in the Hawdon Valley was dependent on rat trapping. A moderate beech seedfall in 2004 led to increases in rat abundance despite the trapping, and as a result bait stations in the Hawdon Valley were loaded with brodifacoum and racumin in November 2004. Rat numbers declined dramatically. The decision-making process to move to rat poisoning has been documented in a report prepared for the Minister in 2005 (Parkes *et al.* 2005).

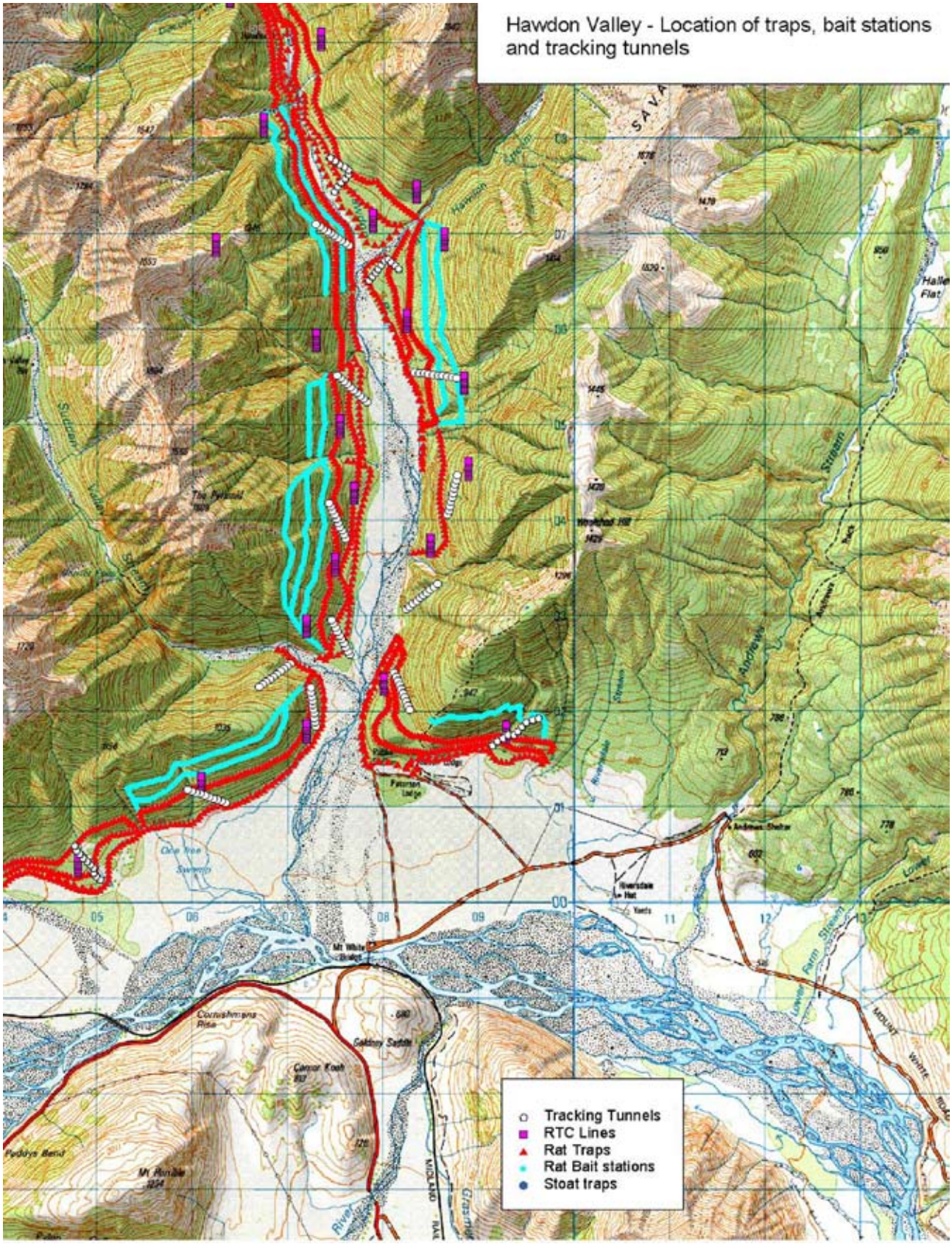
There was no significant seedfall in 2005 and reduced predator risk led to the traps being closed for a period in winter and the bait being removed from the bait stations in September 2005. There was another beech flowering in summer 2005-06 and rat numbers rose in the Hawdon Valley . Brodifacoum was placed in the bait stations in the Hawdon Valley from March 2006.

Despite the brodifacoum, rat numbers rose in late winter 2006. This led to an aerial 1080 drop over 3598 ha in the Hawdon Valley in late September 2006. In the Poulter Valley rising rat numbers and no other control possibilities led to an aerial 1080 drop over 3721 ha at the same time (Map 5). Since then rat numbers have remained low in the Hawdon Valley where bait stations are still operating, but increased slightly in the Poulter Valley until declining in winter 2007 (see Figure 8).

Orange-fronted parakeet. Photo: Dave Crouchley, Department of Conservation

Hawdon Valley. Photo: Kath Walker

MAP 5: RAT AND STOAT TRAPS, RAT BAIT STATIONS, POSSUM RTC (TRAP-LINES) AND TRACKING TUNNEL LINES IN THE HAWDON VALLEY



MAP 6: RAT AND STOAT TRAPS, RAT BAIT STATIONS, POSSUM RTC LINES AND TRACKING TUNNEL LINES IN THE POULTER VALLEY

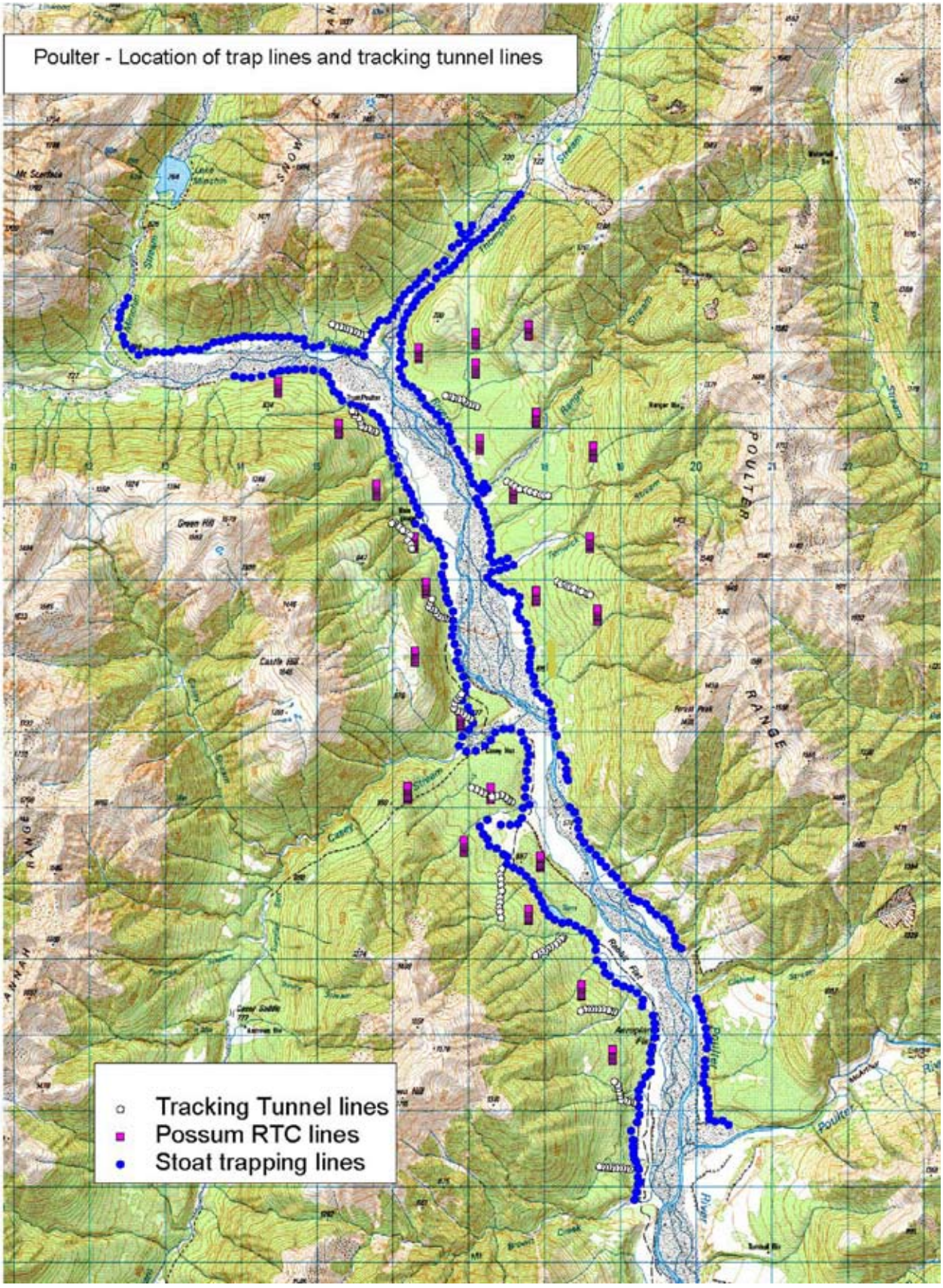
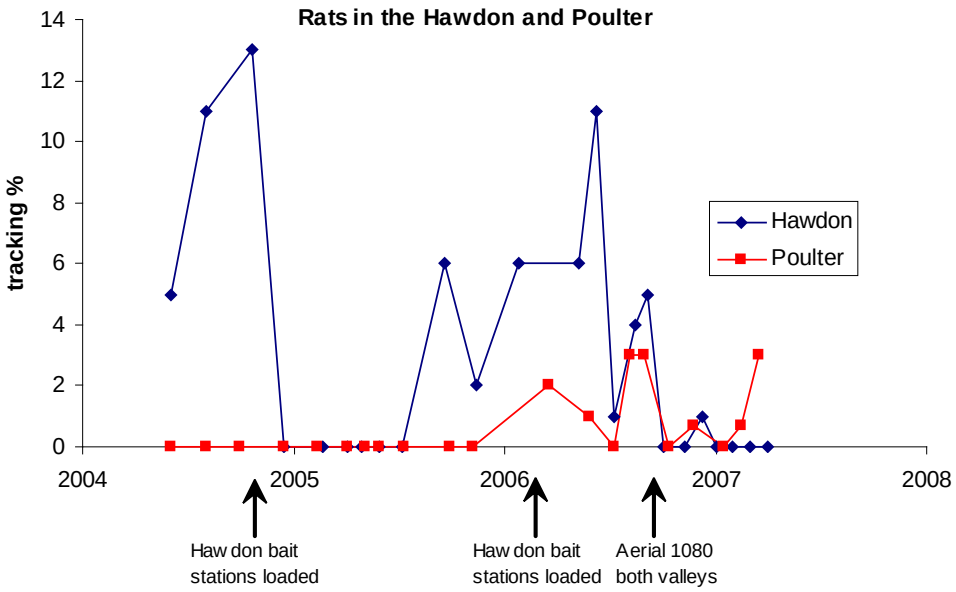
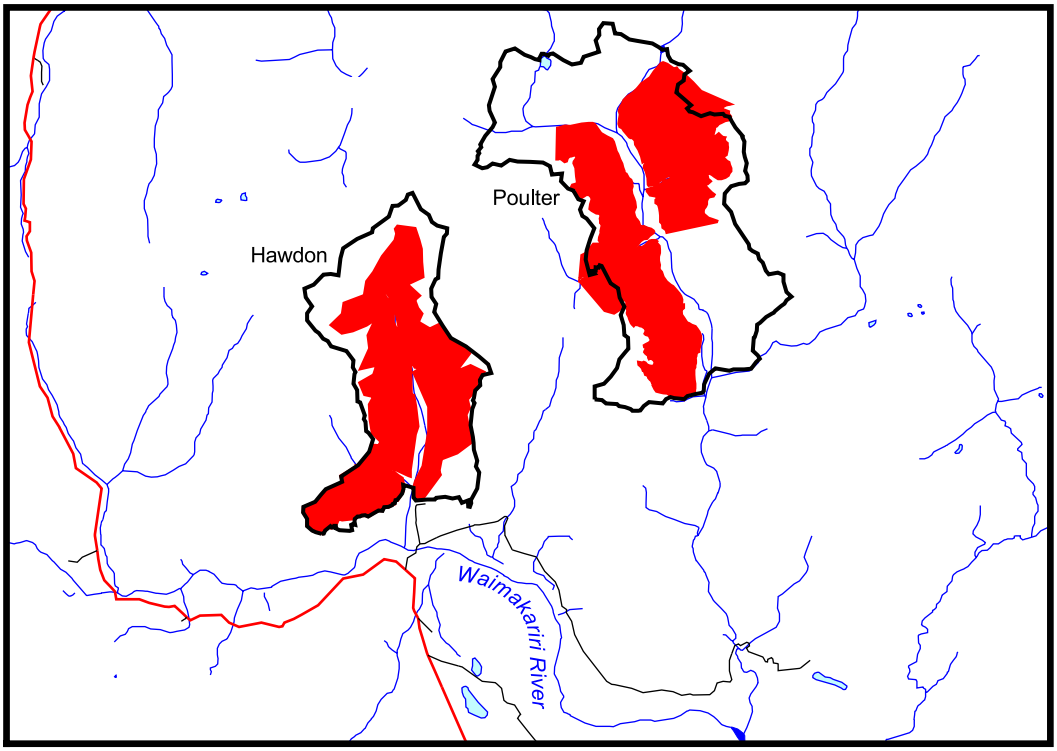


Figure 8: Rat abundance in the Hawdon and Poulter



MAP 7: 3598 HA OF AERIAL 1080 (SOLID RED) IN THE HAWDON VALLEY AND 3721 HA IN THE POULTER VALLEY LAID SEPTEMBER AND OCTOBER 2006



4.5 STOAT CONTROL

Stoats have been trapped in the Hawdon Valley since long before Operation Ark started and their numbers have remained at low levels right through the Operation Ark period. Stoat trapping only started in the Poulter Valley in 2004, and the high numbers initially detected in the valley have now declined to low levels (Figure 9).

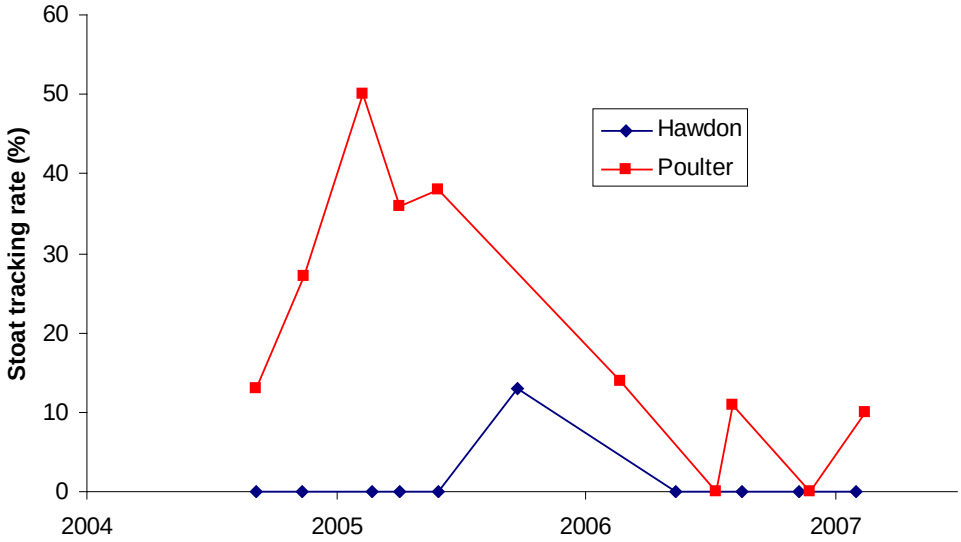


Figure 9: Stoat tracking indices in the Hawdon and Poulter Valleys

4.6 MŌHUA SURVIVAL

Mōhua numbers declined dramatically in both valleys following the heavy beech seed-falls, rat and stoat plagues that occurred in 2001. They are now so rare in the Hawdon and Poulter Valleys that no consistent monitoring is possible, though they are still known to be present. Annual surveys will continue to detect the residual population.

4.7 ORANGE-FRONTED PARAKEET SURVIVAL

Orange-fronted parakeet abundance is monitored by recording the rate at which they are encountered and by searching for nests. All orange-fronted parakeet nests found receive extra protection from predators, including extra traps near nests, and aluminium sheets on the nest trees to prevent predators climbing them (Table 4). Orange-fronted parakeets declined dramatically following the rat plague in 2001, and their numbers have not yet detectably recovered. The rat and stoat control subsequently has however prevented their extinction.

TABLE 4: THE NUMBER OF ORANGE-FRONTED PARAKEET FOUND, MONITORED AND PROTECTED IN THE HAWDON AND POULTER VALLEYS

	NUMBER OF NESTS FOUND	
SEASON	HAWDON	POULTER
2003/04	2	
2004/05	5	1
2005/06	1	1
2006/07		2

4.8 CAPTIVE BREEDING OF ORANGE-FRONTED PARAKEETS

Because the wild orange-fronted parakeet populations were so reduced by the 2001 rat plague, both captive and predator-free island populations have been established as insurance against the possible extinction of orange-fronted parakeets in the Canterbury valleys (see South Branch of the Hurunui). A captive population is maintained at Peacock Springs by the Isaac Wildlife Trust. Two predator-free populations have been established and are successfully breeding on Chalky Island in Fiordland and Maud Island in the Marlborough Sounds.

4.9 SUMMARY

The Hawdon Valley was being trapped for stoats prior to the commencement of Operation Ark because it held a population of orange-fronted parakeets. In 2001 there was a severe rat and stoat plague in both valleys following a heavy beech seeding. Although the stoat control was effective in the Hawdon Valley, the absence of rat control in both valleys and the absence of stoat control in the Poulter Valley at the time meant that both orange-fronted parakeet and mōhua populations declined dramatically in both valleys. Rats had not previously been successfully controlled during a rat plague in high altitude beech forests and the rat control has been of necessity, experimental.

Rat control in the Hawdon Valley in 2004 following a moderate beech mast reduced rat numbers but not sufficiently to allow recovery of mōhua and orange-fronted parakeets. Since 2004 rat control has gradually been intensified. It is likely that the most recent regime – aerial 1080 and brodifacoum in bait stations – is sufficient to protect orange-fronted parakeets and mōhua from decline, but not necessarily sustain a population increase. Protection of mōhua over winter, despite low rat numbers, remains a challenge.

The aerial 1080 operation was essential to ensure the survival of the residual mōhua and orange-fronted parakeets in the valley and had the additional benefit of reducing possums (previously uncontrolled), to a very low level.

The local extinction of orange-fronted parakeets and mōhua has been prevented, but they have not recovered to their pre-2001 levels. The numbers of both the species in the valleys is now so low that their recovery will require the continued implementation of the best predator control regimes. In addition, it will need more intensive monitoring, individual nest protection and the possible reintroduction of birds from captive and predator-free island populations.

