IN THE HIGH COURT OF NEW ZEALAND
NELSON REGISTRY

CIV-2017-442-39

UNDER THE	**Judicial Review Procedure Act 2016 and Declaratory Judgments Act 1908**
IN THE MATTER OF	**An application for judicial review and declaration on the lawfulness of the Resource Management (Exemption) Regulations 2017**
BETWEEN	**BROOK VALLEY COMMUNITY GROUP INCORPORATED**
	Plaintiff
AND	**THE TRUSTEES OF THE BROOK WAIMARAMA SANCTUARY TRUST**
	First Respondent
AND	**THE MINISTER FOR THE ENVIRONMENT**
	Second Respondent

AFFIDAVIT OF NICOLAS REX SMITH AS SECOND RESPONDENT

10 July 2017

Judicial Officer: Unknown
Next Event Date: 27 July 2017

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I, Nicolas Rex Smith, of Wellington, Minister for the Environment, swear:

1. I am currently the Minister for the Environment and Minister for Building and Construction but have also worked as Minister of Conservation between 1996 and 1999 and from 2013 to 2014.

2. I hold a Bachelor of Engineering (1st Class Honours) and a PhD in geotechnical engineering from the University of Canterbury.

3. I have held a keen interest in the development of sanctuaries in response to the serious threats to the survival of New Zealand's native birds and other animals. I have been directly involved with the Tiritiri Matangi Sanctuary in Auckland, the Zealandia sanctuary in Wellington, the Rotokare sanctuary in Taranaki, and the Maungatautari sanctuary in the Waikato. My involvement in these sanctuaries has been as both a Minister and MP, and has involved securing funding, land access, and the support of government agencies. I have visited these sanctuaries many times over many years and have been stunned by their success in enabling prolific native bird life to be re-established and by the flow-on benefits for environmental education, tourism, and community development.

4. I am very familiar with the Brook Waimarama Sanctuary Trust and their work over more than a decade. The Trust has impressed me with their professionalism, their huge volunteer commitment, their careful planning, their community consultation, their fundraising, and their successful construction of the 14 km predator-free fence. I have visited the site dozens of times, met with the Trust regularly and been kept briefed on their progress for over a decade.

5. I have been the responsible Minister for the development of the new national regulations on pest control, the subject of these proceedings. They are part of a broader government policy of providing more consistent national regulation of natural resources and the environment rather than having differing rules in every district or region. Other national regulations at various stages include telecommunications, contaminated sites, water metering, forestry, agriculture, stock exclusion, and waste tyres. National regulations are a more effective approach to many of these environmental issues because: the risks being

managed do not differ significantly between regions; we can provide better quality regulations at a national level; we can achieve more consistent compliance; and, we avoid re-litigating many times over the same issues.

Why at a national level pest control is so important

6. The loss of biodiversity is New Zealand's most challenging environmental issue. We rate well and most international environmental indicators but the loss of biodiversity is our greatest weakness. We have an exceptionally high number of endemic species found nowhere else in the world. Many of the species are iconic and are part of our national identity.

7. New Zealand's biodiversity also underpins our economy. As well as providing ecosystem services to underpin our agriculture and forestry industries, it is a fundamental part of our attractiveness as a destination for tourism.

8. Of New Zealand's 168 species of native birds, 93 are found in no other country, among them the kiwi and kākāpō. A copy of the Parliamentary Commissioner for the Environment's (PCE) report *Taonga of an island nation: Saving New Zealand's birds* is attached as an exhibit marked "**NRS-1**" to this affidavit. These iconic birds are under significant pressure – only one in five native bird species is doing well.[1]

9. The key threat to the survival of these species is introduced mammalian predators. Other threats like the loss of habitat and poaching were once more significant but pests today are the main problem. Pests like rats, stoats and possums kill 25 million native birds a year, and cause ecosystem-scale destruction to our forests.

10. Possums are also a massive threat to New Zealand's agriculture. Possums carry bovine tuberculosis, a serious and highly infectious disease found in cattle and deer herds, causing weight loss and death.

11. In our efforts to protect New Zealand's unique biodiversity and industry, pest control is an essential tool. The Government has recognised this through the establishment of Predator Free 2050, a programme with the ambitious goal of ridding New Zealand of the most damaging introduced predators that threaten

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1 At 5.

our nation's biodiversity, our economy and primary sector. A copy of the Predator Free 2050 statement is attached as an exhibit marked "**NRS-2**" to this affidavit.

12. Pest control in New Zealand requires an array of methods. As well as widespread trapping, the use of vertebrate toxic agents (VTAs) is a crucial component. Research is ongoing into new and effective methods of pest control.

13. Sodium Fluoroacetate (1080) is the most commonly used VTA in New Zealand, and without it we would not have species such as the kiwi on the mainland. 1080 is a naturally occurring compound in plants as a defence against browsing animals, and quickly biodegrades in the environment.

14. The aerial use of 1080 is the most cost-effective option New Zealand has to protect its valuable native species, killing stoats, rats, and possums at the same time. 1080 has been proven to be highly effective in eradicating these pests and restoring our forests to thriving places for our native birds to live, and trees like the rata to recover.

15. 1080 is also essential for the agricultural sector – if the current bovine tuberculosis (Tb) eradication programme were to stop, the cost to New Zealand been estimated as high as $5 billion over 10 years. A copy of 1080 facts information is attached as an exhibit marked "**NRS-3**" to this affidavit. 1080 has proved and essential tool in reducing the number of TB positive herd Numbers in New Zealand from over 1700 in 1994 to just 43 in 2016. A copy of the Bovine Tb Facts information is attached as an exhibit marked "**NRS-4**" to this affidavit.

16. Brodifacoum is another VTA which is used in New Zealand to control populations of rats, mice and possums. While brodifacoum persists longer than 1080 in the environment, it has been used to great effect in many of New Zealand's offshore islands and "mainland island" pest-proof sanctuaries for initial eradication operations. Zealandia, Maungatautari, and Orokonui have all applied brodifacoum aerially, and are now successful sanctuaries offering biodiversity, community education, and benefits to the local economy.

MB

The Parliament Commissioners' report on the use of 1080

17. In 2011 the PCE investigated the use of one of the main VTAs we use in New Zealand - sodium fluoroacetate (1080). A copy of the report *Evaluating the use of 1080: Predators, poisons and silent forests* is attached as an exhibit marked "**NRS-5**" to this affidavit.

18. The PCE also considered brodifacoum. The report noted it had been used effectively to completely eradicate rats, stoats, and possums on offshore islands and fenced "mainland islands" that were now sanctuaries for endangered animals.[2]

19. The PCE concluded that the legislation governing 1080 and other VTAs creates unnecessary complexity and confusion. The report found that under the Resource Management Act 1991 (RMA), the use of VTAs for controlling pest mammals is treated differently by different councils. Some councils treat the use of poisons as a permitted activity with only a few conditions, while other councils treat exactly the same use as a discretionary activity requiring a resource consent. The report also concluded that many of the rules also replicated controls already in place under other legislation.[3]

20. In that report the PCE recommended:[4]

> The Minister for the Environment investigate ways to simplify and standardise the way 1080 and other poisons for pest mammal control are managed under the Resource Management Act and other relevant legislation.

21. In response to the PCE's report on 1080, the Department of Conservation (DoC), Ministry of Primary Industries (MPI) and TBFree NZ (a subsidiary of OSPRI New Zealand Limited) completed a detailed analysis of all consents for aerial use of 1080 issued by councils between 2003 and 2013. Their findings were presented in the report *Business Case: Simplifying the regulation of aerial 1080 under the Resource Management Act (2015)*, which is attached as an exhibit marked "**NRS-6**" to this affidavit. This report found a compelling case to change the

2 At 58.

3 At 68.

4 At 68.

NMB

existing arrangements and seek to simplify the management of aerial 1080 under the RMA, for reasons including but not limited to:

21.1 The risks and effects of 1080 are robustly and effectively managed under the Hazardous Substances and New Organisms Act 1996 (HSNO), the Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM), and by the Ministry of Health. The regulation of 1080 under the RMA does not afford any extra protection to the environment or public health, nor does it manage risks outside those already managed under HSNO.

21.2 There are high levels of unnecessary duplication between the RMA and HSNO. Significant levels of duplication occur between RMA consent conditions and HSNO controls. There is also duplication between plan rules and HSNO requirements. This duplication is costly and does not improve the management of effects and risks.

21.3 The analysis presented in this business case has found the sustainable management purpose and principles of the RMA are being sufficiently achieved under HSNO. The further management of 1080 under the RMA is not affording additional environmental protection, due to 100% duplication with HSNO permissions and standard operating procedures.[5]

21.4 The management of 1080 through regional plans is inconsistent, and this can adversely impact the effectiveness of operations. There are 13 Regions with varying Regional Plan rules and standards that trigger the need for resource consent for aerial 1080 operations. Over 200 such resource consents have been issued in the last ten years in 10 Regions. There is significant regional variability in consent conditions and in the way consents are managed.

21.5 Inconsistency and duplication increases the risk of compliance failure. Having variable consent conditions reduces the ability of the operators to ensure that best practice is always achieved. Regional inconsistency and duplication also increases the risk of breaching

[5] At 42.

consent conditions. Even if the effects of such breaches are minor, they are treated as adverse incidents in EPA reports. The recurrence of such incident reports could lead to imposition of further controls under HSNO, potentially resulting in the loss or reduced availability of 1080 as a pest management tool for biosecurity and biodiversity programmes.