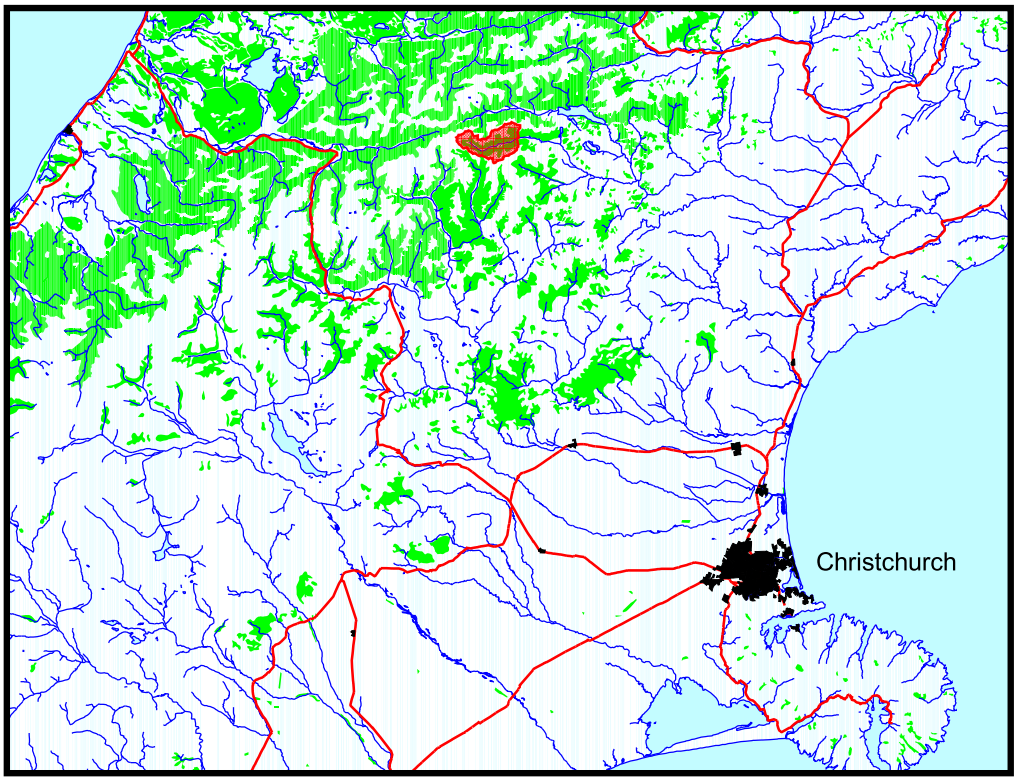
Poulter Valley. Photo: Marion Rhodes

5. South Branch Hurunui

5.1 SITE DESCRIPTION

South Branch Hurunui Operation Ark site (5550 ha) is part of Lake Sumner Conservation Park and is located approximately 40 km southwest of Hanmer Springs and 200 km northwest of Christchurch.

MAP 8: SOUTH BRANCH HURUNUI OPERATION ARK AREA (RED BORDERED AREA)



The operational area comprises a mosaic of red beech at low altitudes in the valley floors and silver and mountain beech elsewhere.

5.2 KEY SPECIES

The South Branch of the Hurunui River is one of only three areas in New Zealand, with populations of the critically endangered orange-fronted parakeet and it supports a population of mōhua. These two species are the focus of conservation efforts in the valley. Both species declined dramatically during a rat plague in 2001. Operation Ark aims to restore these mōhua and orange-fronted parakeet populations to safe levels by controlling predators. Other species of note within the operational area include great spotted kiwi (*Apteryx haastii*), kaka (*Nestor meridionalis*)

and yellow-crowned parakeet.

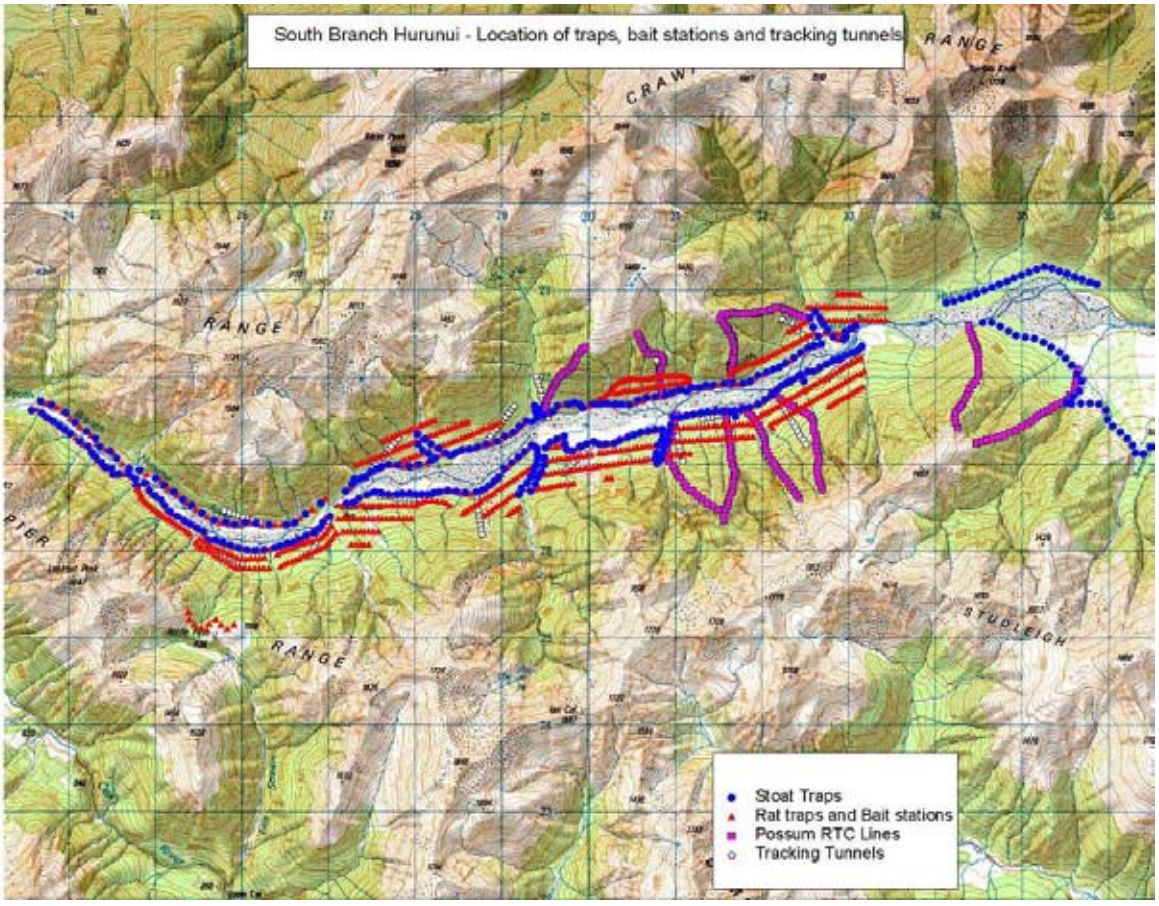
5.3 PRE-OPERATION ARK MANAGEMENT

The South Branch Hurunui is part of the Hurunui Mainland Island which was established in 1995. Intensive stoat and possum control had been in place for more than 10 years. Rat control had started in 2003. Before 2004 there were 27 km of stoat trap lines, 21 km of rodent trap lines and 10 lines of tracking tunnels.

5.4 RAT CONTROL

Tracking tunnels were increased from 10 to 17 lines in 2005, and tunnels are now checked monthly when rat numbers are high. 55 km of rodent bait station lines and 7 km of new rat trap lines have been established since Operation Ark commenced in the area in December 2004 (Map 9).

MAP 9: RAT AND STOAT TRAPS, RAT BAIT STATIONS AND TRACKING TUNNEL LINES IN THE SOUTH BRANCH HURUNUI



Following the rat plague in 2001 rat numbers remained low until 2004. After moderate beech seedfall in the autumn of 2004, rat numbers rose during the spring. Because of the high conservation value of the orange-fronted parakeet population in the valley, poison was put in the bait stations in December 2004. Rat numbers fell but rose again to threatening levels so the bait was maintained in the bait stations. In 2006 there was a heavy beech seedfall and in anticipation of rat numbers rising to high levels, 1080 poison was sown aerially over all the forest (2515 ha) in early October 2006 (see Map 10). Rat numbers fell and have since remained at low levels.

MAP 10: 2515 HA OF AERIAL 1080 IN THE SOUTH BRANCH OF THE HURUNUI

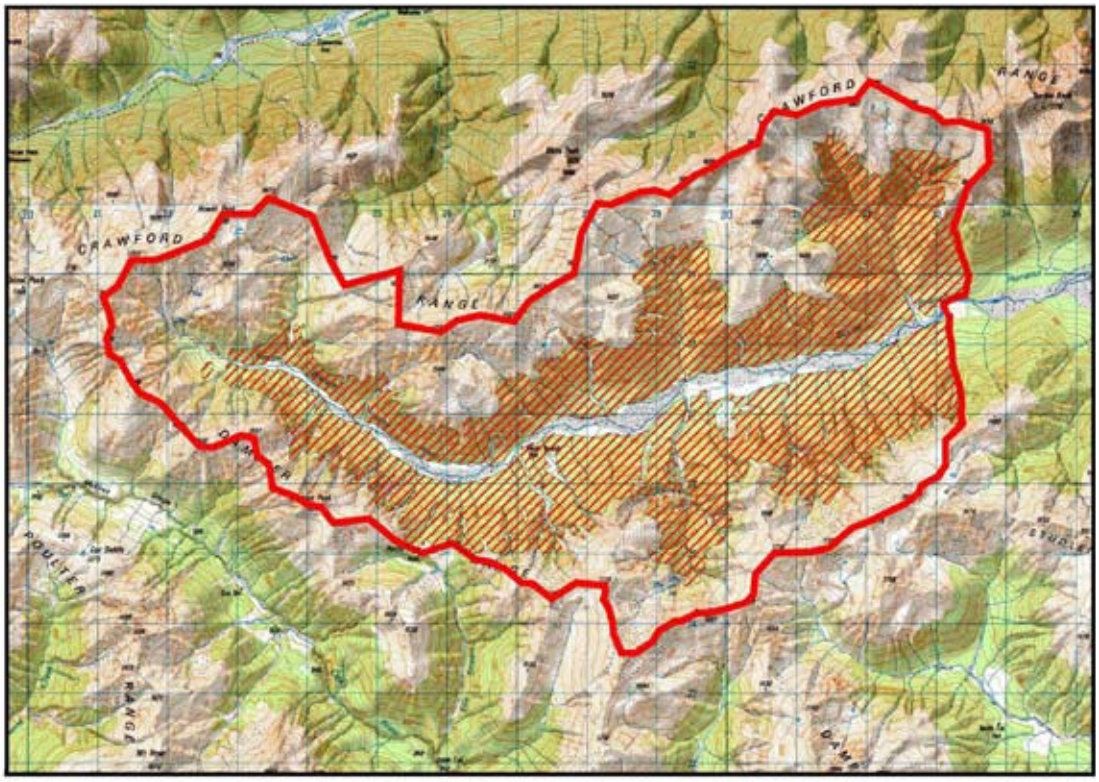
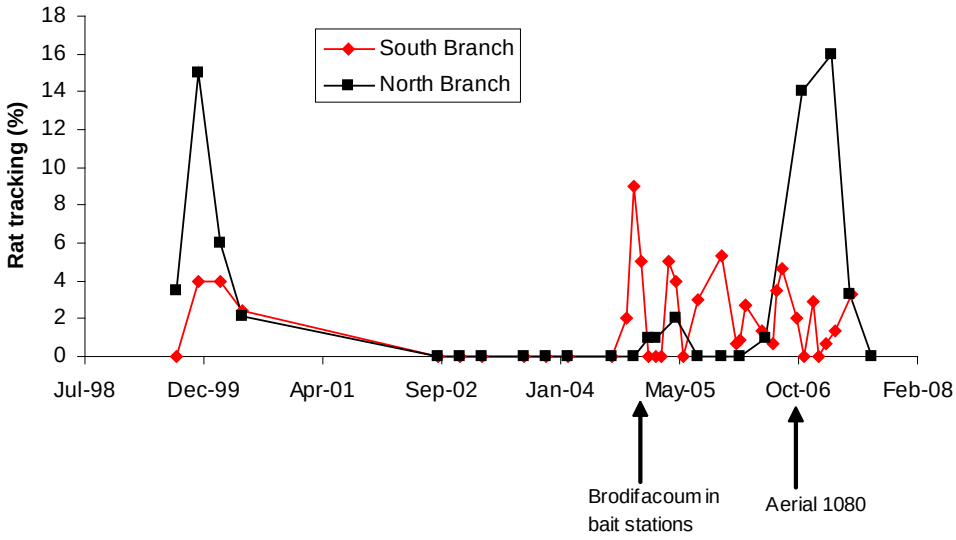


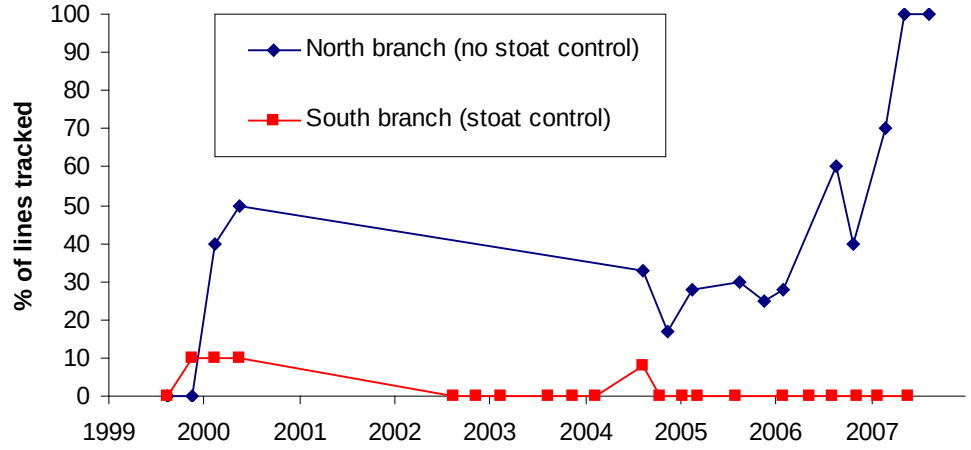
Figure 10: Rat abundance comparisons between the South Branch of the Hurunui and the North Branch (unpoisoned)



5.5 STOAT CONTROL

Tracking tunnels increased from 10 to 17 lines of 10 tunnels in 2005 and are run quarterly for stoats. The 28 km of stoat trap lines in the valley have been checked at regular intervals. Stoats have been kept at low levels throughout the control area (Figure 11).

Figure 11: Stoat tracking indices in the South Branch of the Hurunui comparing trapped with untrapped areas



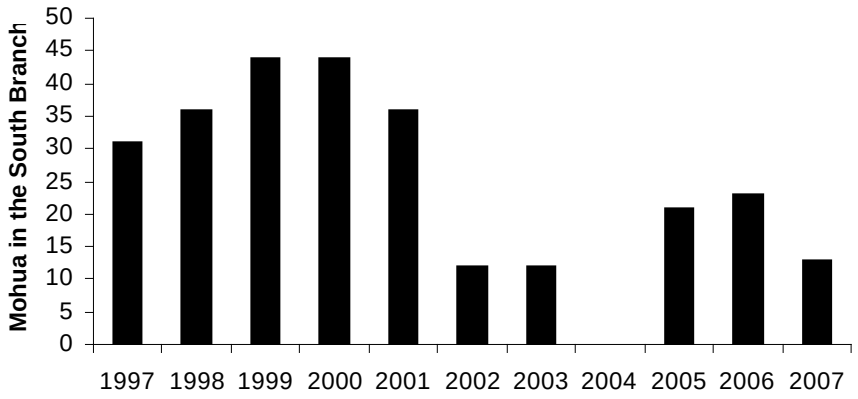
5.6 MŌHUA SURVIVAL

Mōhua have been monitored in the South Branch of the Hurunui, by a programme of nest monitoring, banding and re-sighting.

Mōhua declined dramatically following the rat plague in 2001. Their numbers increased slowly between 2002 and 2006. During the winter of 2006 and the commencement of the rat plague, their numbers once again declined, despite extensive rat poisoning (Figure 12). For the last two years all mōhua nests found in the valley have received extra protection from predators, including extra traps near nests, and aluminium sheets on the nest trees to prevent predators climbing them.

Mōhua mortality in 2006 occurred not during summer nesting but during the winter, despite the relatively low rat abundance (less than 5% tracking). The decline in 2006 was not as great as in 2001 probably because of the poisoning programme, but the most intensive rat control (aerial 1080) was not implemented early enough to protect mōhua during the winter.

Figure 12: Mōhua abundance in the South Branch of the Hurunui

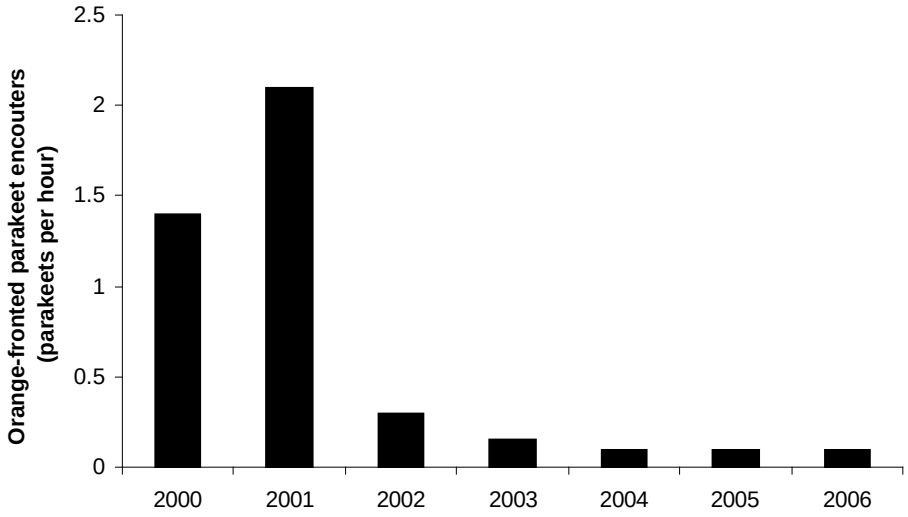


5.7 ORANGE-FRONTED PARAKEETS

Orange-fronted parakeet abundance is monitored by recording the rate at which they are encountered and by searching for nests. All orange-fronted parakeet nests found receive extra protection from predators, including extra traps near nests, and aluminium sheets on the nest trees to prevent predators climbing them.

Orange-fronted parakeets declined dramatically following the rat plague in 2001, and their numbers have not yet recovered, despite predator control efforts (Figure 13).

Figure 13: Orange-fronted parakeet abundance in the South Branch of the Hurunui



The number of orange-fronted parakeet nests found and protected has increased in recent years (Figure 14), though this probably reflects increased search effort rather than increased parakeet abundance.

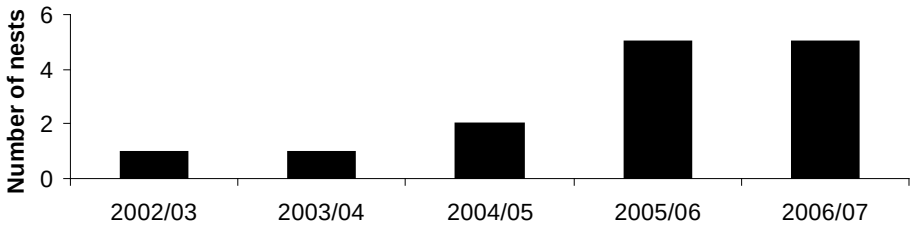


Figure 14: Number of orange-fronted parakeet nests monitored in the South Branch of the Hurunui

During the summer of 2006-7 the nesting success of yellow-crowned parakeets was monitored in the South Branch of the Hurunui as a surrogate for orange-fronted parakeets. The nest sites of the two species are identical and the nesting success of yellow-crowned parakeets thus indicates how successful predator control is at protecting nesting parakeets. Yellow-crowned parakeet nesting success was very high, indicating that predator control during the summer was effective.

5.8 CAPTIVE BREEDING OF ORANGE-FRONTED PARAKEETS

Because the wild orange-fronted parakeet populations were so reduced by the 2001 rat plague, both captive and predator-free island populations have been established as insurance against the possible extinction of orange-fronted parakeets in the Canterbury valleys.

Between February 2003 and March 2004, 29 eggs and chicks were harvested from four orange-fronted parakeet nests in the Hawdon and South Branch of the Hurunui Valleys (two nests from each valley). These birds were hand-raised by the Isaac Wildlife Trust in Christchurch and formed the nucleus of a captive population. Since then 54 birds have been raised by birds in the captive populations and 57 birds have been released onto predator-free islands.

Forty-seven captive raised orange-fronted parakeets were released onto Chalky Island (475 ha) in Fiordland between December 2005 and January 2007. Since their release orange-fronted parakeets have nested, raised chicks, and the first generation of birds raised on the island have also nested. Orange-fronted parakeet numbers have risen steadily on the island.

Ten captive-raised orange-fronted parakeets were released on Maud Island (319 ha) in the Marlborough Sounds in March 2007. By the end of April 2007 three pairs of orange-fronted parakeets, including all three of the male birds released, were observed to be nesting.

5.9 SUMMARY

The South Branch of the Hurunui River was being intensively managed for stoats prior to the commencement of Operation Ark because it is a "mainland island" site, and because it held the largest known population of orange-fronted parakeets. In 2001 there was a severe rat and stoat plague in the valley following a heavy beech seeding. Although the stoat control was effective at controlling stoat numbers, the absence of rat control at the time meant that both orange-fronted parakeet and mōhua populations declined dramatically.

Rat control has since been implemented in the valley in the form of traps, bait stations and aerial 1080. Since rats had not yet been successfully controlled during a rat plague in high altitude beech forests, the rat control that was initiated was of necessity experimental. Rat control in 2004 following a moderate beech mast reduced rat numbers but not sufficiently to allow recovery of mōhua and orange-fronted parakeets. Since 2004 rat control has gradually been intensified. It is likely that the most recent regime – aerial 1080 and brodifacoum in bait stations – is sufficient to protect orange-fronted parakeets and mōhua from decline, but not necessarily sustain a population increase. Protection of mōhua over winter, despite low rat numbers, remains a challenge.

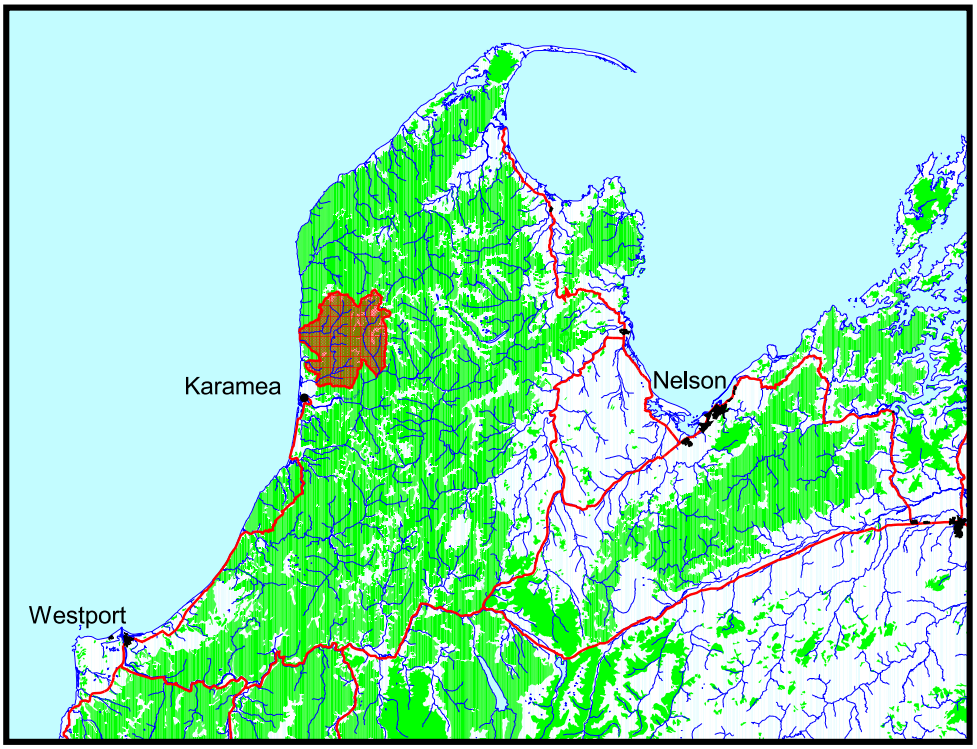
The aerial 1080 operation was essential to ensure the survival of the residual mōhua and orange fronted parakeet in the valley. This intensified rat control has prevented the local extinction of orange-fronted parakeets and mōhua, but they have not recovered to their pre-2001 levels. The numbers of both species in the valley is now so low that their recovery will require the continued implementation of the best predator control regimes. In addition it will need more intensive monitoring, individual nest protection and possibly the re-introduction of birds from captive and predator-free island populations.

6. Oparara-Ugly

6.1 SITE DESCRIPTION

The Oparara-Ugly Operation Ark site (Map 11) comprises about 33000 ha of indigenous forest in Kahurangi National Park about 5 km north of Karamea.

MAP 11: OPARARA-UGLY OPERATION ARK AREA (RED BORDERED AREA)



The operational area comprises a mix of podocarp-hardwood forest at low altitudes and beech forests at higher altitudes. An important feature of the site is that it contains more than 70 km of river which is suitable habitat for whio in the catchments of the Kohaihai, Oparara and Ugly Rivers.

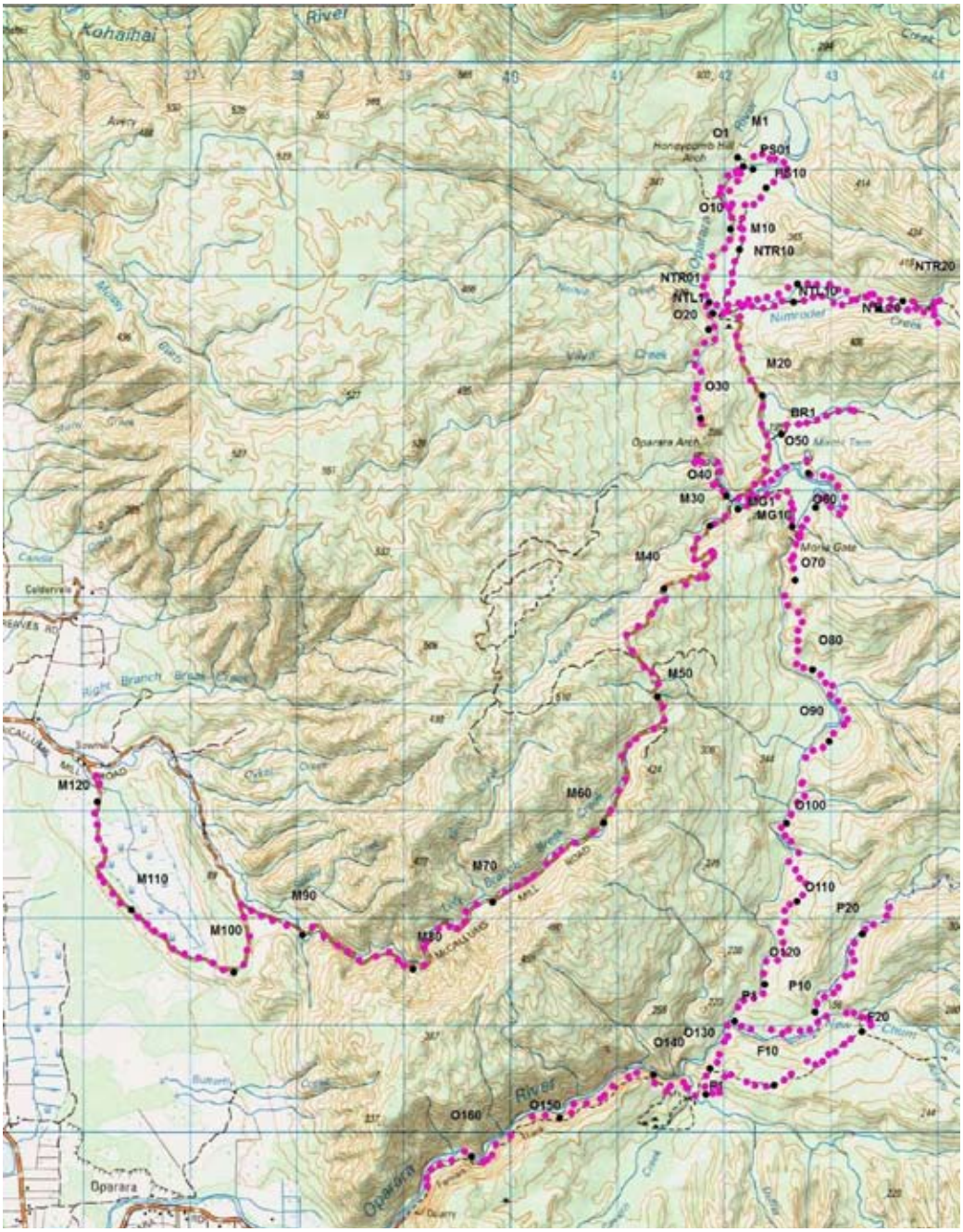
6.2 KEY SPECIES

The Oparara-Ugly is one of four areas in the South Island identified by the Whio Recovery Group as being a key site for whio conservation. The rivers within the site support a remnant population of whio and there is sufficient habitat to support more than 50 pairs of birds. The aim of the predator control is to allow whio to reach this target.

The Oparara-Ugly area also supports populations of short-tailed bat, great spotted kiwi, the giant land snail (*Powelliphanta annectens*), kaka, yellow-crowned parakeet, weka (*Gallirallus australis*) and most common forest birds.

6.3 PRE-OPERATION ARK MANAGEMENT

In August 2002 stoat trap lines had been established along sections of the Oparara River and tributaries known to be inhabited by whio (Map 12). A line was also run along the only access road into the valley. There was a trap every 100 m along the 42 km of trap line which protected approximately 20 km of river. Traps are checked monthly. The establishment of these trap lines was financed by Solid Energy New Zealand Ltd.



6.4 STOAT CONTROL

Thirteen new tracking tunnel lines have been put in place since Operation Ark started, and this expansion was financed by sponsorship from Solid Energy New Zealand Ltd.

6.5 WHIO POPULATION SIZE

Whio living on the Oparara catchment have been monitored closely since 2002, and the whio population has grown in this time (Table 5).

TABLE 5: BANDING, MONITORING AND BREEDING RECORDS FOR EACH WHIO BREEDING SEASON SINCE 2002/03

	2002/03	2003/04	2004/05	2005/06	2006/07
Resident pairs	2	2	3	7	11
Pairs known to have nested	1	1	1	8	4
Ducklings fledged	4	4	3	15	7

Whio populations were surveyed in the Ugly catchment in December 2005 and in the Kohaihai catchment in January 2007. Seventeen adult whio were seen in the Ugly and seven in the Kohaihai.

6.6 SUMMARY

Forty-two kilometres of stoat trap lines in the Oparara-Ugly now protect whio on less than a third of the rivers in the Operation Ark area, and within this area the number of whio has increased. Other catchments within the area have been surveyed and found to support good numbers of whio, though these populations are almost certainly declining.

The number of whio in the managed parts of the Operation Ark area is fast approaching its carrying capacity. Whio will not be able to increase much further unless predator control is undertaken in the remainder of the area. The Ugly River is the first priority for additional stoat control.

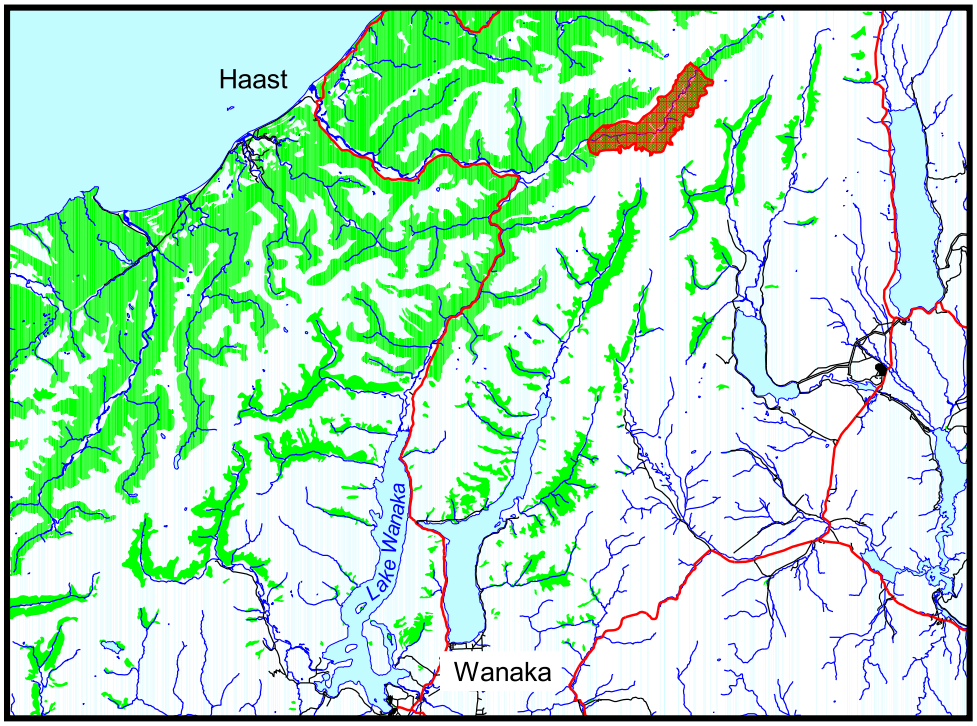
None of the whio protection and monitoring work in the Oparara-Ugly has yet been financed by Operation Ark, but the extensions to the trapping lines that are clearly needed are likely to be Operation Ark funded.

7. Landsborough

7.1 SITE DESCRIPTION

The Landsborough Operation Ark site (Map 13) comprises about 9000 ha of native forest and riverbed in the Landsborough Valley 35 km east of Haast and 80 km north of Wanaka.

MAP 13: LANDSBOROUGH OPERATION ARK AREA (RED BORDERED AREA)



The forests of the Landsborough Operation Ark area are dominated by silver beech and have no other canopy species.

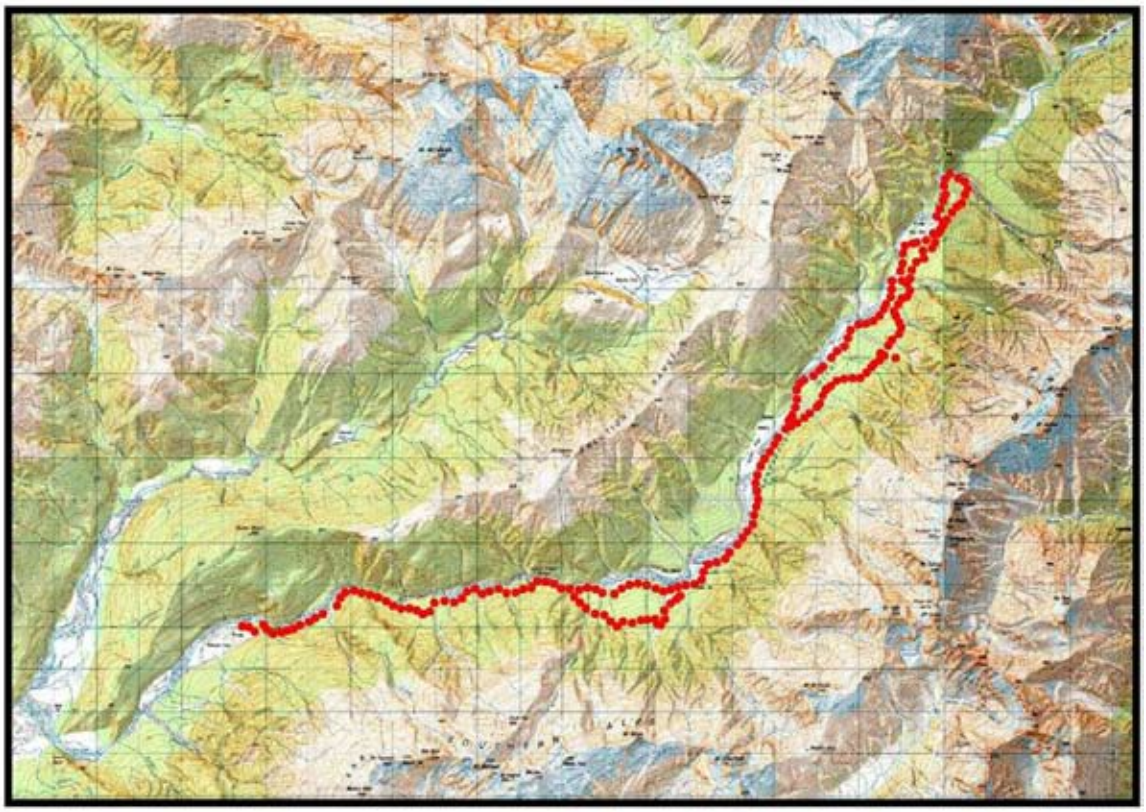
7.2 KEY SPECIES

The Landsborough has a large population of the nationally endangered mōhua, and a small population of the nationally endangered whio. Mōhua are the focus of activity in the Landsborough and the aim of the programme is to maintain numbers at approximately their current levels.

7.3 PRE-OPERATION ARK MANAGEMENT

In the valley 39 km of stoat trapping lines with two traps in a tunnel every 200 m (Map 14) had been installed. A five-year cycle of aerial 1080 operations to control possums had been undertaken.