22. The analysis found the potential adverse effects of 1080 use are being robustly managed at a national level under the HSNO, ACVM and Health Act framework. Independent monitoring completed by the EPA within the last five years confirmed the HSNO system is effective at managing the risks of operations and that the management of operations has improved significantly.

23. The analysis also revealed the further regulation of 1080 at a regional level under the RMA is affording no extra protection to the environment or public health and that there is compelling case to simplify the RMA system.

24. Accordingly, after considering a range of policy options and approaches to achieve standardisation and the costs, benefits and risks of each option the assessment concluded that a national policy approach is most likely to achieve greater consistency and generate the largest net benefits to society over the long term. The preferred policy approach was for a regulation under section 360(1)(h) of the RMA, which would exempt aerial 1080 operations from s 15 of the RMA and leave their continued management under the HSNO and ACVM frameworks.

The proposed regulations

25. In August 2015, I announced my intention to develop regulations to address these findings as part of the Government's National Direction Forward Agenda.

26. As part of the proposal to exempt 1080 from RMA requirements, I also directed the Ministry for the Environment to consider whether there were other VTAs for which adverse effects on human health and the environment were appropriately managed under other regulatory regimes.

27. Brodifacoum was assessed on this basis, and it was proposed that brodifacoum could be covered by the regulation provided its use was restricted to offshore islands or within fenced sanctuaries (where the ACVM Code of Practice must be followed). These limitations provided an effective way to minimise risks to public health and the environment.

28. The aerial use of brodifacoum was previously subject to varying controls by regional councils under the RMA – many permitted its use, but in some it was discretionary, and conditions on its use for similar purposes varied significantly.

29. In 2016, the Ministry for the Environment publicly consulted on a proposal to introduce these regulations. The majority of submitters, including all council and industry submitters, supported the proposal, recognising the regulatory and economic benefits. Opposition to the proposal generally came from those against the use of VTAs in general, rather than the proposed regulations themselves. A copy of summary of submissions is attached as an exhibit marked "**NRS-7**" to this affidavit.

30. The Government made the Resource Management (Exemption) Regulations 2017 (the Regulations) on 1 April 2017. Regulation 5 exempted the discharge of brodifacoum in pest-proof sanctuaries or on offshore islands from the requirements of section 15 of the RMA, meaning the discharge need not be authorised by a rule or resource consent as long as it complies with the conditions in the Regulations. The Resource Management (Exemption) Regulations 2017 Amendment Regulations 2017 were passed on 2 June 2017 to clarify a drafting issue relating to the discharge of brodifacoum to water and air. A copy of the Cabinet Paper is attached as an exhibit marked "**NRS-8**" to this affidavit.

The critical need for pest control over winter in the Sanctuary

31. Brook Waimarama Sanctuary is located in the Brook Valley near Nelson, comprising of 691 hectares of indigenous forest enclosed by 14.4km of pest-proof fencing. The Brook Waimarama Sanctuary Trust seeks to provide a pest-free place for indigenous biodiversity to thrive and previously-vanished species to return, and represents an exciting contribution to New Zealand's conservation efforts.

32. The success of the Brook Waimarama Sanctuary depends on achieving an absolute kill and this is an incredibly challenging scientific and operational task. I have witnessed the development of world leading technology in New Zealand to gradually expand the area in which eradication has been achieved, but success is still not guaranteed. I have been consistently advised previously in operations of this sort that choosing the right weather-window and time of year is critical to maximising the prospect of success. I am concerned that any delay in the operation to a sub-optimum time will compromise the prospect of success.

Sanctuary support and opposition

33. The Brook Waimarama Sanctuary project enjoys strong community support, the support of both the Nelson and Tasman councils and thousands of people have contributed financially and as volunteers to the project's vision. The construction of the fence has always been predicated on the expectation that it would require a poison operation to secure a pest-free sanctuary. It is disingenuous of opponents to attempt to block the operation after the community has spent over $5 million securing the site and building the fence.

34. There is a small but vocal group opposed to poisons like 1080 and brodifacoum. The anti-1080 party contested the 2014 general election in Nelson and secured 386 votes or 1.01 percent. This was significantly more than the national total of 0.21 percent.

35. The opposition to poisons used in pest control is not to the detail of the regulations, but is a philosophical opposition to the use of poison. The Brook Valley Community Group's submission on the regulations provided no suggested refinements of the rules but simply stated the use of such poisons was "a monstrous financial and scientific fraud."

Why pest control by community groups needs to be encouraged

36. Brook Waimarama Sanctuary is owned and managed by a charitable trust – the Brook Waimarama Sanctuary Trust. All of its 12 trustees are volunteers.

37. While the Trust has been generously supported by the Nelson City Council, Tasman District Council, and central government, it remains a community-led project. It relies on over 600 members and donations of money, time, and

resources to manage the sanctuary and construct its pest-proof fence. Around $3.25 million has been raised to help with fence construction.

38. For a charitable trust relying on donations and grants, litigation is a cost which is hard to meet, and threatens the ability of the sanctuary to realise its goal of providing a pest-free haven for our threatened native species.

39. I am also concerned about the financial stress on the Trust of any delay to the pest control operation. The Trust needs to maintain a high level of staff and expertise to successfully carry out the pest eradication and the retention of this team for a further year will cost hundreds of thousands of dollars. It will be very difficult to fundraise for what the community believes they have already contributed to achieving.

40. Given the management framework already in place to manage the risks of brodifacoum to the neighbouring community, it is disappointing for the Brook Waimarama Sanctuary Trust and all its volunteers to be delayed, disrupted, and have their costs increased in undertaking their important contribution to New Zealand's biodiversity.

41. The precedent effect of this litigation against Brook Waimarama Sanctuary Trust is concerning, as it could lead to a chilling effect from community conservation groups volunteering their time and resources to use essential pest control tools in the future. Community groups make an irreplaceable contribution to New Zealand's natural heritage.

How the regulations assist

42. The Regulations enable New Zealand's community, agencies, and organisations conducting pest control operations for our biodiversity and agricultural sectors to do so in a more effective and efficient way as was recommended by the PCE.

43. The Regulations do not change other comprehensive controls in place to protect people and the environment when VTAs are used. They ensure that the use of such controls are not going to be held up in litigation over resource consents, and removes the need to follow inconsistent plan rules for the use of

1080, brodifacoum, and rotenone, provided they meet the prescribed conditions.

44. The Regulations are a contribution to the sustainable management of our natural resources and biodiversity.

SWORN)
at Wellington this 10th day of July 2017)
)
before me:) Nicolas Rex Smith

10/7/17

Miriam Sophie Bookman
Solicitor
WELLINGTON

A Solicitor of the High Court of New Zealand at Wellington

"NRS -1"

This is the exhibit marked "NRS-1" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Miriam Sophie Bookman
Solicitor
WELLINGTON

Solicitor of the High Court of New Zealand

Taonga of an island nation:

Saving New Zealand's birds

May 2017

Parliamentary Commissioner for the Environment

Te Kaitiaki Taiao a Te Whare Pāremata

Acknowledgements

The Parliamentary Commissioner for the Environment would like to express her gratitude to those who assisted with the research and preparation of this report, with special thanks to her staff who worked so tirelessly to bring it to completion.

Photography

Cover photo: © Rob Suisted / Nature's Pic

This report and other publications by the Parliamentary Commissioner for the Environment are available at: **www.pce.parliament.nz**

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Overview

This report begins with a vision – the restoration of abundant, resilient, and diverse birdlife on the New Zealand mainland. People who know me know that I am not generally given to visions. This one crept up on me during our investigation into New Zealand's native birds.

Our birds are indeed a great treasure – they are a taonga of this island nation. The kiwi deserves its iconic status – it is one of the very few birds left in the world that is only a step away from the dinosaurs. But we also have parrots and penguins, gannets and gulls, shearwaters and shags, ducks and dotterels, and many others.

There are 168 different species of native birds in New Zealand. Of these, 93 are especially precious because they are found in no other country.

But they are far from safe. Only 20% – one in every five – is in good shape. And one in every three is not far off from following the moa and many others into extinction. The situation is desperate.

Our native birds need three things – safety from predators, suitable habitat, and enough genetic diversity for long-term resilience.

Undoubtedly, the first – safety from predators – is the most urgent. Possums, rats, stoats, and other introduced animals kill millions of birds every year. And it is not just birds – they also devour lizards and frogs and insects.

Last year the Government announced the goal of making the country free of predators by 2050. While some might criticise this goal as unrealistic, it does something very important – it focuses our attention on the predators that are devastating our native fauna.

In the future, breakthrough genetic technologies may make it possible to eradicate some predators altogether. But for the foreseeable future, the name of the game is predator suppression.

Accordingly, I am greatly encouraged by the wave of innovation underway experimenting with new ways of luring, trapping, and poisoning predators. A range of creative ideas are on the table, and it is vital that this continues.

It is also vital to recognise that aerial application of the toxin 1080 remains essential for the foreseeable future. An aerial 1080 drop will effectively (and cost-effectively) knock down populations of possums, rats, and stoats to low levels over large areas, even when these areas are rugged and difficult to access. It is also the only way we have of preventing the devastation of mast years, when rat and stoat numbers soar in response to an abundance of food.

Possums, rats, and stoats are not the only predators. During this investigation, I have become increasingly concerned about the feral cats that now almost certainly number in the millions in the countryside and along forest margins. They are major killers of precious wading birds like the wrybill – the only bird in the world with a beak that curves to the side.