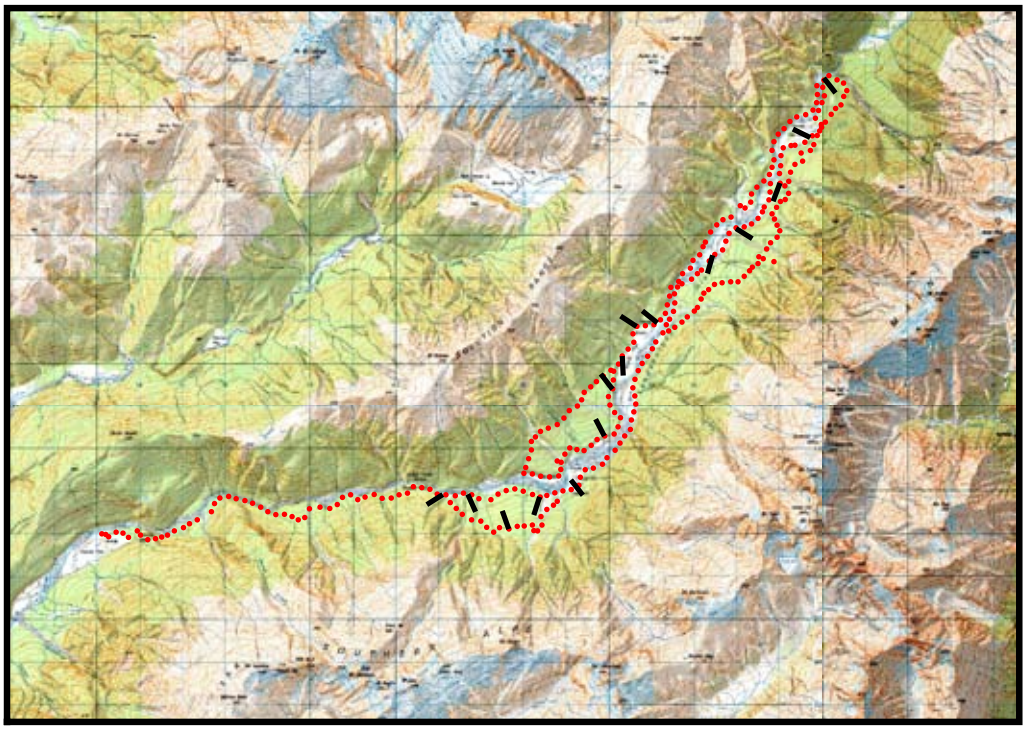
MAP 14: STOAT TRAPS IN THE LANDSBOROUGH BEFORE OPERATION ARK STARTED



7.4 PREDATORS

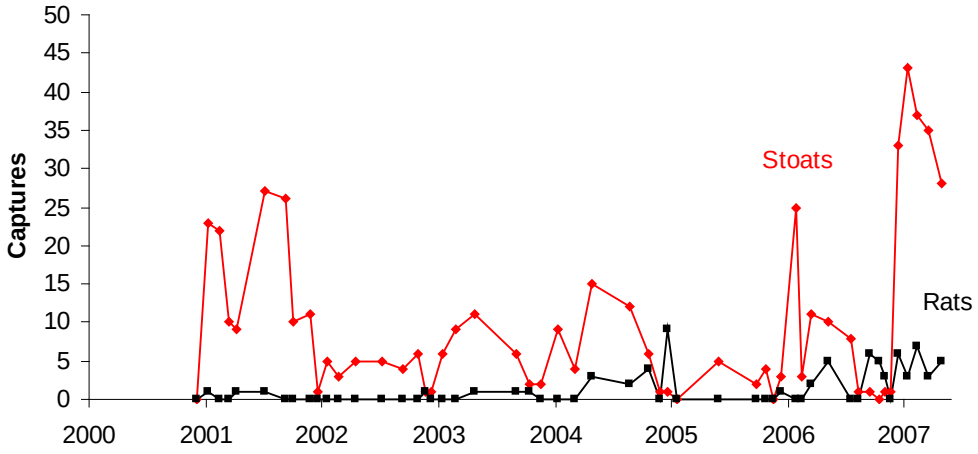
Between December 2005 and November 2006 a further 17 km of stoat trap lines were installed, bringing the total to 56 km of stoat lines with 280 double set tunnels (560 traps) protecting approximately 1500 ha. This was undertaken with the assistance of funding from Queenstown Rafting Ltd. In March 2006, 15 lines of 10 tracking tunnels were installed (Map 15).

MAP 15: STOAT TRAPS AND TRACKING TUNNEL LINES CURRENTLY IN THE LANDSBOROUGH. RED DOTS ARE STOAT TRAPS, AND SHORT BLACK LINES ARE TRACKING TUNNEL LINES



Stoat numbers were reduced to low levels during the first year after the traps were established in 2000, and there has been a short peak of captures during the last summer following a beech mast in the autumn of 2006. Rats are uncommon in the Landsborough (Figure 15).

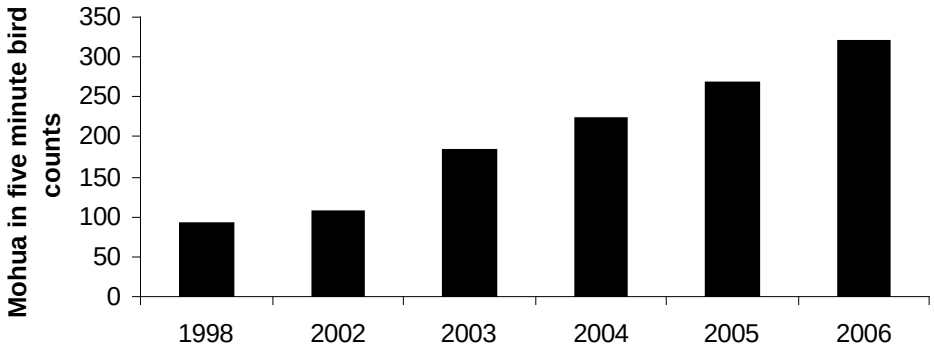
Figure 15: Rat and stoat captures in the stoat traps in the Landsborough



7.5 MŌHUA

Mōhua have increased in abundance since stoat trapping was first instigated (Figure 16).

Figure 16: Mōhua recorded in five minute bird counts in the Landsborough Valley



7.6 SUMMARY

A well established network of stoat traps existed in the Landsborough before Operation Ark and this trapline has recently been extended to cover both sides of the valley. Ship rats are rare in the valley and the presence of only one beech species in the valley means that rat numbers are unlikely to rise to a level where they significantly impact on mōhua. A ground-based control regime for rats is unlikely to be necessary.

There has been an almost threefold increase in mōhua abundance in the valley since the stoat traps were installed. Stoat control benefits both mōhua and whio. Future survey work will determine the baseline population of whio and help develop any improvements to the stoat control programme.

In the future the stoat trap lines could be extended to protect a greater area of mōhua habitat and to protect the small numbers of whio that occur in parts of the valley and its tributaries.

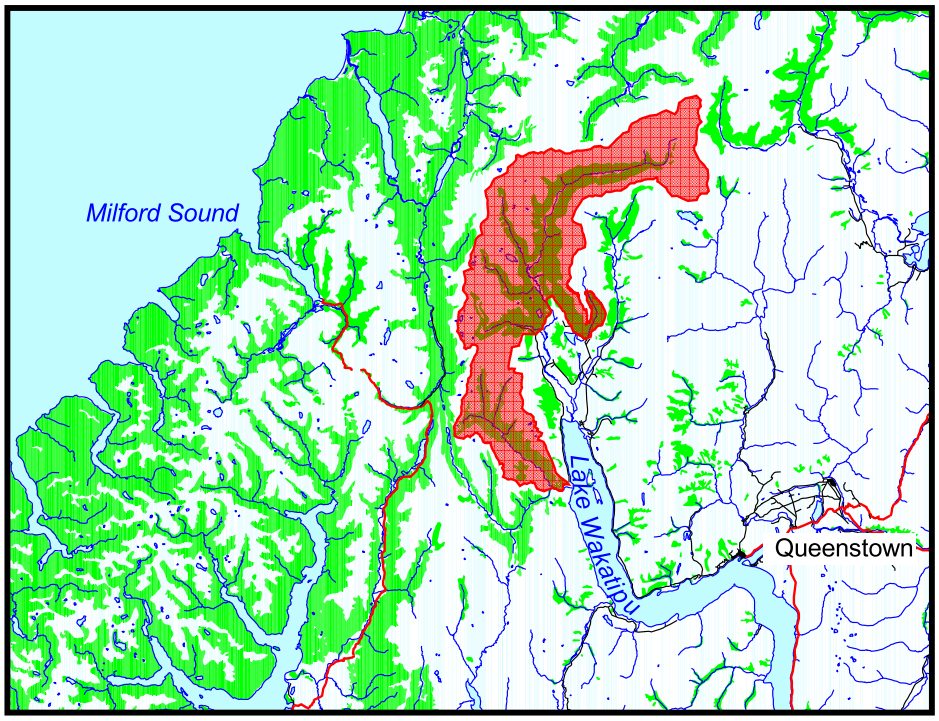
Whio. Photo: Rod Morris

8. Dart-Caples

8.1 SITE DESCRIPTION

The Dart-Caples Operation Ark site (Map 16) comprises 72,000 ha of native forest, and alpine tops (or 25,000 ha of forest) in Mt Aspiring National Park (35,5543 ha) about 30 km west of Queenstown.

MAP 16: DART-CAPLES OPERATION ARK AREA (RED BORDERED AREA)



The operational area comprises a mosaic of red beech at low altitudes in the valley floors and silver and mountain beech elsewhere.

8.2 KEY SPECIES

The Dart-Caples has one of the three largest remaining populations of nationally endangered mōhua, probably about 25% of the current population. Mōhua are the focus of predator control efforts in the Dart-Caples and the aim of the predator control is to maintain mōhua populations at approximately their current levels.

Other species of note within the operational area include long-tailed bat and the scarlet mistletoe (*Peraxilla colensoi*), kaka, yellow-crowned parakeet, whio and rock wren (*Xenicus gilviventris*).

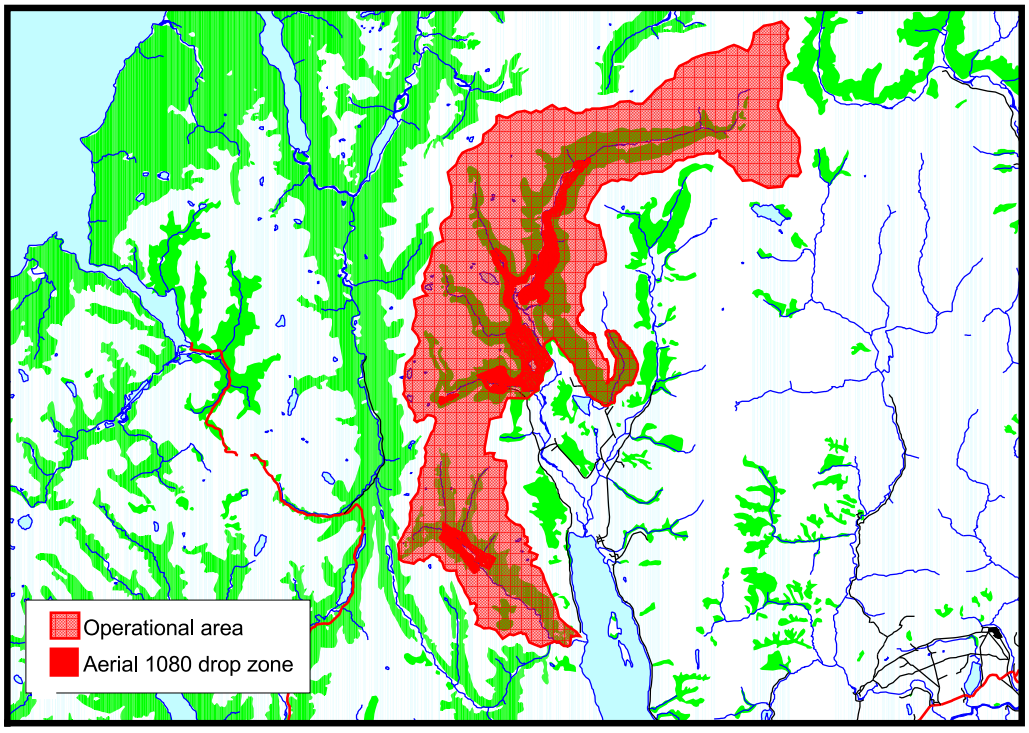
8.3 PRE-OPERATION ARK MANAGEMENT

Before Operation Ark commenced the Dart-Caples Valley already had an extensive area of stoat control and regular monitoring. This included 75 km of stoat trap line protecting 7500 ha, 20 lines of 10 tracking tunnels run quarterly for rodents and stoats, 20 mōhua transects and 80 five minute bird counts run annually and eight seed fall trays.

8.4 RAT CONTROL

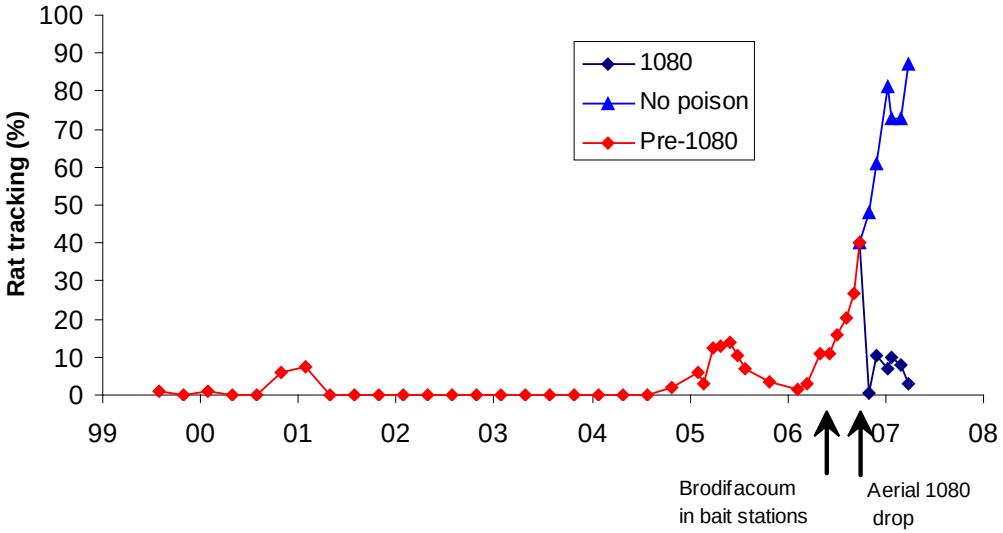
Tracking tunnels increased to 26 lines of 10 tunnels in 2004-05 and 40 lines in 2005-06. The tracking tunnels are now run six times a year. Since the start of Operation Ark in 2004, 2700 rat bait stations have been set out at 100 × 100 m intervals to protect 3000 ha of the best mōhua habitat in 2004-05.

MAP 17: 5600 HA OF AERIAL 1080 IN THE DART-CAPLES



Small increases in rat abundance occurred in the summers of 2001-02 and 2004-05. During the winter of 2006 rat numbers increased steadily in response to a heavy beech seedfall in the preceding autumn. Brodifacoum rat poison placed in bait stations in June 2006 proved ineffective at stopping the increasing rat population. 1080 applied aerially over 5600 ha (see Map 17) in October 2006 dramatically reduced rat numbers and they have been maintained at low levels by continued application of brodifacoum in bait stations. Rat numbers continued to increase in areas not treated with poison (Figure 17)

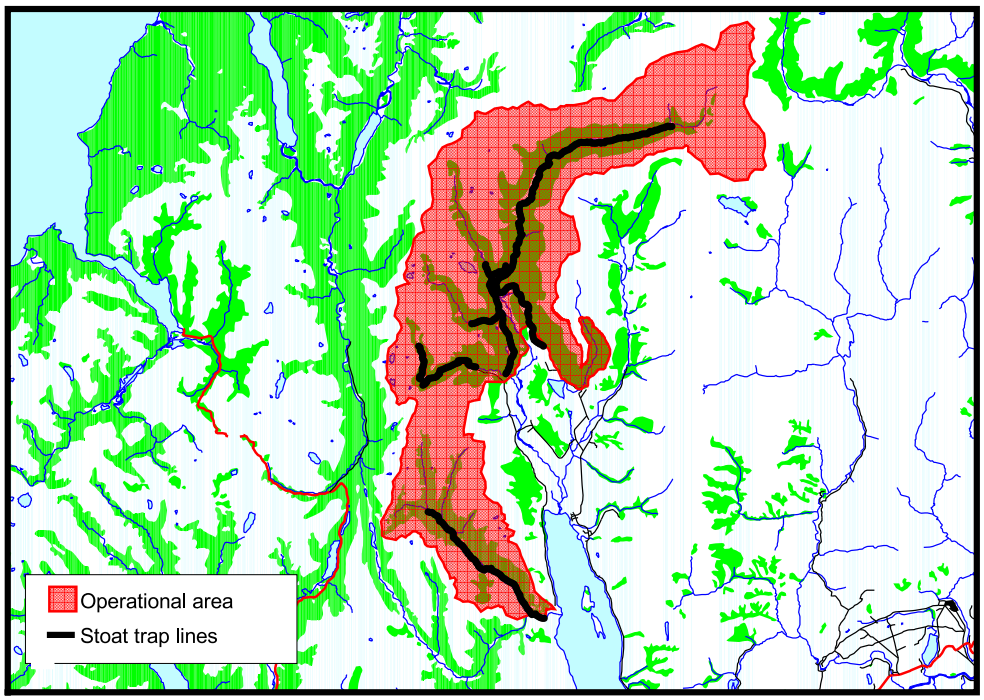
Figure 17: Rat abundance in the Dart-Caples



8.5 STOAT CONTROL

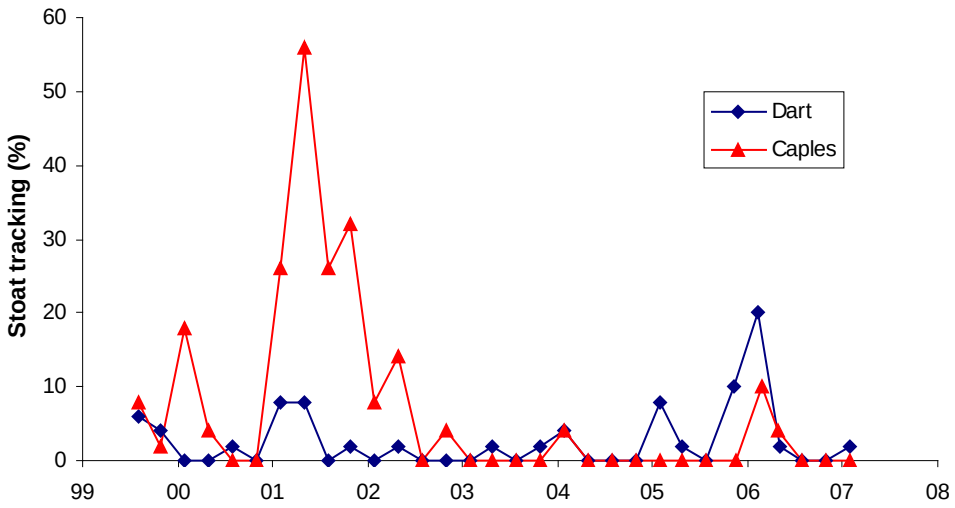
After Operation Ark started, the stoat and rat tracking tunnels were increased to 26 lines of 10 tunnels in 2004-05 and 40 lines in 2005-06. The stoat trap lines were increased by 10 km in 2004-05, and increased by a further 15 km in 2005-06, bringing the total to 100 km of trap lines protecting 10,000 ha (Map 18).

MAP 18: STOAT TRAP LINES IN THE DART-CAPLES OPERATION ARK AREA



Since trapping was started stoat tracking indices have remained at levels enabling mōhua population survival (Figure 18). The peak of stoat abundance recorded in the Caples valley in 2001-02, was before stoat trapping commenced.

Figure 18: Stoat tracking indices in the Dart and Caples valleys within the Dart-Caples Operation Ark area



8.6 MŌHUA SURVIVAL

In 2004-05, 10 mōhua nests were monitored. This was increased to 18 in 2005-06. In 2006-07, 24 mōhua nests were monitored in areas in which predators were controlled (stoat traps, aerial 1080 poison, and brodifacoum in bait stations) and six nests were monitored in a small area where there was no predator control. Mōhua nesting success was high enough to sustain population numbers in the area where predators were controlled and unsustainably low where predators were not controlled. This demonstrates that the predator control was successful and necessary.

8.7 SUMMARY

Since Operation Ark was implemented in the Dart-Caples stoat control has been expanded to cover approximately 10,000 ha of the best mōhua habitat and appears to be controlling stoats to levels consistent with the maintenance of a healthy mōhua population. Rat bait stations have been placed in 3000 ha. Rat numbers were sufficiently low prior to the winter of 2006 that rat control was unnecessary, but during the winter of 2006 rat numbers rose steadily in response to the heavy beech seedfall in the autumn. Brodifacoum rat poison was put in the bait stations but proved ineffective at that time (for reasons that may be related to the type of bait station and abundance of seed food supply).

To achieve rat control, 1080 poison was dropped from the air over 5600 ha in October 2006. The 1080 effectively reduced rat numbers which have been maintained at relatively low levels by the continued use of brodifacoum in bait stations. Mōhua nesting success was high in the areas where poison was used, but too low to enable continued presence of mōhua elsewhere.

Mōhua are still abundant in many parts of the Dart-Caples Operation Ark area, though their numbers will have declined in all but the areas treated with both 1080 and brodifacoum last summer. Increasing and intensifying the area for bait station control of rats is the next challenge for site managers.

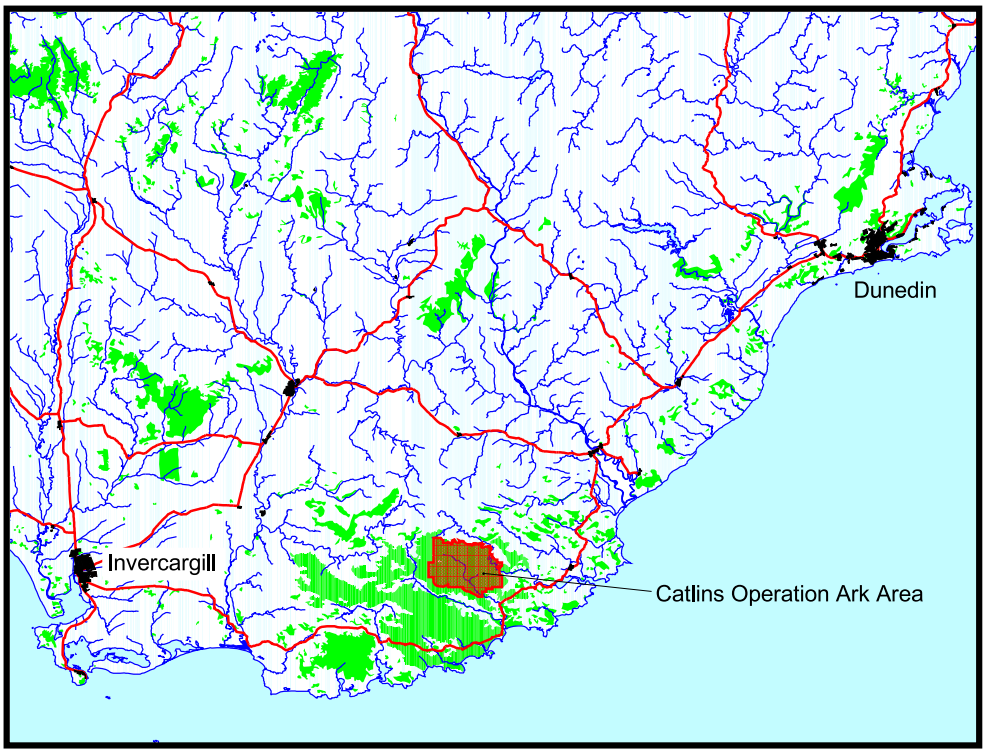
Mohua. Photo: Michael Eckstaed (michael@naturephoto.co.nz)t

9. Catlins

9.1 SITE DESCRIPTION

The Catlins Operation Ark site (Map 19) comprises 12,651 ha of native forest, which is part of the Catlins Conservation Park (53,000 ha) which is about 100 km southwest of Dunedin. This forest is the largest remaining area of native forest on the east coast of the South Island.

MAP 19: CATLINS CONSERVATION PARK AND THE OPERATION ARK AREA (RED BORDERED AREA)



The Operational Area comprises a mosaic of predominantly silver beech, with fringes of Podocarp-hardwood forest, and subalpine yellow-silver pine (*Lepidothamnus intermedius)* - cedar (*Libocedrus bidwillii*) forest. Unlike most other Operation Ark sites, the Catlins is nota single montane valley, but rolling country dissected by steep-sided streams. This presents some special problems for the control of rats and stoats whose movement is not limited by high mountain ranges as it is in most of the other Operation Ark sites.

9.2 KEY SPECIES

The Catlins has one of the three largest remaining populations of nationally endangered mōhua, probably about 25% of the current population. Recent surveys show that two to three thousand mōhua are present in about 8500 ha of the operational area. Mōhua are the focus of predator control efforts in the Catlins and the aim of the predator control is to maintain mōhua populations at approximately their current levels.

Red and yellow-crowned parakeets are present and the red-crowned parakeet population may be the largest remaining on the New Zealand mainland. Other species of note within the operational area include long-tailed bat and the scarlet mistletoe *Peraxilla colensoi*. Kaka and whio were present within the last 20 years. The forest has good populations of most common forest birds, and kereru (*Hemiphaga novaeseelandiae*) are conspicuously abundant.

9.3 PRE-OPERATION ARK MANAGEMENT

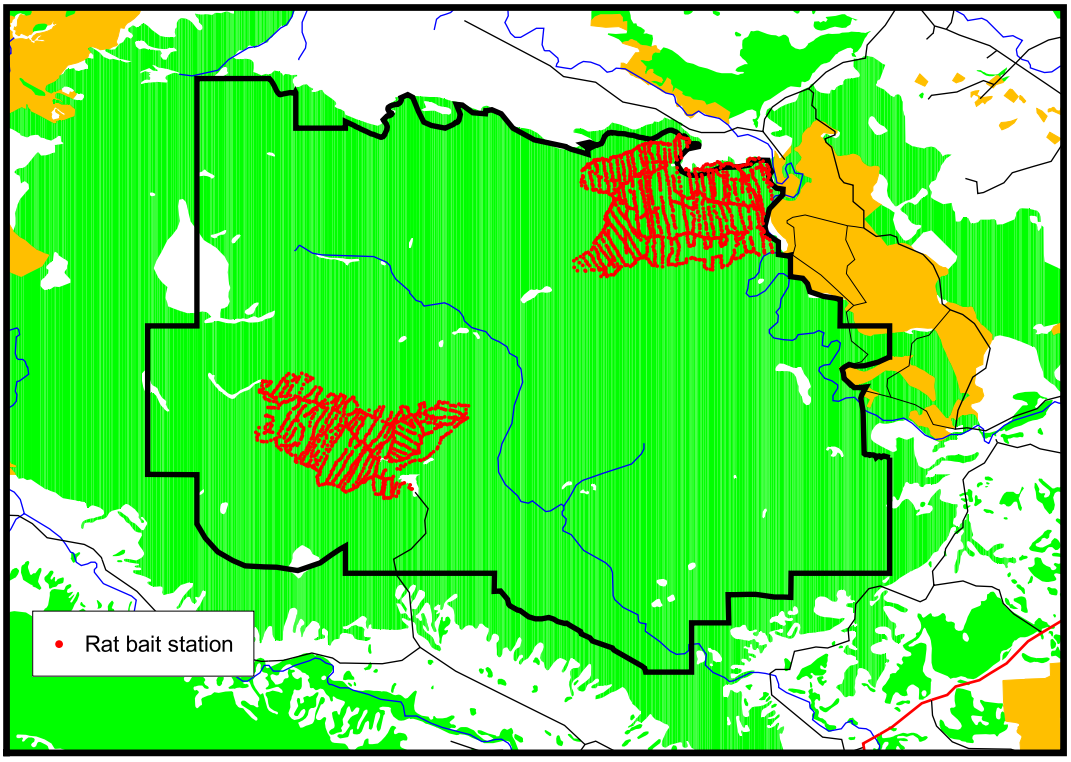
Prior to Operation Ark there was some monitoring and protection of the mōhua population, and some monitoring of beech seedfall and stoat abundance. Periodic distribution surveys of mōhua occurred, a small network of stoat trapping lines protected an area of less than 2000 ha, and some tracking tunnel lines were run. There was no rat control. The Animal Health Board undertook aerial 1080 possum control across the site every five years.

9.4 RAT CONTROL

Rat monitoring along 25 tracking tunnel lines was started in November 2002 and carried out quarterly until rat numbers rose in spring 2004, after which rats were monitored monthly. Sixteen new tracking tunnel lines that conformed to new DOC standards were added to 10 of the original lines in May 2006.

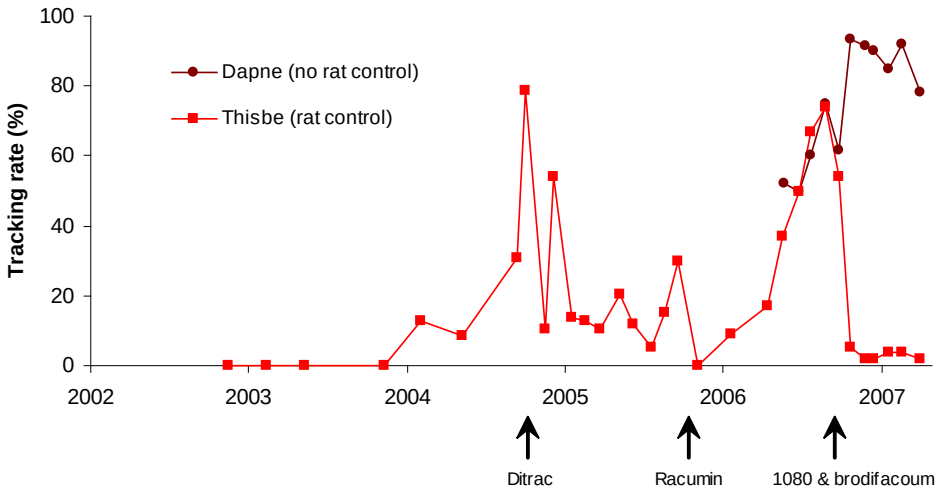
Two rat poisoning grids covering a total of about 1500 ha in the Thisbe Stream catchment and the Hunter Hills were established in 2004 (Map 20). The original KK bait stations were replaced with more expensive and more effective Philproof bait stations in 2004, and the density of bait stations was doubled in 2006. The majority of the site still lacks rat bait station control.

MAP 20; RAT BAIT STATIONS IN THE THISBE STREAM CATCHMENT (UPPER RIGHT) AND THE HUNTER HILLS (BOTTOM LEFT)



In response to beech seed-falls, rat numbers increased dramatically in parts of the Catlins during the winter of 2004, but were subsequently suppressed in Thisbe Stream when Ditrac poison was put in the bait stations. In the following winter rats were controlled by Racumin poison in the Thisbe bait stations. Rat numbers rose again in parts of the Catlins in winter 2006 after a heavy seedfall in the autumn, and were suppressed to very low levels by the use of 1080 followed by brodifacoum in the bait stations in Thisbe Stream (see Figure 19).

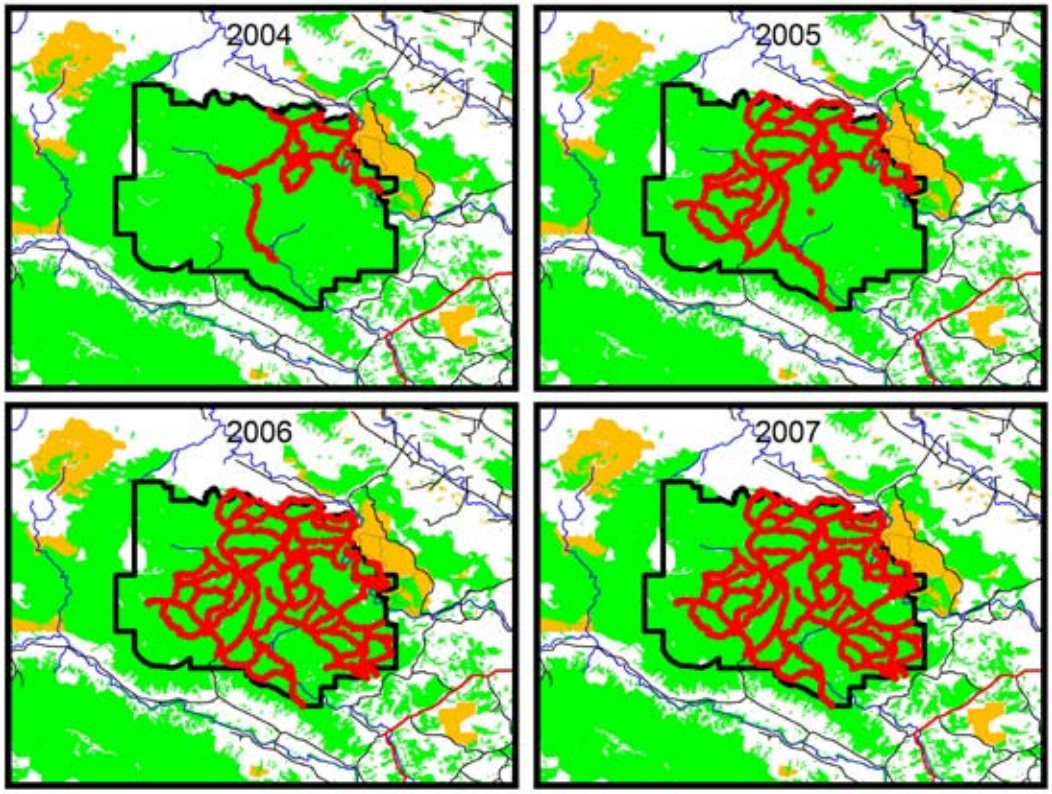
Figure 19: Rat numbers in Thisbe Stream control area compared with rat numbers in the adjacent uncontrolled Daphne Stream area



9.5 STOAT CONTROL

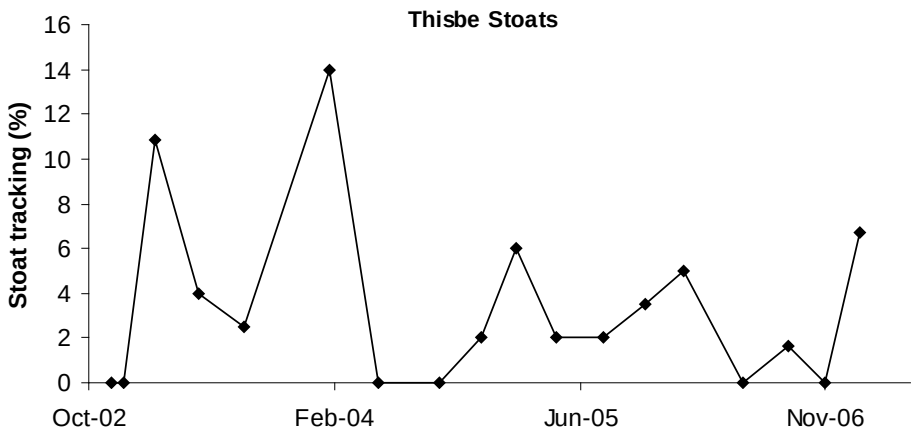
Under Operation Ark, the area over which stoat control is being undertaken has increased from 2000 ha in 2004 to over 12000 ha now (Figure 20). Stoat traps have been placed at 200 m intervals along 164 km of tracks and are serviced at least 14 times a year; more often during the summer when stoats are common.

Figure 20: Stoat trap lines in the Catlins since 2004



Stoats have been maintained at levels so low that they have almost no impact on mōhua survival and nesting success (see Figure 21).

Figure 21: Stoat numbers tracked in the Thisbe Stream area since 2002



9.6 MŌHUA

Mōhua declined in 1999 following a heavy beech seedfall and associated rat and stoat plagues. Since then their range (Figure 22) and abundance (Figure 23) have been slowly increasing.