Birds also need suitable habitat – somewhere to live. A population of birds might be safe from predators, but will not thrive without enough food and somewhere to nest. The honey-eaters – tūī and bellbirds – will not proliferate in a beech forest where wasps are eating all the honeydew.

The habitat for New Zealand's native birds is not just forest, and it is not all within national parks and other reserves. Restoring abundant, resilient and diverse birdlife back on the mainland will involve bringing birds back to farmland, coasts, riverbeds, and cities.

There is no shortage of interest. The QEII National Trust struggles to keep up with the demand for covenants that place permanent protection on areas of habitat on farmland. Similarly, Ngā Whenua Rāhui is engaged with placing kawenata on Māori land. And the number of eco-sanctuaries continues to grow, with many on private land.

Finally, birds need a measure of genetic diversity.

A great success of New Zealand conservation has been the eradication of predators on offshore islands, enabling them to be used as sanctuaries for birds. On the mainland also, some birds are effectively trapped in remnants of habitat.

But small isolated bird populations can become inbred, and struggle to produce healthy chicks. On Tiritiri Matangi in the Hauraki Gulf, a kokako named Bandit is consorting with his grandmother. This may be a happy relationship, but it is unlikely to be a healthy one. We must guard against our birds drifting to the shallow end of the gene pool.

In the last chapter of this report, I have made seven recommendations to Government Ministers.

The first three recommendations are concerned with the most important and pressing thing birds need – safety from predators.

The first recommendation is for the development of a plan for Predator Free 2050 – a living document that is revised and added to over time. All the disparate efforts currently underway will not just magically come together. There is a Far Side cartoon that captures this perfectly. It shows a group of cowboys and horses piled up in a heap outside the Sheriff's office. The Sheriff is saying "And so you just threw everything together?... Mathews, a posse is something you have to *organize*".

The first element of such a plan needs to be the preparation of a portfolio of areas for sustained predator control. Like Taranaki Mounga, these areas need to be large, so they can support bigger populations of birds and reduce the risk of inbreeding, and slow the rate of predator reinvasion.

The second recommendation highlights some areas of research that should be given a high priority. One of these is about optimising the effectiveness of 1080 drops. Another is about the urgent need to tackle the problem of feral cats effectively and humanely. In Australia, feral cats are widely recognised by the public as a great threat to their native species – we need the same cultural change to occur here.

While the quest for scientific breakthroughs that could completely eradicate at least one predator is underway, we cannot afford to wait. We may eventually succeed in building a wonderful high tech hospital, but in the meantime the patient may die. We may succeed in developing a breakthrough genetic technique, but in the meantime, many of our bird species may disappear altogether. Recall that only 20% are in good shape. Doing better with current ways of controlling predators is critical.

The third recommendation addresses the need for early engagement with the public over research into breakthrough genetic techniques. One of these techniques known as gene drive could potentially drive infertility through a population of predators. Approaches like this that rely on genetic modification are likely to encounter strong opposition from some. Kevin Estvelt, a world leader in gene drive research, argues that we need to share ideas and information with the public to *"permit open assessment and critique before experiments begin."* I agree.

The fourth recommendation is about some aspects of habitat protection and restoration. Without food to eat and places to nest, birds cannot thrive. I am asking Ministers to ensure some particular aspects of habitat restoration are explicitly considered during the development of environmental and conservation policies.

One of these aspects is the weeds that have invaded a particularly special bird habitat – the braided riverbeds of the eastern South Island where oystercatchers and other wading birds lay their eggs. Not only do these weeds crowd out nesting sites, they provide perfect cover for stalking predators.

Another of these aspects is the idea that indigenous species should be maintained and restored only within their natural range. In some instances, this may be the best thing to do, but in others it may not. Since kauri dieback disease is threatening the continued existence of these magnificent trees, does it not make sense to plant some far away from their natural range?

The fifth recommendation is concerned with genetic diversity. When a population of birds becomes too alike, it lacks resilience. If one bird is susceptible to a disease, it is likely that all will be.

One of our most treasured birds is the kākāpō. Once common across New Zealand, it is the heaviest parrot in the world and the only one that cannot fly. Despite the tremendous efforts put into the kākāpō, the effects of inbreeding are becoming apparent. To say we have brought the kākāpō back from the brink of extinction is not correct; rather it continues to teeter on the brink of extinction. The long-term survival of the kākāpō may well depend on genetically engineering the birds themselves. We must work to prevent other birds from slipping into this state.

During this investigation, it has become apparent that there are strong disagreements about managing bird genetics. What some see as genetic pollution, others see as hybrid vigour. This must be sorted through open discussion and the elucidation of clear principles.

Saving our birds will require a great deal more money to be invested in conservation. My sixth recommendation is concerned with potential sources of new money, including requiring visitors to the country to pay a Nature border levy. Tourists do not come to New Zealand to shop; they come because they have seen photographs of stunningly beautiful national parks.

The Government has recently announced more funding for the tracks, bridges, toilets, carparks, and other infrastructure that supports the visitor experience. But the flora and fauna that draw visitors need much more help too. It is not just birds – lizards, frogs, insects and other native fauna are also in trouble. And now myrtle rust has blown across from Australia, threatening pōhutukawa, rātā, and mānuka.

My last recommendation is concerned with the need for support for, and coordination of, conservation community groups – the thousands of people across the country who are giving so much to suppress predators, and protect and restore habitat. My staff and I have had the privilege of visiting some of these groups over the course of this investigation.

My memories of a trip to Northland are clear and warm. I remember the hospitality of the Rawhiti marae and Rana calling to the toutouwai – the robins – on Urupukapuka Island. I remember the difficulty of even asking a question during the enthusiastic babble of a meeting with Backyard Kiwi at Whangarei Heads.

I have enjoyed this investigation immensely. With no particular prior knowledge about our native birds, I have loved learning about them. But beyond the birds themselves, this investigation has opened a window into some of the big questions about conservation.

What, for instance, do we seek to achieve? Taking the country back to a prehuman state is not possible or desirable – we are here now. And when we have decided what it is we seek to achieve, how do we go about getting there?

It is my view that one of the things we should seek to achieve is the restoration of abundant, resilient, and diverse birdlife on the New Zealand mainland. Let us aim for much more than bird ‘museums’ on offshore islands that few can ever visit.

Nearly 50 years ago, like many young people at that time, I was a moderately serious tramper. More accurately, I trailed in the wake of moderately serious trampers doing my best to keep up. I clearly remember the joy of the dawn chorus on the Wangapeka Track. Can we not bring this experience back for young New Zealanders?

Ko te reoreo a kea ki uta,

ko te whakataki mai a toroa ki tai,

he kōtuku ki te raki,

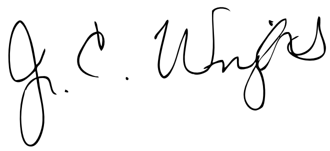
he kākāpō ki te whenua.

The voice of the kea is heard inland,

the cry of the albatross is heard at sea,

a white heron in the sky,

a kākāpō on the ground.



Dr Jan Wright

Parliamentary Commissioner for the Environment

Tirohanga Whānui

Ka tīmata tēnei pūrongo ki te moemoeā – te whakarauoratanga o te taupori manu kia makuru, kia manawaroa, kia kanorau anō hoki ki te tūwhenua. Mēnā e mōhio ana koe ki a au, ka mōhio ehara au i te tangata whai moemoeā. I tūpono whakaninihi mai tēnei moemoeā i a tātou e rangahau ana i ngā manu ake o Aotearoa.

He tino taonga ā tatou manu – he taonga nō te motu nei. Ka tika rā kua hau te rongo o te kiwi – koia tētahi o ngā toenga manu ruarua nei, huri noa te ao, he whanaunga tata rawa ki te mokonui. Engari, kei konei hoki ngā kākā, ngā hoiho, ngā pokotiwha, ngā tākapu, ngā tītī, ngā kawau, ngā rakiraki, ngā tūturiwhatu, me te maha noa atu.

Kotahi rau ono tekau mā waru ngā tūmomo manu i Aotearoa. E iwa tekau mā toru o ēnei nō Aotearoa anake.

Kāore i te haumarutia ngā manu nei. Rua tekau ōrau anake – kotahi haurima – e pai ana. Ā, kotahi hautoru e tata ana ki te mate ā-moa. He raru nui kei te haere.

E toru ngā mea e tika ana mō ā tātou manu nō Aotearoa ake – kia aukatia ngā konihi, he nōhanga tika, ā, he ira kanorau kia manawaroa ai mō āke tonu atu.

Kāore e kore, ko te mea tuatahi – te aukati i te konihi – te mea kōhukihuki. He miriona ngā manu e whakamatea ai e ngā paihamu, kiore nui, toiura me ētahi atu kararehe kua tatū mai. Ā, ehara i te manu anake e whakamatea ana – ka horomitia hoki ngā ngārara, ngā peketua me te aitanga pepeke.

I tērā tau i whāki te Kawanatanga i te whāinga kia whakakorea ngā konihi kia tae ki te tau 2050. Tērā ētahi e whakahē ana me te kī e kore e tutukihia te whāinga nei. Engari, he kaupapa nui tō te whāinga nei – ka āta whakaarohia ngā konihi e whakamōtī ana i ngāi kīrehe nō Aotearoa ake.

Ā tōna wā, ka puta mai ngā hangarau ira hou e whakakore rawatia ai ētahi konihi. Engari, i te wāheke e mōhiotia ana, ko te tino kaupapa ko te pēhanga o te konihi.

Nā reira, e harikoa ana au i te maha o ngā auahatanga e whakahaeretia ana, e whakamātau ana i ngā huarahi hou ki te tīmori, ki te tārore, ki te paihana i ngā konihi. He maha ngā whakaaro auaha kua toko ake, ā, me haere tonu te mahi nei.

Kia mōhio mai tātou me haere tonu te whakamakere i te paitini 1080 i te rangi mō te wāheke e mōhiotia ana. Mā te whakamakere 1080 e whakaitia ai ngā taupori paihamu, kiore nui, toiura hoki kia itiiti noa ki ngā wāhi whānui. Ka pēnei ahakoa he wāhi uaua, ā, he uaua ki te tomo mai. Koia hoki te huarahi anake e aukatia ai te whakamōtītanga i ngā tau he huhua ngā pua o ngā rākau, ā e nekeneke mai ai te tini me te mano o ngā kiore nui me ngā toiura i te huhua o te kai.

Ehara te paihamu, te kiore nui me te toiura anake i te konihi. I roto i te rangahau nei, kua tino maharahara au mō ngā ngeru kūwao. Kāore e kore kua eke ki ngā miriona te taupori ki te taiwhenua me te taha o ngā ngahere. He kaha ēnei ki te whakamate i ngā manu kautū tongarewa pērā i te ngutu pare – te manu anake o te ao e kōpiko ana ngā ngutu ki te taha.

He mea nui mō te manu ko te nōhanga tika – tētahi wāhi hei noho. Ka aukatia te konihi i te taupori manu pea, engari kāore e tōnui ki te kore he kai, he wāhi ki te hanga kōhanga hoki. Ko ngā manu kai mīere – ngā tūī me ngā korimako – kāore e whakaranea i roto i te ngahere tawai e kāinga ana te tōmairangi mīere.

Ehara i te mea ko te nōhanga o ngā manu ake o Aotearoa kei ngā wāhi pēnei i te ngahere, i te papa rēhia ā-motu, i ngā whenua rāhui anake. Ki te whakaoratia ai ngā manu ki te tūwhenua kia makuru, kia manawaroa, kia kanorau me whakahoki mai ngā manu ki ngā pāmu, ki ngā takutai, ki ngā whaiawa, ki ngā tāone nui anō hoki.

He tokomaha ngā kaitautoko.

He uaua kia whakatutukihia e te QEII National Trust ngā tono mō ngā kawenata e rāhui tuturu ai ngā wāhi nōhanga manu ki ngā pāmu. Waihoki, ka whakaritea ngā kawenata e Ngā Whenua Rāhui ki ngā whenua Māori. Ā, kei te piki tonu te maha o ngā whakahaumarutanga hauropi, ā, tērā ētahi kei ngā whenua tumataiti.

Ko te ira kanorau te kaupapa whakamutunga e tika ana mā ngā manu.

Kua angitu te whāomoomo i Aotearoa i te whakakorenga o ngā konihi ki ngā motu ririki i waho atu o te motu whānui. Kua noho ērā hei whakahaumarutanga mā ngā manu. Kei te tūwhenua, tērā ētahi manu kua whakamaua ki ngā toenga nōhanga.

Engari, ki ngā taupori manu mōriroriro, iti nei, ka moe tahi ngā manu whanaunga tata, ā, he uaua te whakaputa i ngā pī ora. I Tiritiri Mātangi i Tīkapa Moana, tērā tētahi kōkako, a Bandit, e moepuku ana i tana kuia. He whakapiringa whakakoakoa pea, engari kāore i te pai. Kei tere atu ā tātou manu ki te pito pāpaku o te hōpua ira.

I te ūpoko whakamutunga o te pūrongo nei, e whitu aku tūtohunga ki ngā Minita Kāwanatanga.

Ko ngā tūtohunga tuatahi takitoru nei mō te kaupapa tino nui mō ināianei tonu – te aukati i ngā konihi.

Ko te tūtohunga tuatahi e pā ana ki te whakawhanake i te mahere mō te Konihi Kore 2050 – he tuhinga mataora e whakahoungia, ā, ka tāpiritia ētahi atu kōrero i ētahi wā. Kāore i te pai ki te kī ko te whakapau kaha a tēnā, a tēnā ka tūhonohono ai ā tōna wā. Tērā te pakiwaituhi Far Side e whakaatu pai ana i tēnei. Tērā te haupūtanga o ngā kaupoai me ngā hōiho i waho i te tari o te Pirihimana. E pēnei ana te kī a te Pirihimana "And so you just threw everything together?... Mathews, a posse is something you have to *organize*".

Ko te wāhanga tuatahi o te mahere nei ko te whakarite i te kohinga wāhi mō te whakahaere konihi e haere tonu ana. Ōrite ana ki Taranaki Mounga, me whānui ngā wāhi nei, kia tautoko ai i ngā taupori manu e whakaputa pī ana. Ā, kia kaua e moe tahi he whanaunga tata, ā, kia whakapōturi i te hokinga mai o ngā konihi.

Ka tīpako te tūtohunga tuarua i ngā wāhanga o te rangahau kia whakanuia rawatia. Ko tētahi o ēnei ko te whakakaha i te whakaaweawe i te whakamakere 1080. Ko tētahi atu ko te tūmanako kia whakatikatikahia paitia te raru e pā ana ki ngā ngeru kūwao. Me whakaaweawe, me whai aroha te whakatikatika. I Ahitereiria, e mōhiotia rawatia e te iwi whānui he whakawehi nui ngā ngeru kūwao ki ngā kararehe nō Ahitereiria ake – me huri kia pērā te whakaaro i konei.

Ahakoa e haere ana te rapu mō ngā kitenga hou ā-pūtaiao e whakakorengia rawatia ai tētahi konihi, kāore e taea e tātou te tatari. Ā tōna wā pea, ka hangaia te hōhipera hangarau mīharo, engari kua mate noa atu te tūroro. Ka tutuki i a tātou te kitenga hou mō te tikanga ira, engari, i mua i tēnā, kua mate noa atu ētahi o ngā tūmomo manu. Kaua e wareware e whā haurima ngā tūmomo manu – 80% - kua raru ināianei. Me pai ake ngā tukanga whakamate konihi o te wā nei.

Ko te tūtohunga tuatoru e pā ana ki te kōrerorero ki te hunga tūmatanui mō te rangahau kitenga hou mō te tikanga ira. Ko tētahi o ēnei tikanga, ko te whakahaere ira, ka whakahaere i te pukupā ki ngā taupori konihi. Ko ngā tukanga pēnei, i, hangaia i runga i te raweke ira, ka whakahēngia rawatia e ētahi. E ai ki a Kevin Estvelt, tētahi o ngā mātanga whakahaere ira, me tuku i ngā whakaaro me te pārongo ki te hunga tūmatanui kia *"permit open assessment and critique before experiments begin."* E whakaae ana au.

Ko te tūtohunga tuawhā mō ētahi āhuatanga e pā ana ki te haumarutanga me te whakaoranga o te nōhanga. Mēnā kāore he wāhi ki te kai, ki te hanga kōhanga, e kore ngā manu e tōnui. E akiaki ana au ki ngā Minita kia āta whakaarohia ētahi āhuatanga e pā ana ki te whakaora nōhanga i te wā e whakawhanakehia ngā kaupapa here mō te taiao, me te whāomoomo.

Ko tētahi o ēnei āhuatanga ko ngā taru kua urutomo i tētahi nōhanga motuhake manu – ko ngā whaiawa tūhonohono i te taha whakaterāwhiti o Te Waipounamu e whakaputa ai te tōrea me ēra atu manu kautū i ngā huamanu. Ka tāmuimuia ngā wāhi kōhanga, ā, ka hunaia ngā konihi whakamokamoka.

Ko tētahi atu āhuatanga ko te whakaaro me pupuri, me whakaora rānei i ngā kararehe nō Aotearoa ake ki ngā wāhi anake i noho ai ēnei kararehe i ngā wā o mua. I ētahi wā, e tika ana tēnei, engari i ētahi e hē ana. Nā te mea, kua whakatuma te mate kauri i te rākau mīharo nei, te kauri, kāore e kore me whakatō i ētahi ki ngā wāhi tawhiti atu i ngā wāhi i noho ai ēnei i ngā wā o mua.

Ko te tūtohunga tuarima e pā ana ki te kanorau ira. Mēnā ka ōrite te āhua o te taupori manu, ka ngoikore, kāore e manawaroa. Mēnā ka patua tētahi manu e tētahi mate, ko te whakaaro ka patua te katoa e taua mate.

Ko tētahi o ā tātou tino manu ko te kākāpō. I mua he tino maha rawa te taupori, ā, ko te manu nei te kākā taumaha o te ao, me te kākā anake kāore e taea te rere. Ahakoa te whakapau kaha ki te tautoko i te kākāpō, e kitea ana ngā whakaaweawe o te moe tahi o ngā whanaunga tata. Kāore i te tika ki te kī kua whakahokia te kākāpō i te mate ā-moa; engari e tata ana te mate ā-moa. Ka ora tonu te kākāpō mēnā ka rawekehia te ira o ngā manu nei. Me whakapau kaha tātou kia kaua e pēnā ai ētahi atu manu.