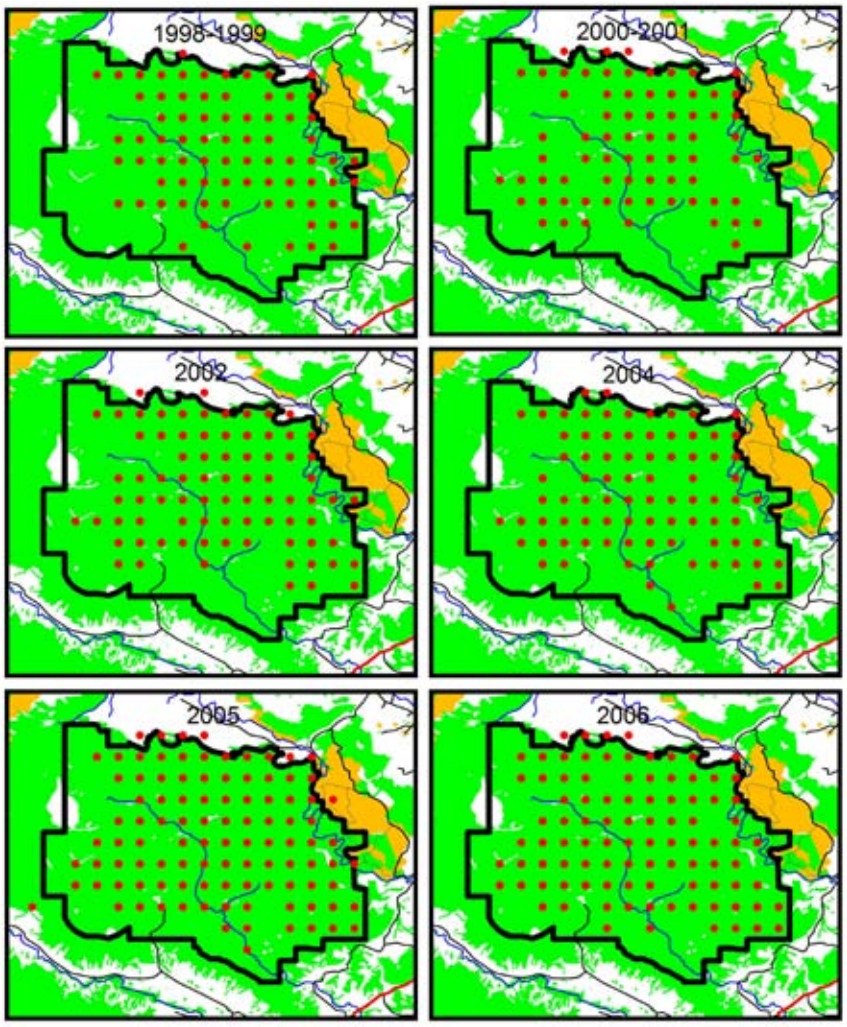


Figure 22: Changing distribution of mōhua in the Catlins Operation Ark area. Red dots represent 1000m grid squares in which mōhua were detected

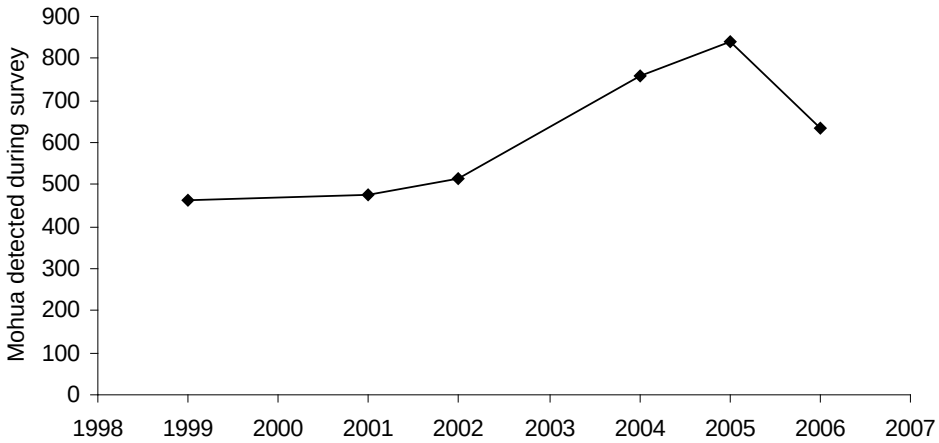


Figure 23: Abundance of mōhua in the Catlins

Mōhua survival and nesting were monitored during the summers of 2005/06 and 2006/07 and nesting success in the Thisbe stream area where stoat and rat control was undertaken was compared with that in an area where there was stoat control only.

During 2005/06 rat numbers did not rise enough to substantially affect mōhua nesting, even in the areas where no rat control was undertaken. Mōhua survival during the winter of 2006 between the beech masts of 2005 and 2006 was low probably because of rat predation. This led to a decline in mōhua numbers (see Figure 23). During the 2006/07 summer mōhua nesting success in the Thisbe poisoned area was high, while it was too low for population survival in the adjacent unpoisoned Daphne stream area

9.7 SUMMARY

Since Operation Ark was implemented in the Catlins, stoat control has been expanded to cover 12,000 ha and appears to be controlling stoats to levels consistent with the maintenance of a healthy mōhua population. Rat control using bait stations has been implemented in an area of 1500 ha and by a process of adaptive management an effective regime has been developed, and trigger points for the implementation of rat control determined. Rat control, in the Catlins is unnecessary in all but the largest beech masts but it must be undertaken for about a year (including winter) after rat numbers start to rise.

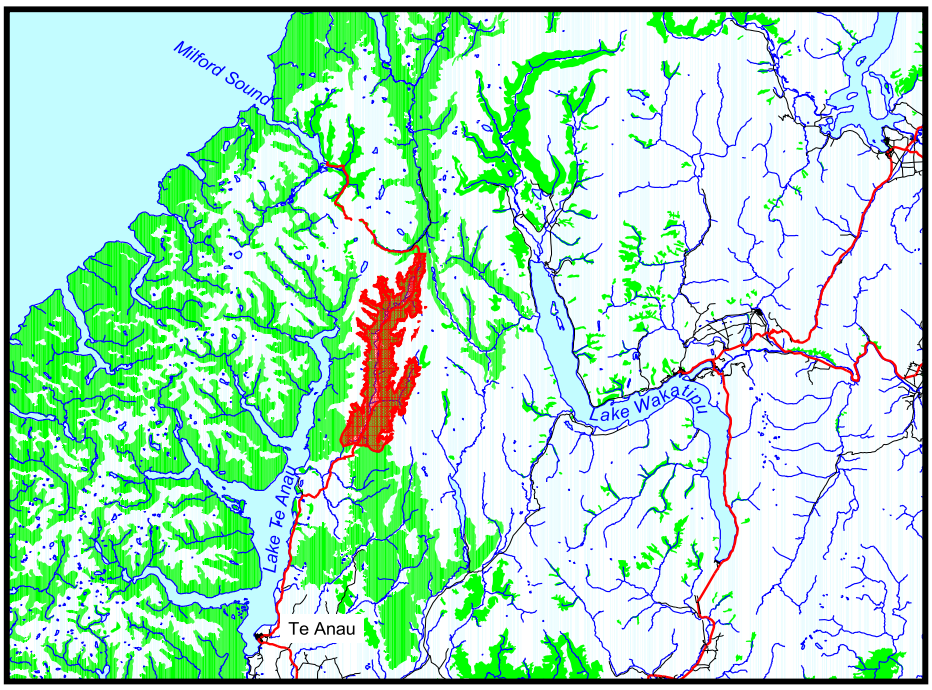
The mōhua population in the Catlins has been growing for the last few years following a dramatic decline in summer 1999-2000. Two small rat plagues in 2004 and 2005 probably had little effect on mōhua, but over the last winter and summer a more severe rat plague probably caused an overall decline. Operation Ark scientists are increasingly convinced that when rat numbers are high rat control is necessary to protect mōhua over winter as well as summer. Rat control, although effective, was undertaken over less than 20% of the range of mōhua and commenced in early October. The area over which rat control is undertaken will need to be increased before the next beech mast and the duration of control extended back into winter, if the total mōhua population at the site is to be maintained.

10. Eglinton

10.1 SITE DESCRIPTION

The Eglinton Operation Ark site (Map 21) comprises about 16,500 ha of native forest and riverbed in the Eglinton Valley in Fiordland National Park (1,260,200 ha). It is about 50 km north of Te Anau on the highway to Milford Sound.

MAP 21: EGLINTON OPERATION ARK AREA (RED BORDERED AREA)



The operational areas comprise a mosaic of red beech at low altitudes in the valley floors and silver and mountain beech elsewhere. There are grassy flats and shrub-lands in the valley bottom, and shingly riverbeds

10.2 KEY SPECIES

The Eglinton has the only known mainland population of the southern short-tailed bat, a large population of the nationally endangered long-tailed bat and a small remnant of a recently much larger population of the nationally endangered mōhua. During an extreme rat plague in 2001 following two years of heavy beech seeding the mōhua population in the valley declined from several hundred to less than 50 birds and there were declines in the numbers of both bat species. The aim of the programme

is to restore mōhua numbers to 1990 levels, and increase the abundance of both bat species.

10.3 PRE-OPERATION ARK MANAGEMENT

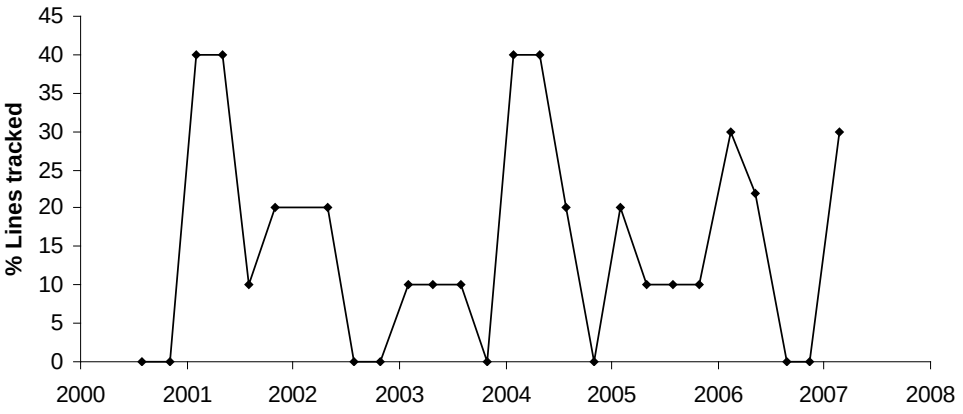
Since January 1999 there had been stoat traps at 200m intervals beside 40km of the highway which ran up the middle of the valley. These traps had been serviced monthly. Since August 1999, 10 lines of 10 tracking tunnels had been run four times a year to assess the abundance of stoats and rodents. No rat control was undertaken in the valley before Operation Ark.

10.4 STOAT CONTROL

Since Operation Ark started, some additional tracking tunnel lines have been established and run quarterly, but otherwise the stoat control established before Operation Ark started has continued unchanged.

Stoat control in the Eglinton has eliminated the dramatic increases in stoat abundance that occur after beech mast, but has not reduced stoat numbers to the very low levels achieved at some other Operation Ark sites where stoats are trapped more intensively (Figure 24).

Figure 24: Stoat tracking in the Eglinton Valley

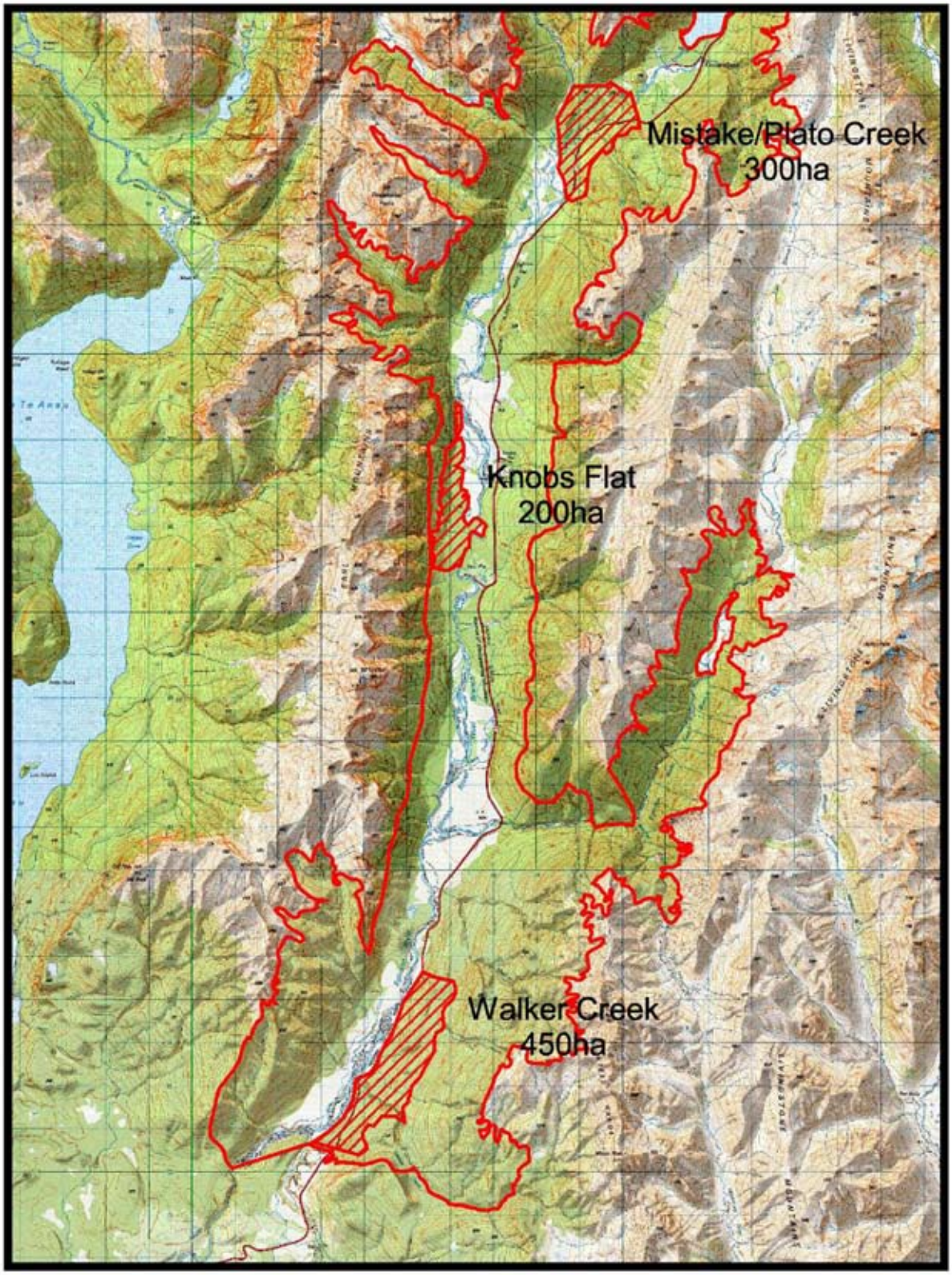


10.5

In response to increasing rat numbers, bait stations were placed in three blocks totalling 950 ha at 100x100 m intervals in May 2006 (Map 22). These areas are:

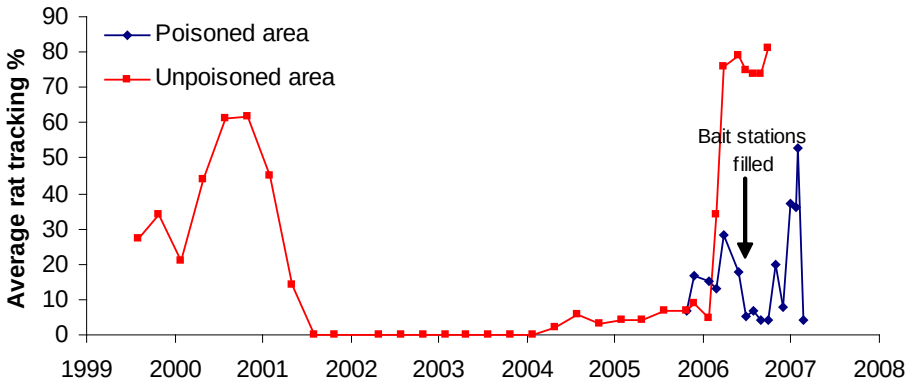
- Mistake-Plato Creek - 300 ha for mōhua protection in the northern part of the valley
- Knobs Flat – 200 ha for southern short-tailed bat protection in the central valley
- Walker Creek – 450 ha for long-tailed bat protection in the southern part of the valley

MAP 22: RAT CONTROL BLOCKS IN THE EGLINTON VALLEY



Between June 2006 and March 2007 the bait stations were filled sequentially with non-toxic prefeed, 1080 pellets, Racumin poison (4 times), 1080 pellets and then Racumin. The poison regime substantially reduced rat abundance but not to the near zero levels that are desirable (Figure 25). In April 2007 diphacimone paste replaced Racumin and rat numbers finally decreased by August 2007.

Figure 25: Rat tracking in the Eglinton Valley



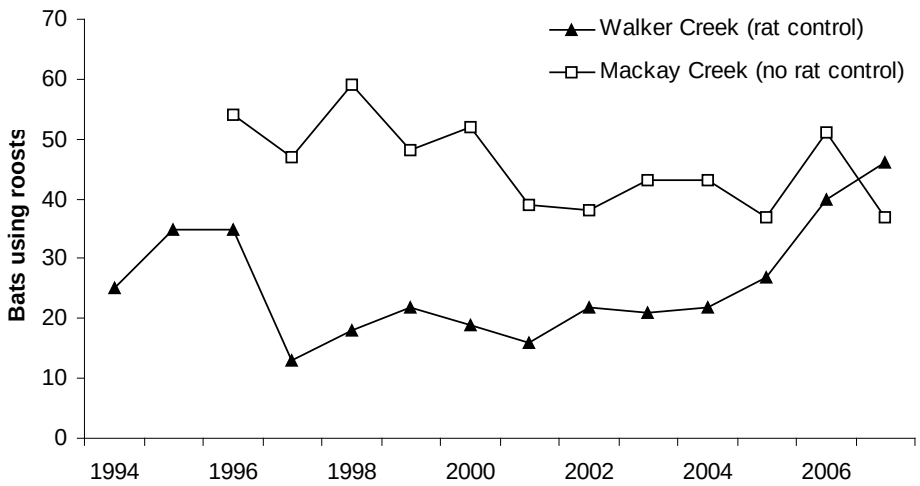
10.6 MŌHUA

Two rat plagues in 2000 and 2001 eliminated mōhua from most parts of the Eglinton Valley, so that only scattered pairs were known by 2006. During the 2006-07 rat plague mōhua in areas that were rat poisoned survived and produced fledglings, whereas those in the unpoisoned areas disappeared and were presumably killed by rats.

10.7 LONG-TAILED BATS

Long-tailed bats have been stable or increasing in numbers since the large rat plague of 2000/01 indicating that the stoat control has been sufficient to protect bats when rat numbers are low. During the rat plague of 2006, long-tailed bats declined by 16% in areas that received no rat control, but increased by 5% in areas in which there was rat control (Figure 26).

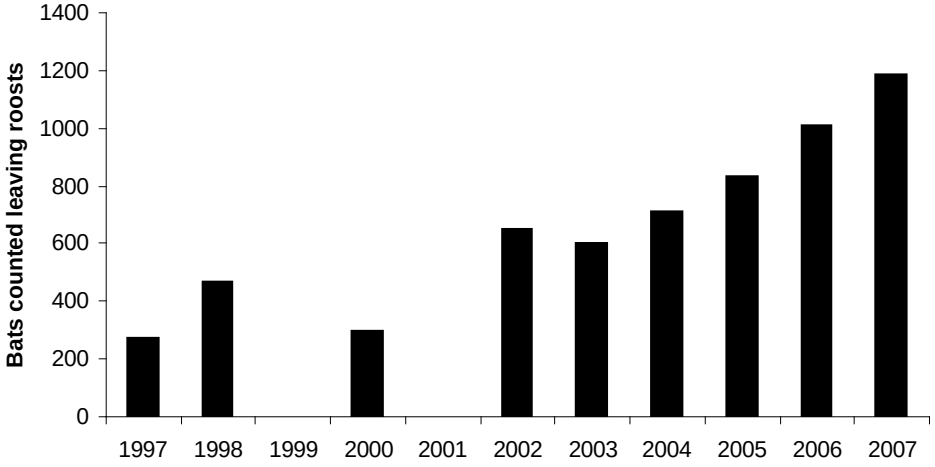
Figure 26: Long-tailed bat abundance in the Eglinton Valley



10.8 SHORT-TAILED BATS

Counts of short-tailed bats leaving their roosts show that short-tailed bat numbers have been rising since the rat plague of 2000-01, and that predator control during the 2006 rat plague prevented any dramatic decline in abundance (Figure 27).