I roto i te rangahau nei, kua mārama he nui ngā taupatupatu e pā ana ki te whakahaere i te ira manu. Ki ētahi he takakino ira, ki ētahi he uekaha momorua. Me whakatau tēnei mā te kōrerorero tūmatanui me te whakahua i ngā mātāpono mārama.

Ki te whakarauora i ā tātou manu, me nui ake te pūtea e utua ai mō te whāomoomo. Ko taku tūtohunga tuaono, e pā ana ki ngā pūtea hou, ko tētahi, me utu ngā tāpoi ki te motu nei i te utu aukati Taiao. Kāore e haere mai ngā tāpoi ki Aotearoa ki te hoko mea; ka haere mai nā te mea kua kite rātou i ngā whakaahua o ngā papa rēhia ā-motu ātaahua.

Inā tata nei, kua whakapaoho te Kāwanatanga i te pūtea mō ngā huarahi, arawhata, wharepaku, papawaka, me ērā atu kaupapa e tautoko ai i te urunga mai o ngā manuhiri nei. Engari me tiaki i ngā tipu me ngāi kīrehe e tōtō mai ai i aua manuhiri. Ehara i te manu anake – ko ngā ngārara, ngā peketua, te aitanga pepeke me ēra atu kararehe nō Aotearoa ake kua raru. Ā, ināianei, kua pūhia mai te 'myrtle rust' i Ahitereiria. Kua whakatumahia te pōhutukawa, te rātā me te mānuka.

Ko taku tūtohunga whakamutunga e pā ana ki te tautoko me te ruruku i ngā rōpū whāomoomo hapori. Ko te tini me te mano o ngā tāngata, huri noa i te motu, e whakapau kaha ana ki te pēhi i ngā konihi. Ā, ki te haumaru, ki te whakaora anō i te nōhanga. Kua waimarie mātou ko aku kaimahi ki te toro atu ki ēnei rōpū i a mātou e rangahau ana.

He mārama, he mahana taku maumahara i tētahi haerenga ki Te Tai Tokerau. Ka maumahara au ki te manaakitanga o te marae o Te Rāwhiti me Rana e pepe ana ki ngā toutouwai i te motu o Urupukapuka. Ka maumahara hoki au i te uauatanga ki te tuku pātai i te papā waha uekaha me Backyard Kiwi i te matakūrae o Whāngārei.

Kua harikoa au i roto i te rangahau nei. Kāore au i tino matatau mō ngā manu ake o Aotearoa i mua, ā, kua harikoa au ki te ako. Engari, atu i ngā manu, kua whakatairanga te rangahau nei i ētahi pātai nunui e pā ana ki te whāomoomo.

Hei tauira, he aha te tino whāinga? Kāore e taea, kāore i te hiahiatia hoki kia hoki ki te wā i mua i te tangata. Kei konei tātou. Ā, ki te whakatau mātou, he aha tā mātou e rapu nei, mā te aha e tae atu ki reira?

Ki taku nei titiro, ko tētahi o ngā kaupapa ko te whakaora i te taupori manu kia makuru, kia manawaroa, kia kanorau anō hoki i runga i te tūwhenua o Aotearoa. Me kaua e pēnei te whāinga: te whare taonga manu i runga i ngā motu ririki kāore e kitea e te nuinga.

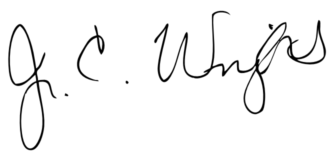
Nui ake i te 50 tau i mua, e pērā ana ki ngā rangatahi o taua wā, he āhua kaha au ki te takahitanga. Ko te tikanga kē pea, i te whai au i ngā kaihōkai, me te whakapau kaha kei mahue au ki muri. Ka mārama taku maumahara i te kōrihi o te manu, i te tākiritanga mai o te ata ki te huarahi o Wangapeka. Ka whakahokia mai anō pea ināianei tēnei āhuatanga mā ngā rangatahi o Aotearoa?

Ko te reoreo a kea ki uta,

ko te whakataki mai a toroa ki tai,

he kōtuku ki te raki,

he kākāpō ki te whenua.



Dr Jan Wright.

Te Kaitiaki Taiao a Te Whare Pāremata

1 Introduction

Before dinosaurs became extinct and before mammals flourished, New Zealand drifted apart from the ancient supercontinent of Gondwanaland. This set New Zealand on a different evolutionary path to the rest of the world.

Before the arrival of humans, New Zealand was a land of birds. Instead of mice, tiny flightless wrens scampered around the forest floor. Instead of badgers, kiwi rustled through the undergrowth probing for worms and insects. Instead of deer, tall moa browsed the forest. Instead of squirrels, kōkako ranged along tree branches searching for food. Instead of lions and wolves, the top predator was the giant Haast's eagle with a wingspan of three metres.

The forests, rivers, and shores teemed with birds. The beating of kererū wings reverberated over the forest. Along the coast at dusk the sky was dark with millions of seabirds.

Ngā manu – birds – were woven into many aspects of everyday Māori life. Moa, geese, kererū, and tītī were a ready source of protein. Kūmara planting started with the first calls of migratory pīpīwharauroa (shining cuckoo) as they returned from the tropics.

Kiwi bones were used to apply tā moko. The white-tipped tail feathers of the huia were worn in the hair by people of high rank. Tūī were sometimes taught to talk by tohunga. Great singers and speakers were compared to the korimako.

Although a number of bird species went extinct after the arrival of Māori, New Zealand was still a land of many birds when Europeans arrived. While the Endeavour was anchored in Queen Charlotte Sound, botanist Joseph Banks wrote, *"This morn I was awakd by the singing of birds … their voices were certainly the most melodious musick I had ever heard."*[1] A century later, explorer Charles Douglas recorded shaking kākāpō out of a tutu bush like apples out of a tree.[2]

New Zealand remains home to over 150 species of native birds, and many of these are found in no other country – they are endemic to New Zealand. Four out of every five are in trouble – and some sit on the brink of extinction.

Across the country, many New Zealanders are working hard to save our natural heritage. The Government has set a goal for kiwi to shift from an annual decline of 2% to an annual increase of 2%. But many other precious birds are in similar or greater trouble.

This investigation is focused on a vision – a vision of restoring abundant, resilient, and diverse native birdlife on the mainland. Realising this vision will require using the knowledge, ingenuity, and passion of many New Zealanders.

1.1 Purpose of this report

The Parliamentary Commissioner for the Environment is an independent Officer of Parliament, with functions and powers granted through the Environment Act 1986. Her role allows a unique opportunity to provide Members of Parliament with independent advice in their consideration of matters that may have impacts on the environment.

This investigation is aimed at shining a light on the state of New Zealand's native bird populations, the challenges they face, and what it might take to restore them in large numbers back on to the mainland.

There is, of course, much more to protecting our natural heritage than saving the birds that sit at the top level of our ecosystems. But if we can restore our bird populations, much else will also benefit.

The possums, rats, and mice that eat eggs and chicks also devour foliage, seeds, snails, and insects. The stoats, ferrets, weasels, and cats that so skilfully hunt birds also eat lizards and insects. Together these introduced animals degrade the mauri of the forest.

Birds eat and disperse seeds, maintaining forest diversity – the spread of karaka trees is heavily dependent on the presence of kererū. The flowers of the pikirangi (mistletoe), which has become so rare, are pollinated by the honey-eaters – tūī, korimako, and hihi. Although much depleted in numbers, the birds that feed at sea and return to the land to sleep and nest fertilise the land with their phosphorus-rich guano.

Sometime after this investigation had begun, the Government launched a major initiative aimed at eradicating possums, rats, and stoats on the mainland by 2050. Introduced predators are now the main cause of declining bird populations, so the goals of ridding the country of predators and of restoring native bird populations have much in common.

Accordingly, both share some major challenges. There is still some opposition to the use of the pesticide 1080, and concerns about the development of new gene technologies. Ways of dealing with predators will need to be both effective and cost-effective, given the nature of the task and the inevitable limits on resources.

This report has been produced pursuant to subsections 16(1)(a) to (c) of the Environment Act 1986.

Source: Kererū Discovery

Figure 1.1 The kererū (kūkupa as it is known in Northland and on the West Coast) is very important for dispersing the seed of large-fruited trees like the karaka.

1.2 What comes next?

The remainder of this report is structured as follows.

Chapter 2 tells the story of what has happened to New Zealand's birds over time. It begins with showing how their evolution in isolation from the rest of the world has made them vulnerable as well as unique. A short account of the impact of the arrival of humans is followed by a description of the rise of a conservation ethic in the 20th century. The final section covers some of the developments in conservation since 1990.

Chapter 3 is about the 168 species of native birds that still exist today. It shows which are thriving, which are in difficulty, and which are just hanging on.

Chapter 4 explores two fundamental issues about the nature of species – the 'currency of biology'. First, dividing Nature into species is far from clear-cut. Second, it is often assumed to be self-evident that all species are equally valuable – this is discussed with reference to New Zealand's native birds.

Chapters 5 to 8 deal with the most critical requirements for birds to thrive on the mainland – safety from predators and suitable habitat.

Chapter 5 is about the big three predators – possums, rats, and stoats. These three are the primary target of Predator Free 2050. It covers some current innovations in trapping and poisoning, and shows why the pesticide 1080 is still a vital weapon in the war against these predators.

Chapter 6 covers other predators of native birds – mice, ferrets, weasels, hedgehogs, cats, and dogs. It finishes with a section on humans as unintentional predators – the bycatch of seabirds from fishing.