Figure 27: Counts of short-tailed bats leaving roost sites in the Eglinton Valley



10.9 SUMMARY

A well established line of stoat traps existed in the Eglinton before Operation Ark and this has continued to be maintained and checked regularly. The trap line keeps stoats to a level where they have little impact on the key species, though it is likely that an increase in the number of traps in the valley could result in further benefit.

Ship rats are usually rare in the valley, but during heavy beech seed falls their numbers rise to levels that have severe impacts on native wildlife. During two rat plagues that occurred in 2000 and 2001 mōhua were all but exterminated in the valley and bat numbers reduced. Between 2001 and 2006 bat and mōhua numbers increased slowly.

In 2006 a heavy beech seedfall was followed by an increase in rat numbers which led to a ground-based poison operation being implemented in part of the valley. This operation reduced rat numbers to levels that enabled pekapeka and mōhua to continue to increase, but only within the area within which poison was laid. Outside the poisoned areas bats and mōhua numbers declined, and because the poisoned area accounted for only a small portion of the total valley the total numbers of the key species in the valley will have declined during last summer. Repeated reinvasions of rats into the Walker Block means that the size of the rat control area and the density of the rat bait stations need further development. Aerial 1080 control of rats in the valley is also an option that will be considered in future rat plagues.

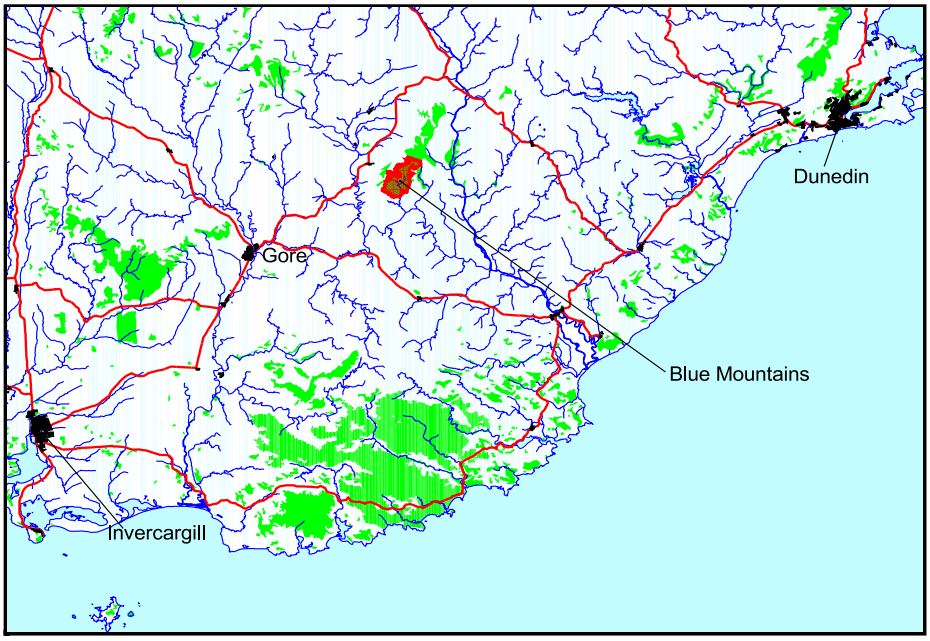
Mōhua and pekapeka have been protected where rat bait stations were operative. To rebuild mōhua numbers and to ensure sustainability of the pekapeka population, control areas need to be expanded.

11. Blue Mountains

11.1 SITE DESCRIPTION

The Blue Mountains Operation Ark site (Map 23) comprises about 2800 ha of native forest in the Blue Mountains Forest Conservation Area (12400 ha) 30 km north-east of Gore.

MAP 23: BLUE MOUNTAINS OPERATION ARK AREA (RED BORDERED AREA)



The forests of the Blue Mountains Operation Ark area are dominated by silver beech and have no other canopy species.

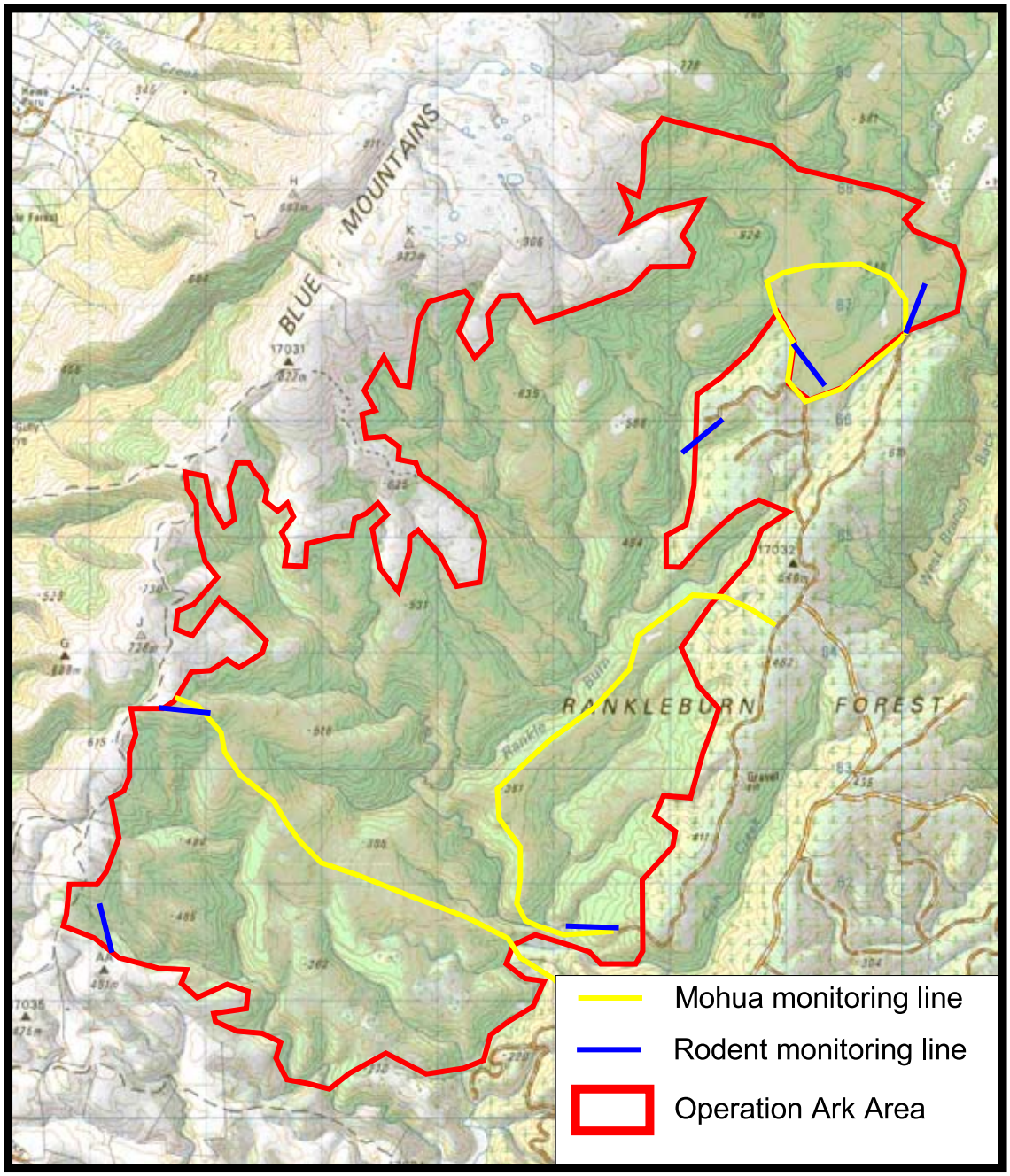
11.2 KEY SPECIES

The Blue Mountains has one of the three largest remaining populations of nationally endangered mōhua, probably about 25% of the current population. Mōhua are the focus of activity in the Blue Mountains and the aim of the programme is to monitor mōhua populations and if necessary implement management aimed at maintaining numbers at approximately their current levels.

11.3 PRE-OPERATION ARK MANAGEMENT

Before Operation Ark started there were seven lines of 10 tracking tunnels for monitoring stoats and rodents that were set up in 2002 and run quarterly for two years. There were also three mōhua monitoring lines that had been run annually since 1990 (Map 24).

MAP 24: TRACKING TUNNELS LINES AND MŌHUA MONITORING LINES IN THE BLUE MOUNTAINS

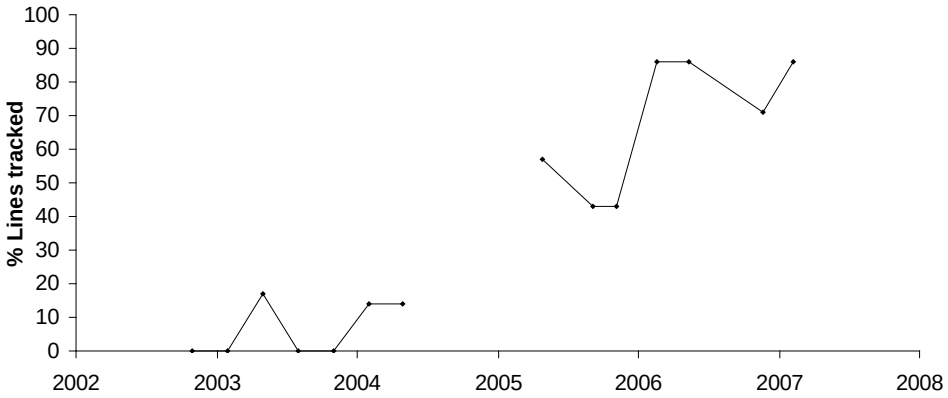


11.4 PREDATORS

The tracking tunnel lines set up in 2002 and run for two years were re-established in 2005 and have been run at least quarterly since then.

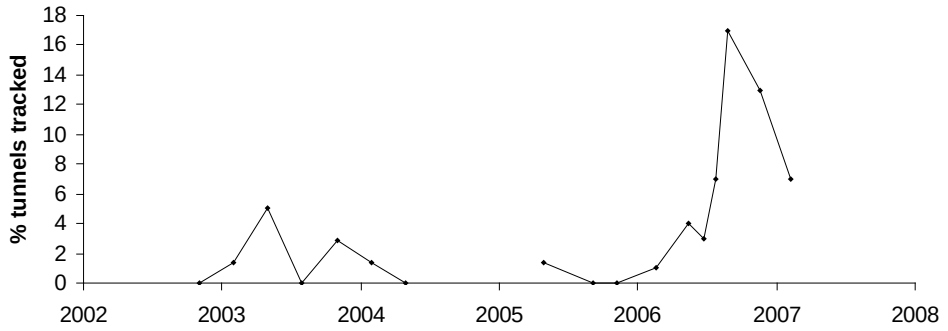
Stoat numbers are relatively high in the Blue Mountains, as there is no stoat control being undertaken (Figure 28). We have no explanation for the apparent increase in stoat numbers since 2002.

Figure 28: Stoat abundance in the Blue Mountains



Rat numbers were at low levels during the tracking that was undertaken between 2002 and 2004, but during 2006 their numbers rose in response to a heavy beech seedfall in autumn 2006 (Figure 29). The levels to which rats rose was only as high as that recorded in the Catlins in similar forest in 2005 and which had no impact on mōhua.

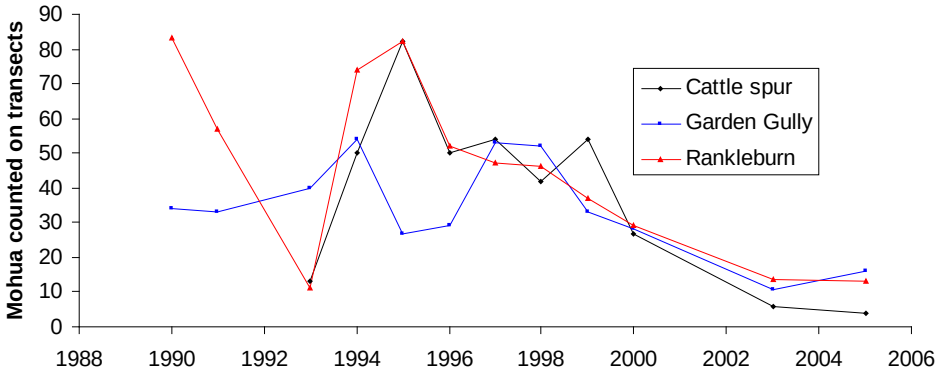
Figure 29: Rat abundance in the Blue Mountains



11.5 MŌHUA

Recent mōhua monitoring suggests that mōhua have declined in the Blue Mountains over the last 15 years (Figure 30). However, techniques for counting mōhua have only recently been standardised and the skills of the bird counters has varied considerably over this time. A new monitoring regime has been established and this will enable us to confidently detect future trends.

Figure 30: Mōhua abundance in the Blue Mountains at three sites



11.6 SUMMARY

Since Operation Ark started no predator control has been instigated in the Blue Mountains, though predator monitoring started in 2002 has been re-established. Blue Mountain's forests comprise only silver beech and heavy seed falls are rare. Furthermore silver beech has small seeds and the impact of seedfall is less in the Blue Mountains than it is in forests with more than one species of beech. For these reasons rat plagues such as that in 2006 are smaller and have less impact on mōhua than they do at other sites. Rat control is probably unnecessary.

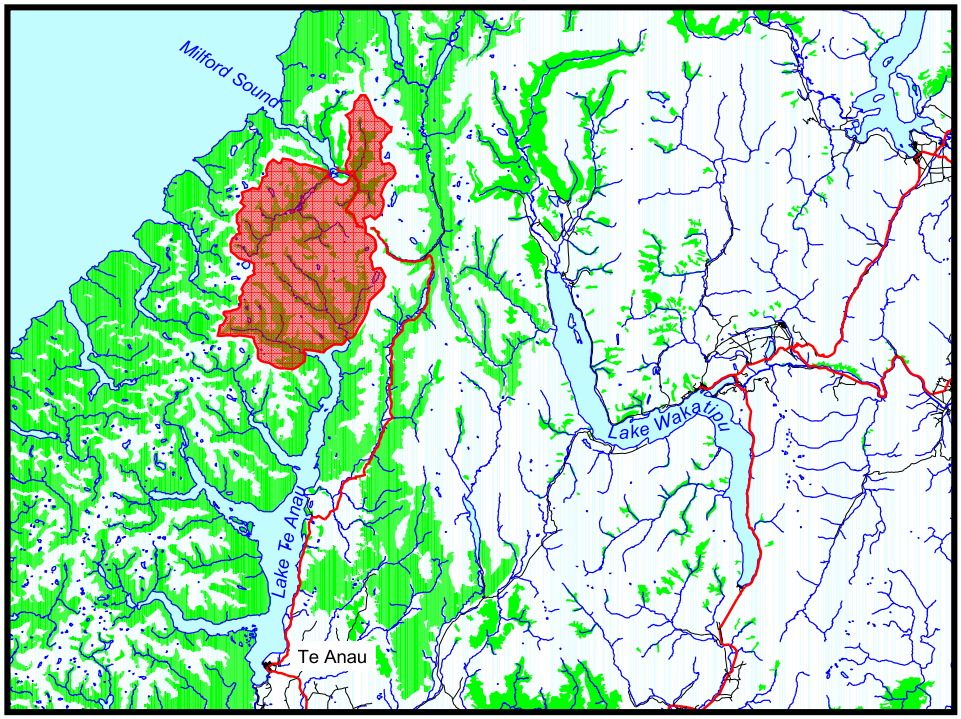
The apparent increase in stoat abundance and the possible reduction in mōhua abundance in the last two years are of concern. Improved mōhua monitoring will provide a firm indication of whether a reduction in mōhua abundance is occurring and stoat control will be instigated if necessary.

12. Clinton Arthur Cleddau

12.1 SITE DESCRIPTION

The Clinton Arthur Cleddau Operation Ark site (Map 25) comprises about 97 km of Department protected river in the Clinton, Arthur and Cleddau catchments in Fiordland National Park (1,260,200 ha). An additional 26 km of river in the Worsley and Castle catchments is protected by the efforts of the Fiordland Wapiti Foundation. The site is about 70 km north of Te Anau and is centred around the Milford Track.

MAP 25: CLINTON ARTHUR CLEDDAU OPERATION ARK AREA (RED BORDERED AREA)



The forests in these valleys comprise mostly silver beech, though in the lower reaches of the Clinton Valley there is some red beech, and the lower reaches of the Arthur and Cleddau Valleys there is rimu (*Dacrydium cupressinum*), totara *(Podocarpus hallii*), and miro (*Prumnopitys ferruginea*). More important is the presence of approximately 100 km of river suitable for whio.

12.2 KEY SPECIES

The Clinton Arthur Cleddau supports one of the largest populations of whio left in the South Island, and a small remnant population of mōhua. It is one of four areas in the South Island identified by the Whio Recovery Group as being a key site for whio conservation and whio are the focus of attention for Operation Ark at this site. The project aims to increase the whio population to at least 50 pairs by controlling stoats. The valley also supports populations of southern tokoeka (*Apteryx australis*) and weka.

12.3 PRE-OPERATION ARK MANAGEMENT

Between September 2000 and September 2003 approximately 87 km of stoat trap lines with traps at 200 m intervals in the Clinton Arthur and Cleddau catchments had been checked monthly. Tracking tunnel lines to monitor rat and stoat abundance had been set up in 2001.

12.4 STOAT CONTROL

Since 2004 the already initiated stoat trapping has been continued and in June 2005 10 km of new trap lines were established in the Joes catchment, a tributary of the Arthur. Additional tracking tunnel lines to monitor rats and stoats were established in June 2005.

In July 2005 stoat trap lines were established in the neighbouring Worsley and Castle Valleys using funding and volunteer effort contributed by the Fiordland Wapiti Foundation.

Stoat trapping quickly reduced stoat numbers to low levels which enabled whio numbers to rise (Figure 31).