Chapter 7 is a short description of three areas of scientific research that may lead to radically new ways of controlling, and possibly eradicating, predators.

Chapter 8 deals with what birds need to thrive after predators have been suppressed – habitat. It describes how a number of introduced animals and plants degrade bird habitat. The last section is about protecting and restoring habitat on private land.

Chapter 9 is about the resilience of New Zealand's native birds in the long term. Some, like the much-loved kākāpō, are highly inbred, and others are likely to be heading that way. The four forces of evolution are explained – an understanding of these is critical for deciding whether birds should be moved from one population to another.

Chapter 10 contains conclusions and recommendations from the Commissioner.

At the end of the report, the Appendix contains a detailed list of all New Zealand's native birds. It shows which are endemic; that is, found in no other country. It also gives the current threat classification (at a high level) of all bird taxa.

2

A brief history of New Zealand’s native birds

This chapter tells the story of the native birds of New Zealand – their distinctiveness, the impact of human settlement, and the changing response to their decline.

There are four sections in the chapter.

The first section describes how the long isolation of New Zealand and the absence of mammals led to the evolution of many unusual birds.

The second section describes the impact of the arrival of humans and the animals they brought with them. The features that made many birds so distinctive left them vulnerable to these new arrivals. Many European settlers saw the decline of native species as inevitable due to the ‘superiority’ of European plants and animals.

The third section describes the concern about the decline of native plants and animals that began to develop towards the end of the 19th century. The growing conservation ethic was increasingly accompanied by initiatives aimed at protecting what remained of the country’s natural heritage. Efforts to protect birds were focused on the creation of island sanctuaries.

The fourth section brings the New Zealand bird story into the present day. The most recent development occurred in 2016 – the setting of a target aimed at ridding the country of the most damaging introduced predators by 2050.

2.1 A land of distinctive birds

Safe from predation by mammals, many New Zealand birds evolved in unusual ways.

With no need to evade ground-dwelling predators, flying was a waste of energy, so many birds lost the ability.[3] Many, like moa and adzebill, are now extinct, but some, including kiwi, kākāpō, takahē, and weka, still survive.

The ground was a safe place to live and nest. Kakī and wrybill lay their eggs on open riverbeds with the eggs camouflaged to look like stones. Fairy terns lay their eggs in sandy hollows on beaches. Takahē make rudimentary nests under tussock. Mohua, kākā, and hihi nest in holes in trees.

Some New Zealand birds evolved to lay fewer eggs than birds in other countries.[4] In the years of plenty when trees 'masted', some bred more prolifically.

Although there were no mammalian predators on the ground, there were predators in the air. The giant Haast's eagle has long been extinct, but the speedy New Zealand falcon (kārearea) survives. Such airborne predators locate their prey by using their keen eyes to detect movement, so many New Zealand birds evolved to freeze in the presence of danger. Nothing could make them more vulnerable to mammalian predators with an acute sense of smell.[5]

It is not surprising that many of New Zealand's birds evolved to be exceptional – particularly the 'deep endemics' that adapted to local conditions over many millions of years.

The Haast's eagle was the largest eagle known to have ever existed. The South Island giant moa was the tallest bird ever to exist. The takahē is the world's largest rail. The kea is the world's only alpine parrot, and the kākāpō is the only parrot that cannot fly. Three of New Zealand's penguins nest in forests, and Hutton's shearwater is the only seabird that lays its eggs high above the bushline.

The kiwi is so odd that it is sometimes referred to as an 'honorary mammal'. Its bones are filled with marrow, not air like most birds. Kiwi have two functioning ovaries whereas most birds only have one. Their eggs are six times as big as those of birds of similar size. Kiwi even have whiskers rather like cats.

Source: Wikimedia/ PLoS Biology CC BY 2.5

Figure 2.1 A Haast's eagle hunting moa. Both species are now extinct.

Source: Wikimedia

Figure 2.2 The huia was regarded by Māori as tapu, and the distinctive tail feathers were worn by those of high rank. The beak of the male was short and robust, while the beak of the female was a long, fine, downward-curving arc. The last official sighting of a huia was in 1907.

2.2 The arrival of humans

About 50 native bird species have become extinct since humans arrived in New Zealand.[6]

The first mammalian predator was the kiore – the Polynesian rat – which arrived in the ancestral waka of Māori. To the kiore, New Zealand was a food paradise, and the vulnerability of some birds would have made them easy pickings. At least four species of flightless birds succumbed to kiore (see Figure 2.3).

Māori also brought kurī (dogs) with them, using them for companionship, for food, and for hunting birds. All nine species of moa had been hunted to extinction by the 16th century. With the loss of its main food source, the Haast's eagle also disappeared.[7]

Large areas of rich lowland forest – the home for many birds – were burned following the arrival of Māori. Fire was used for various purposes, including clearing land for easier travel.[8] It is likely that larger areas of forest were cleared than intended when fires got out of control.

When Europeans arrived, they brought a whole host of predatory mammals. Some were stowaways, like rats and mice. Kiore were almost completely displaced by mice, Norway rats, and the particularly destructive ship rats.

Possums were brought over from Australia to establish a fur trade. Hedgehogs were brought in by acclimatisation societies to make New Zealand more like England. When rabbit populations boomed following their introduction for food and sport, mustelids – weasels, stoats, and ferrets – were brought in to control them.[9]

Between 1880 and 1920, 15 bird species were lost. The last few birds of seven species were killed by cats that had been put on islands to suppress rabbits.[10]

Other animals changed the nature of the forest. Goats and pigs arrived with the first European explorers.[11] Game animals – deer, chamois, and thar – were carefully imported and released for hunting. These animals browsed selectively on the more palatable plants, altering the composition and density of the forest, thus reducing food available for birds.[12]

European settlers felled large areas of forest. After the first refrigerated ship sailed for England in 1882 laden with thousands of frozen lamb carcasses, the value of pasture for grazing sheep soared, and the rate of forest clearance accelerated. In the last decade of the 19th century alone, over a quarter of the remaining native forest was felled or burned.[13] Wetlands were also drained to create new farmland, greatly reducing the habitat of bitterns, fernbirds, and teal.

Few Europeans were concerned by the decline of birdlife in New Zealand. The dominant view of 19th century scientists was that indigenous species would inevitably die out in the face of introduced species – displacement theory. The duty of the scientists was to record the past by killing and stuffing these 'doomed' birds for display in museums.[14]

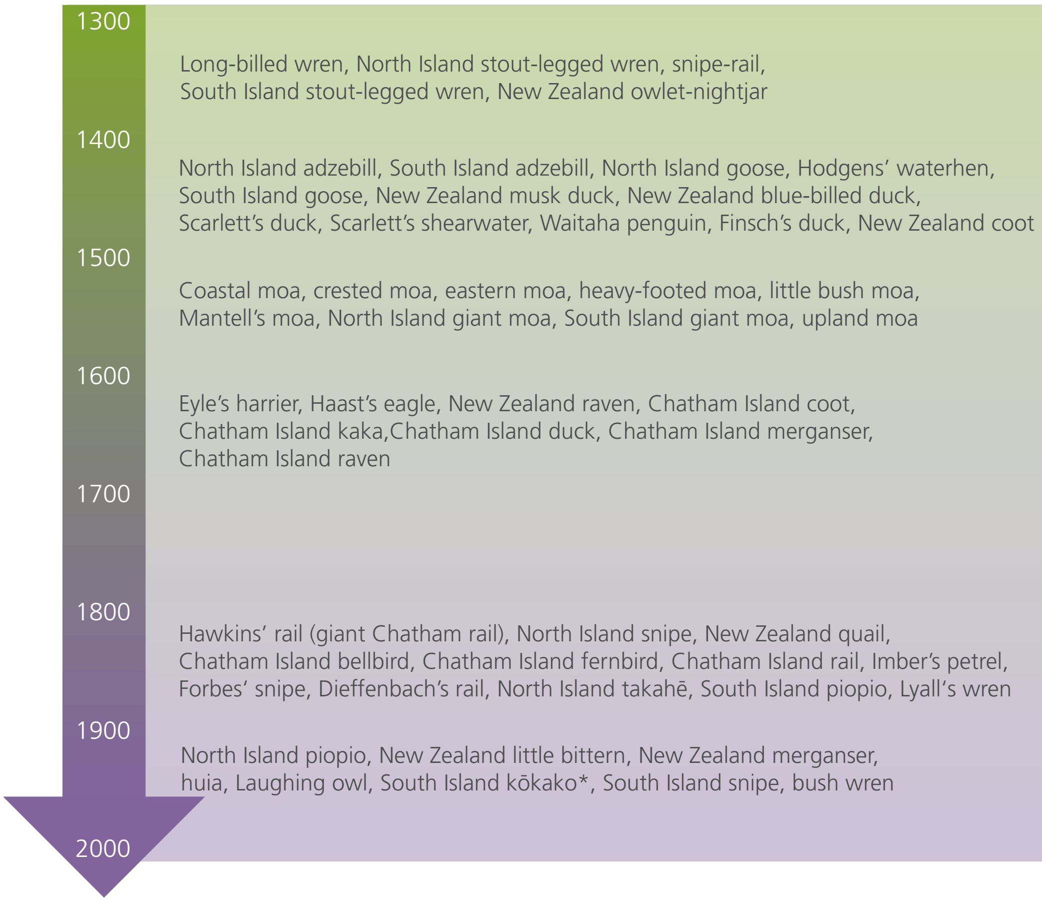


Figure 2.3 A timeline showing when New Zealand birds are believed to have become extinct or were last sighted. It is based primarily on information taken from Holdaway (1989). *The South Island kōkako is classified as 'data deficient', but is almost certainly extinct.