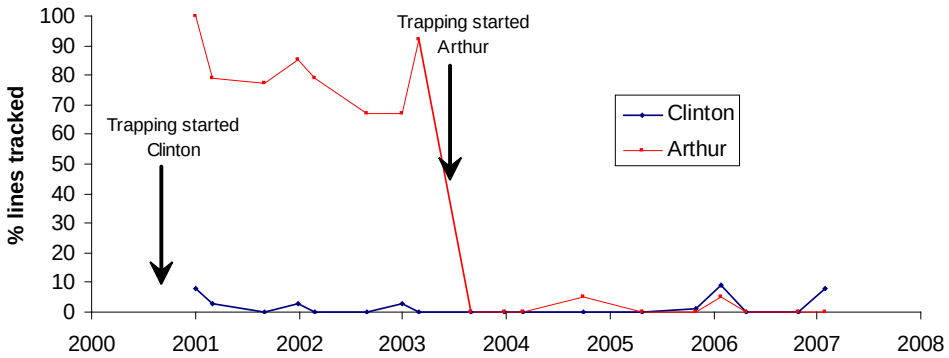


Figure 31: Stoat abundance in the Clinton and Arthur catchments

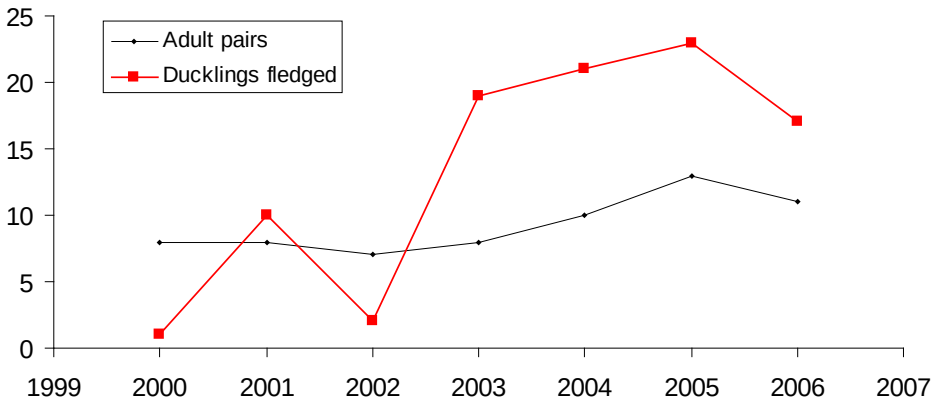
12.5 WHIO

Whio breeding success and survivorship have increased dramatically since stoat control was initiated. Before stoat control was initiated, 25% of females were killed each year by stoats and only 10% of their nests were successful. Now less than 10% of females are killed by stoats and 54% of nests fledge ducklings so that the total number of ducklings fledged each year has increased (Figure 32).

To increase the rate at which the whio population increases, eggs from whio nesting in areas where there is no predator control have been harvested. These eggs are hatched, the ducklings raised in captivity, and when old enough to be self-supporting, they have been released back into the wild. So far six juveniles have been released back into the Clinton Arthur Cleddau; other juveniles from the site have been released into the Murchison Mountains.

In response to increased survivorship, productivity, and the released hand-raised ducklings, the population size of whio in the Operation Ark area has grown (Figure 32).

Figure 32: Pairs of whio and the number of ducklings fledged in the Clinton and Arthur Catchments



As well as a population increase, the sex ratio and age structure of the whio population has dramatically improved. Prior to the stoat trapping programme the population comprised mostly old males as nesting was rarely successful and the females were often killed by predators while nesting. With improved productivity the population now comprises closer to 50:50 males and females and the average age of birds is much lower.

12.6 SUMMARY

97 km of stoat trap lines in the Clinton Arthur Cleddau, plus 26 km in the Worsley Castle catchments, now protect whio on most of the rivers in the Operation Ark area. Operation Nest Egg has resulted in the release of six young whio into the area, and these releases combined with the benefits of the stoat trapping regime have led to a substantial increase in the number of adult whio in the intensively managed parts since 2000. Furthermore the population has shifted from being dominated by old males, to a more even mix of males and females and many more young birds.

Population modelling indicates that the number of whio in the Clinton Arthur Cleddau should reach the target of 50 pairs within five or six years if current management continues.

13. Conclusions

13.1 PEKAPEKA (LONG AND SHORT-TAILED BAT) PROTECTION

Stoat and rat control in parts of the Eglinton Valley was effective at protecting those bats that lived mostly within the protected areas. The rat and stoat controlled areas in the Eglinton are too small to support viable populations of the two species of bat, and they need to be expanded.

Bats are known to be present in the Catlins and Dart-Caples and those bats within the predator-controlled areas will have benefited from the predator control. Monitoring of bats at these sites would enable predator control to be targeted at improved bat protection.

Long-tailed bat. Photo: Colin O'Donnell, Department of Conservation

13.2 WHIO PROTECTION

Predator control success for whio

Stoat control to protect whio has been largely completed at Clinton-Arthur-Cleddau, but can be significantly extended at the Wangapeka-Fyfe and Oparara-Ugly sites (see Table 6). Effective stoat control for whio comprises lines of traps on either one or both sides of a river with traps at 100 m intervals.

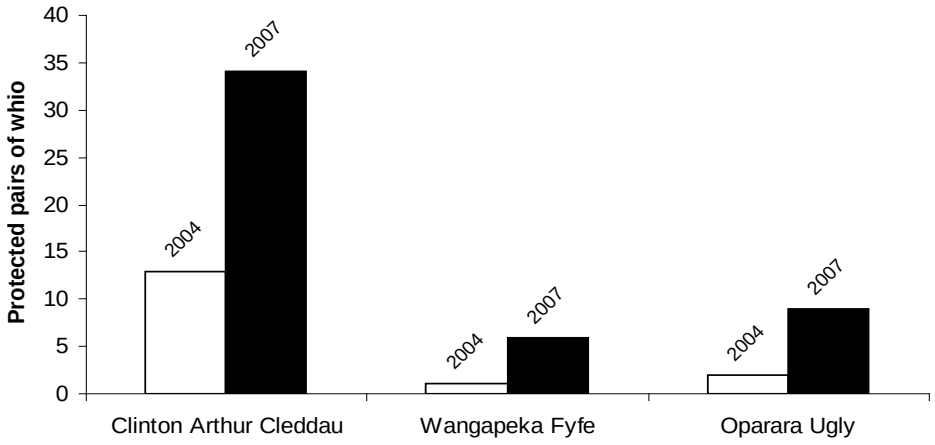
TABLE 6: STOAT CONTROL AT THE THREE WHIO-FOCUSED OPERATION ARK SITES

SITE	LENGTH OF RIVER WITH STOAT CONTROL (KM)	LENGTH OF ADDITIONAL STOAT CONTROL LINES NEEDED TO SUPPORT 50 PAIRS OF WHIO (KM)
Clinton Arthur Cleddau	123*	20
Wangapeka Fyfe	20	70
Oparara Ugly	20	45

*Includes Worsley and Castle valleys

The length of protected river has increased over the last three years, and the effectiveness of the stoat control being undertaken has led to increases in whio numbers in the managed parts of the three sites so that the total number of protected whio has increased dramatically at all three sites in the last three years (Figure 33).

Figure 33: Protected pairs of whio at 3 whio-focused Operation Ark sites



Operation Nest Egg and whio

The harvesting of whio eggs and the subsequent release of hand-raised young ducks has proved a valuable way of quickly increasing whio numbers. Six ducklings have been reared in the Department's Te Anau Wildlife Park and subsequently released into the Clinton Valley. Since then a further 12 from Clinton Arthur Cleddau site were reared in the 2005/06 summer but all of these were released into the Murchison Mountain stoat control area. A total of 34 whio ducklings have been raised at the Isaac Wildlife Trust aviary with 22 released into the Wangapeka-Fyfe site.

Future of whio at the sites

Whio numbers are likely to increase at the three sites, but only in the Clinton Arthur Cleddau is there sufficient length of predator-controlled river to support the target of 50 pairs. Whio Recovery Group priorities are that stoat trap lines need to be extended at the other two sites (see Table 6). South Branch Wangapeka is to be completed in 2006/07 and the next priority is the Ugly River in the Oparara Operation Ark site.

In some parts of the whio-focused Operation Ark sites, whio numbers are so low that predator control alone may not be enough to ensure that whio numbers quickly rise to target levels. Release of hand-raised whio will be an important tool for increasing whio for the next few years.

13.3 MŌHUA AND ORANGE-FRONTED PARAKEET PROTECTION

Stoat control to protect mōhua and/or orange-fronted parakeets has been fully, or nearly fully, set up at five of the sites that are key for these species (see Table 7), and at two sites (Eglinton, Catlins) the proposed stoat control network is still incomplete. This additional establishment will extend the habitat available for mōhua.

Stoats have their greatest impact on mōhua and orange-fronted parakeets during plague years after beech-masts. There is good evidence from early work that the stoat control regimes that have been put in place will be effective during plague years. During recent plagues at Operation Ark sites, stoats have not only been trapped, but will also have been killed as a result of eating rats poisoned by aerial 1080 and bait station poisons.

TABLE 7: STOAT CONTROL AT OPERATION ARK SITES WITH MŌHUA AND/OR ORANGE-FRONTED PARAKEETS

SITE	ESTABLISHED STOAT CONTROL LINES (KM)
Hawdon Valley	25
Poulter Valley	37
South Branch Hurunui	28
Landsborough	56
Eglinton	41
Catlins	165
Dart Caples	100
Blue Mountains	0

Because of rat predation, stoat trapping alone is not sufficient to protect orange-fronted parakeets and mōhua. While stoats probably have a role in reducing overall rat abundance, there is no compelling evidence one way or the other that leaving stoat populations intact will prevent rat plagues from occurring. The impacts of stoats on bird populations means that stoat control at all sites must remain a fundamental tool of Operation Ark. Further research to determine the effectiveness of stoat control is required.

Rat control for mōhua and orange-fronted parakeets

Rat control during rat plagues had not previously been successfully achieved in South Island beech forests. It was thought likely to require different techniques from those that have been successfully used in lowland podocarp forests in the North Island. In high altitude beech forests rats are normally at very low numbers and need no control. After heavy beech seed-falls however, their numbers can rise to levels that are dangerous to many native species. Furthermore, during rat plagues in beech forests, food (in the form of beech seeds) is superabundant and there is little incentive for rats to eat poison bait or bait in traps.

During the summers of 2004/05 and 2005/06 there were small rises in rat numbers at five Operation Ark sites. Substantial rat plagues then occurred at these five sites in 2006-07. These rises in rat abundance triggered rat control at these sites, but the responses were of necessity, experimental. Some of the early responses were unnecessary, because rats rose to only intermediate levels which had little effect on mōhua. This is always a possible outcome of a precautionary approach. Research also demonstrated that mōhua in the Catlins could survive a higher level of rats over summer than previously thought.

Other timing issues also need to be resolved. Evidence from bird monitoring is increasingly showing that rat plagues are a significant factor in over-winter mortality of birds. In the Dart-Caples and the South Branch Hurunui, aerial 1080 was not used until spring and there had been significant mōhua mortality before then. In the Catlins, bait-station rat control was not commenced until October and over-winter mōhua mortality was unacceptably high. On some sites, future rat control will need to be introduced during the autumn and winter of a rat plague, rather than waiting for the onset of breeding.

Some responses were unsuccessful (eg brodifacoum in 'yellow-submarine bait stations' (Dart/Caples), or the use of Ditrac) as they failed to adequately reduce rat numbers. Further investigation of the optimal design of bait stations is necessary. Increasing the range of toxins available for rat control is also vitally important because at the moment we are limited to using 1080 or a range of anticoagulant rodenticides. Diphacinone, a first generation anticoagulant in a block or paste (Ratabate), has become recently available and was trialled in the Eglinton.

By the end of the 2006/07 summer, successful rat control for mōhua and orange-fronted parakeets had been implemented at the five sites. In these rat control areas, where monitoring was undertaken the species nesting success was found to be high. Survival of adult birds was also high.

Two techniques have proved successful at controlling rats during beech mast induced rat plagues. In one, 1080 cereal bait is dropped from the air to knock rat numbers down, and they are maintained at low levels through the use of bait stations loaded with anticoagulant poison. In the second system, only high densities of bait stations with 1080 or anticoagulant poison are used (see Table 8). Traps set for rats on their own have proved ineffective.

Further work is required to determine which is the more cost-effective of these two approaches. The arrangement and extent of bait stations at some sites may need to be changed to bring them up to the most effective standard. Intensive bait-station control is only technically possible and economic in terrain that is not too steep. The current array of bait stations have been placed in flatter terrain in areas of highest bird concentration. Small rat control areas are subject to high levels of rat reinvasion from adjacent untreated land and do not protect birds that are nesting or roosting outside of them. These areas can only be easily expanded on sites that are not mountainous (eg Catlins, Eglinton).

TABLE 8: RAT BAIT STATION CONTROL AREAS AT OPERATION ARK SITES WITH MŌHUA AND/OR ORANGE-FRONTED PARAKEETS

SITE	AREA PROTECTED BY POISON BAIT STATIONS (HA)
Hawdon Valley	810
Poulter Valley	0
South Branch Hurunui	550
Landsborough	0
Eglinton	300*
Catlins	1,500
Dart Caples	2,700
Blue Mountains	0

*Plus an additional 650ha currently covered for pekapeka protection

Aerial 1080 usage

Aerial 1080 operation. Photo: Richard Suggate, Department of Conservation

The aerial 1080 operations achieved significant results by reducing rats to almost undetectable numbers. The concentrations of 1080 in the bait, the size of bait and the density of bait were modified to achieve optimum rat kill as well as an effective possum kill. Operation Ark is supporting further research on aerial 1080 operations to ensure that they can be fine-tuned to achieve the maximum reduction in both rat and possum abundances.

Aerial 1080 has been shown to be an effective tool to knock down growing rat numbers in a plague situation where bait station operations have been insufficient to prevent the rats numbers increasing. This is particularly important when managing populations of birds that have been decimated by previous rat plagues and are barely surviving through natural breeding (even if there was no predation). If the rat plague had gone unchecked in the three Canterbury Valleys (Hawdon-Poulter and South Branch Hurunui) in 2006/07, it is likely that both mōhua and orange-fronted parakeets would be locally extinct by 2007/08.

Aerial 1080 alone, as we are currently using it, is not a complete solution to the problem of rat plagues. Residual rats that survive the 1080 drop and re-invasion by rats from outside the baited area means that although rats are at undetectable numbers after the operation, within three months they can rise again to numbers that threaten endangered bird populations. Having bait stations in place to prevent post 1080 rat build up is essential if endangered birds are to be protected for the duration of a rat plague. Further research on the ability of aerial operations to remove all rats in a catchment for longer periods is required.

Future of mōhua

Effective rat control techniques to protect mōhua have been tested and implemented at Operation Ark sites. However, they have not been deployed over all the habitat of mōhua in the sites at which they were used. This was because of the small areas of rat bait stations in some sites and the lack of an aerial 1080 operation option in the Eglinton and Catlins in 2006-07.

During the summer of 2006/07, mōhua numbers increased within those parts of the Dart/Caples and Catlins sites which received rat control, but outside these areas, they almost certainly declined. Furthermore, the rat-controlled parts of the Catlins and Eglinton sites are not yet large enough to support self-sustaining mōhua population.

No rat control was undertaken in the Blue Mountains (where only monitoring is occurring at present) and the Landsborough (where rats have not, as yet, been recorded in significant numbers). Ground-based rat control is also not a cost effective option in the Landsborough.

At three sites, Eglinton, Hawdon-Poulter and South Branch Hurunui, mōhua numbers are so low that even with effective predator control there is a risk that the populations will become locally extinct either during a particularly severe winter or through loss of fertility due to inbreeding. Translocation of mōhua from other sites may be necessary to secure mōhua at these three sites.

Future of orange-fronted parakeets

Effective predator control regimes are in place in parts of the two orange-fronted parakeet sites, though they may need some changes to bring them up to standard (e.g. better and more bait stations, bigger control area and optimised aerial poisoning). Orange-fronted parakeets are now so rare at these sites however, that even with effective predator control there is a risk that the populations will become locally extinct during a particularly severe winter or through loss of fertility due to inbreeding. Protecting individual orange-fronted parakeet nests, captive breeding and supplementation from offshore islands all remain important tools for orange-fronted parakeet management for the foreseeable future.

One population has been successfully established on Chalky Island in Fiordland, and another is being established on Maud Island in the Marlborough Sounds, and there is a small captive population, so there is little risk of extinction of the species. It may be necessary to bring orange-fronted parakeets back from the islands or captivity, for release in the Hawdon-Poulter and South Branch of the Hurunui to maintain these mainland populations.

13.4 SUCCESSES

Operation Ark has demonstrated its effectiveness in protecting its target species in the areas selected for intensive predator control. This is true for mōhua, orange-fronted parakeets and pekapeka where there has been intensive stoat and rat control in targeted areas and aerial 1080 has been available to provide both knockdown and re-invasion reduction. The ability to obtain additional funding in plague years has been essential to providing a timely response.

The steady increase in whio through stoat trapping along rivers gives great confidence for their sustainability on mainland sites. Whio numbers will steadily rise if the kilometres of river valley stoat lines put in place increase. This growth rate can be speeded up by use of Operation Nest Egg fledgling and egg transfers. The Wangapeka, Oparara and Clinton-Arthur-Cleddau sites all have the potential to reach the Whio Recovery Group target of 50 breeding pairs at each site.

The other major task of Operation Ark has been to respond to rat plagues in South Island beech forests. Before Operation Ark commenced a series of beech masts and rat plagues had decimated mōhua and orange-fronted parakeet populations in the South Island. Between 2004 and 2006 local irruptions of rats at sites provided the opportunity to test control techniques and monitor the response of bird populations.

To have maintained and increased bird numbers in predator-controlled areas through the 2006-07 rat plague is a major success. It is fair to say that further localised extinctions would have occurred if the control regimes had not been in place. This knowledge is tempered by the understanding that many birds will have been lost in areas that did not receive pest control.

Aerial 1080 has been demonstrated to be an effective tool for reducing rat numbers to very low levels in South Island beech forests. The endangered species also benefit from the reduction in stoat and possum numbers. However, there is room for improvement in our baiting strategies. We need to increase the level of knockdown and expand the treated areas to extend the duration of resulting rat control. With current aerial baiting strategies, ongoing rat control requires complementary ground-based baiting.

13.5 ONGOING CHALLENGES

There is still uncertainty about the timing, duration and scale of rat control that is necessary to effectively protect mōhua and orange-fronted parakeets and continued research and monitoring around these issues is required. Issues such as the timing of aerial 1080 usage, bait station design, additional rat control poisons and intensive bird monitoring methods all require refinement. A three-year research programme is investigating optimising aerial 1080 operations to kill multiple pest species (mainly rats, stoat and possums).

The existing predator control regimes are expensive. Further work to reduce the cost of predator control and to increase its effectiveness will considerably enhance the conservation gains achieved by Operation Ark.

In sites where the mōhua, orange-fronted parakeet and pekapeka are too rare to provide sustainable breeding populations, trigger levels for rat control will have to remain low, providing for early intervention if rat populations increase. In addition, if the birds are to regain a critical breeding mass more individual nest monitoring and protection and possibly egg and bird translocations to the sites will be required.

At almost all sites, the area in which predators are controlled is less than that required to support sustainable populations of target species (whio, mōhua, pekapeka and orange-fronted parakeet) and needs to be increased. Current levels of funding are insufficient to achieve this goal.

14. Acknowledgements

Operation Ark staff who have worked in all conditions to protect the species. The Operation Ark Coordinating Committee - Colin O'Donnell, Craig Gillies, Elaine Murphy, Elaine Wright, Josh Kemp. Kingsley Timpson (Operation Ark Coordinator (2004-05)).

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