2.3 The growth of a conservation ethic

In the second half of the 19th century, attitudes towards native species began to change. Europeans born in New Zealand started to identify with their local landmarks, scenery, and wildlife.[15]

One early conservationist was Thomas Potts, who saw the native flora and fauna as valuable in their own right, saying, *"It will not redound to our credit if we suffer the indigenous fauna to be exterminated without some further efforts for its preservation."*[16]

Potts proposed the setting aside of large areas of land as national domains *"held under tapu as to dog and gun"*, and suggested Resolution Island in Dusky Sound as a candidate. In 1891 Resolution Island was made a reserve. Richard Henry was appointed as curator, and sailed his dinghy around Dusky Sound capturing and relocating birds from the mainland. But after Richard Henry saw a stoat on Resolution Island, he realised that protection from *"dog and gun"* was not enough.[17]

Another key figure was scientist Sir Walter Buller, famous for his painstaking documentation of New Zealand's birds. Although Buller subscribed to displacement theory, he advocated delaying the extinction of native birds by moving remnant populations on to offshore islands and keeping these islands pest-free. Little Barrier Island and Kapiti Island followed Resolution Island by becoming 'island sanctuaries' in 1897.

For the first half of the 20th century, the focus of conservationists turned to the loss of forests and the preservation of scenery.[18] But in 1948, Geoffrey Orbell's discovery of the takahē – long thought extinct – in a remote part of Fiordland caused great excitement and helped ignite further efforts to conserve native birds.[19]

Until the middle of the 20th century, there were five national parks in New Zealand, primarily managed for recreation and tourism. This changed in 1952 when the National Parks Act required that native plants and animals be preserved *"as far as possible"* in all parks.[20] The following year the Wildlife Act granted full protection to most indigenous birds.[21]

There are now 13 national parks, and together with other reserves about a third of New Zealand lies within the conservation estate. But placing an area within a national park or reserve does not guarantee protection for the diverse life within – the animals that eat birds and plants are oblivious to lines on maps.

The network of island sanctuaries has also grown over the years. In the early 1960s, a modest programme to supress rodents on tiny Maria Island in the Hauraki Gulf was unexpectedly successful when it was discovered that the entire rat population had been eradicated. This triggered a series of ever-bolder predator eradications on larger and larger islands.[22]

In 1987, the importance of conserving New Zealand's natural heritage was given a new status with the creation of the Department of Conservation. In 1991, the Resource Management Act made the protection of *"significant habitats of indigenous fauna"* a matter of national importance, although not the fauna themselves.[23] Twelve years later an amendment to the Act charged councils with *"maintaining indigenous biological diversity"*.

Source: Parliamentary Commissioner for the Environment archives

Figure 2.4 The remains of a pen Richard Henry built to keep flightless birds in can still be seen on an island in Dusky Sound.

Source: Karen Baird

Figure 2.5 The late John Kendrick recording bird calls in the 1970s that were used for many years to signal the beginning of the morning news on Radio New Zealand.

2.4 Recent developments

Over the last few decades, a number of changes in the management of New Zealand's natural heritage have influenced the protection of native birds. This section describes some of these, but is not comprehensive.

The mid-1990s saw the expansion of 'island sanctuaries' on to the mainland, with some enclosed within predator-proof fences. There are now over 30 fenced sanctuaries, enclosing several thousand hectares.[24] Some have now been surrounded by 'halos', where people work to suppress predators over larger areas.

The mid-1990s also saw the development of a deeper understanding of 'masting' – the mass seeding of trees that occurs in some years and the plagues of rodents and stoats that follow. This leads to the devastation of populations of native birds and other animals. It was not until 2004 that the pesticide 1080 was first used to kill the populations of rats and stoats that soar during a mast.[25]

In 1991 six claimants, each representing a different iwi, lodged with the Waitangi Tribunal what became known as the 'Wai 262 claim' or the 'indigenous flora and fauna claim'.[26] A major aspect of the claim was the ownership and control over taonga plants and animals. In 2011, the Tribunal concluded that *"… partnership and shared decision-making between the department and kaitiaki must be the default approach to conservation management."*[27] A number of agreements between iwi and the Department of Conservation have now been established, including for Te Urewera.[28]

For a long time, interest in and concern about New Zealand birds has been focused on forest birds – largely because some of them are so very different from birds in other countries. That New Zealand is the 'Seabird Capital of the World' is only now being appreciated – about 10% of all the seabird species in the world breed in no other country.[29] Widespread awareness that most of these are in trouble has yet to develop.[30]

In recent years there has been a growing realisation that conservation of natural heritage is, and must be, much wider than the activities of the Department of Conservation and councils.

Community groups and iwi involved in conservation now number in the thousands. Some conservation projects are funded by private money. Project Janszoon, which aims to *"restore the ecology"* of the Abel Tasman National Park over 30 years, is one of the largest of these.

In 2015, concern about the falling population of New Zealand's most iconic bird, the kiwi, resulted in the Government announcing its intent to turn a 2% annual decrease into a 2% annual increase in population.[31]

The following year, the Government adopted a new conservation initiative – the aim of making New Zealand 'predator-free' by 2050.[32] This idea was given impetus in 2012 by the late Sir Paul Callaghan in his last lecture. Sir Paul spoke of the devastating effect of introduced mammals on New Zealand's natural heritage, describing the state of our forests as catastrophic. He finished with a 'crazy' idea. *"Let's get rid of the lot. Let's get rid of all the damn mustelids, all the rats, all the possums, from the mainland islands of New Zealand."*[33]

Predator Free 2050

Predator Free 2050 has the goal of ridding New Zealand of possums, rats, and stoats by 2050.

The Cabinet Minute of the Predator Free 2050 decision describes this ambitious goal as credible because of four changes that are underway in New Zealand.[34]

- The interest shown by some philanthropists in supporting large-scale conservation projects.
- The development of innovative ways of controlling predators.
- The rapid progress being made in genetic sciences.
- The growth in the number of community groups controlling predators.

Four interim goals have been set for 2025.

- Increase the area of the mainland where possums, rats, and stoats are suppressed by one million hectares – about 4% of the country.
- Eradicate possums, rats, and stoats from areas of 20,000 hectares on the mainland without fences.
- Eradicate all mammal predators (not just possums, rats, and stoats) from offshore island nature reserves.
- Develop a break through science solution that could eradicate at least one small mammal predator from the mainland.

A new Crown entity – Predator Free 2050 Ltd – has been created to help realise this ambitious objective.[35]

How safe are our birds?

Today New Zealand remains home to 168 species of native birds, many of which are found in no other country.[36] How secure are they? How likely are they to follow the moa, the huia, and many others into oblivion?

This chapter is focused on the state of New Zealand's native birds – which species are in good shape, which are in difficulty, and which are just hanging on.

There are four sections in this chapter.

The first section introduces the system used to assess the conservation status of native plants and animals. Under this system, every bird species is assigned a threat ranking.

In the next three sections, the threat rankings of groups of native birds are shown. The birds have been grouped in a way intended to show the great diversity of bird species in New Zealand.

The second section is concerned with the native birds that live in forests.

The third section is concerned with the native birds that live in open country, in rivers and lakes, and along the coast. These habitats have been grouped together because some birds move between them. For instance, some oystercatchers nest in fields, feed in riverbeds, and spend their winters on the coast.

The fourth section is concerned with seabirds.

The Appendix contains the threat rankings of all native bird species, subspecies, and isolated populations.

3.1 Assigning threat rankings

Figure 3.1 shows the structure of the classification system used for assessing the conservation status of native plants and animals. This report is concerned with the native birds that live and breed in New Zealand; that is, they fall within the dotted line in the figure.[37],[38]

The Department of Conservation's audits of the status of New Zealand birds assign threat rankings to all bird taxa – not just to species, but also to subspecies and to some isolated populations. The table and figures in this chapter present threat ranking at the species level only.[39]

As can be seen in Figure 3.1, native bird species living and breeding in New Zealand are assigned one of four high-level threat rankings.

- Extinct
- Threatened
- At risk
- Not threatened

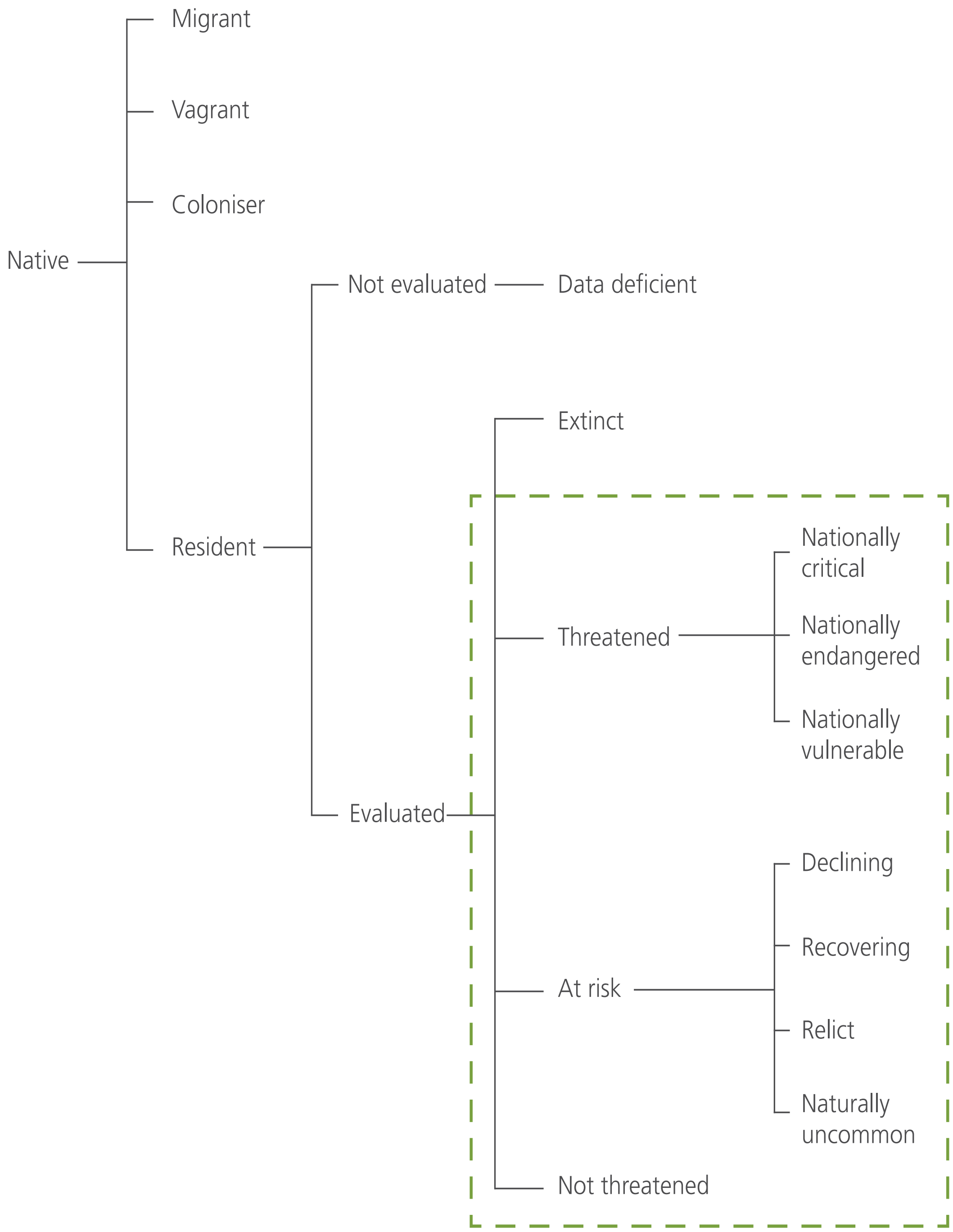
The meaning of these terms is confusing for the uninitiated.[40] Therefore, the threat rankings in this report have been renamed as follows:

- Extinct
- In serious trouble
- In some trouble
- Doing OK

In summary, only a fifth of New Zealand's 168 native bird species are doing OK, and a third are in serious trouble.

	Number of species	Percentage of species
In serious trouble	54	32%
In some trouble	81	48%
Doing OK	33	20%
Total	**168**	

Table 3.1 The conservation status of New Zealand's 168 species of native birds.



Source: Department of Conservation

Figure 3.1 The structure of the New Zealand Threat Classification System used for assessing the threat status of flora and fauna.[41] This report is concerned with the native bird species that live and breed in New Zealand; that is, they fall within the dotted line in the figure.

3.2 Forest birds

Forest birds can be put into six groups – perching birds, parrots, kiwi, pigeons, cuckoos, and ducks.

The conservation status of each of these groups is shown in Figure 3.2, and much more detail is given in the Appendix.

Perching birds

There are 22 different species of perching birds in New Zealand forests. Technically, these birds are called passerines – all perch with three toes pointing forward and one back. All except the rifleman and the rock wren are songbirds. Tūī, bellbirds, and fantails are all songbirds well known to New Zealanders.

The hihi (stitchbird), the rock wren, and the black robin are the most endangered. The kōkako and the tīeke (saddleback) belong to the same family as the extinct huia, and both are in some trouble, but classified as recovering.

Parrots

Three native parrot species – the kākāpō, kea, and kākā – are like no other parrots in the world. The kākāpō is particularly odd – it is exceptionally large, nocturnal, and cannot fly – and is classified as nationally critical.

There are six different species of kākāriki. Of the three that live on the mainland, the orange-fronted kākāriki is the most endangered.

Kiwi

There are five different species of New Zealand's most iconic bird, with the North Island brown kiwi by far the most common. The rowi and tokoeka are now confined to small pockets of the South Island, and both are in serious trouble.

Pigeons

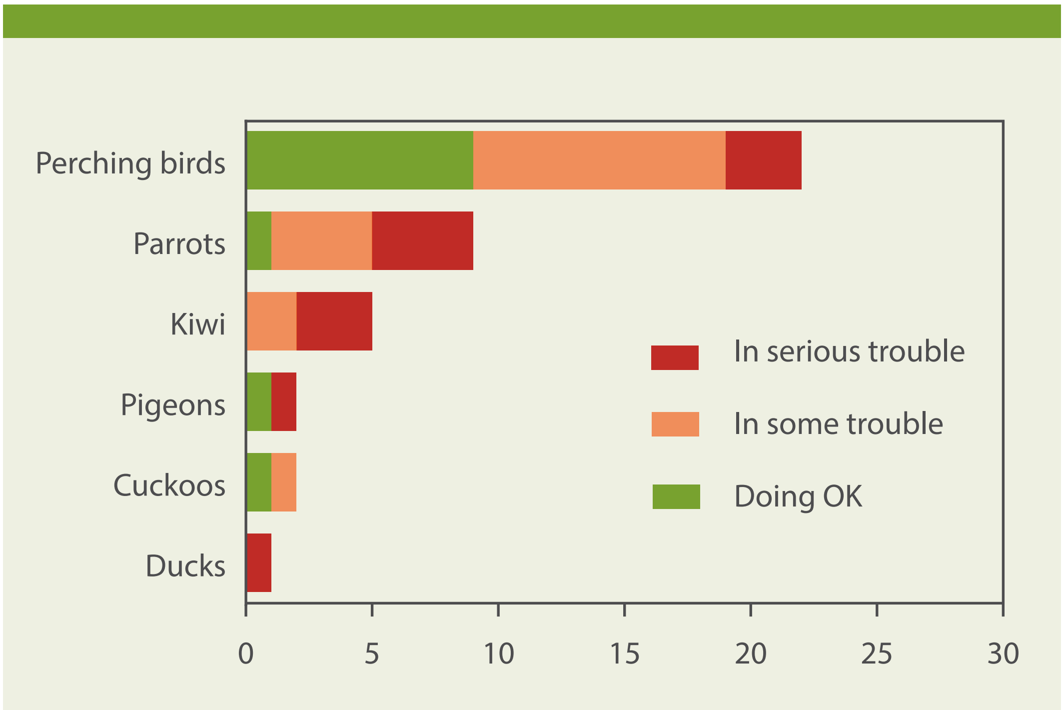
There are two native pigeon species in New Zealand – the kererū or kūkupa, and the now rare Chatham Island parea.

Cuckoos

The long-tailed cuckoo is naturally uncommon and breeds only in New Zealand. The much more numerous shining cuckoo (pīpīwharauroa) is in good shape. Both lay their eggs in the nests of other birds.

Ducks

The whio (blue duck) is an unusual duck because it prefers to live in fast-flowing rivers in the forest. It is the white-water kayaker of the bird world.



Data: Department of Conservation

Figure 3.2 The conservation status of the six groups of forest birds.

3.3 Field, river, and coast birds

Birds that live in open country, in rivers and lakes, and along coasts can be placed into 10 groups – birds of prey; rails; ducks and swans; grebes; herons, bitterns, and spoonbills; kingfishers; shags; waders; gulls and skuas; and terns.

The conservation status of each of these groups is shown in Figure 3.3, and much more detail is given in the Appendix.

Birds of prey

New Zealand has three remaining birds of prey. The ruru (morepork) and the kāhu are both in better shape than the kārearea.[42]

Rails

Rails are small to medium-sized birds that live largely in or around wetlands. Takahē, weka, and pūkeko are the most well-known of the eight rails. The takahē and the pūkeko stand in direct contrast, although both belong to the same family – the takahē has been nursed back from the brink of extinction, while the irascible pūkeko is thriving.

Ducks and swans

There are eight native duck species living in rivers and lakes, and one recently arrived swan species from Australia. The two duck species on subantarctic islands are endangered. On the mainland, the pāteke (brown teal) is in some trouble.

Grebes

Grebes are freshwater diving birds. There are two species in New Zealand – the endemic weweia (dabchick) is faring better than the pūteketeke.

Herons, bitterns, and spoonbills

New Zealand is home to three species of herons, one bittern, and one spoonbill. The exceptionally beautiful kōtuku (white heron) has always been rare in New Zealand, but is common in some other countries. Only the matuku moana (white-faced heron) is doing OK.

Kingfishers

The kōtare (sacred kingfisher) is the only native kingfisher. The population is widespread and in good shape.

Shags

There are 13 species of shags or cormorants in New Zealand, and nine of these are endemic. Three live primarily in rivers and estuaries, and the remainder live primarily on the coast. All but one of the marine shag species are endemic, and only one – the spotted shag (kawau tikitiki) is doing OK.

Waders

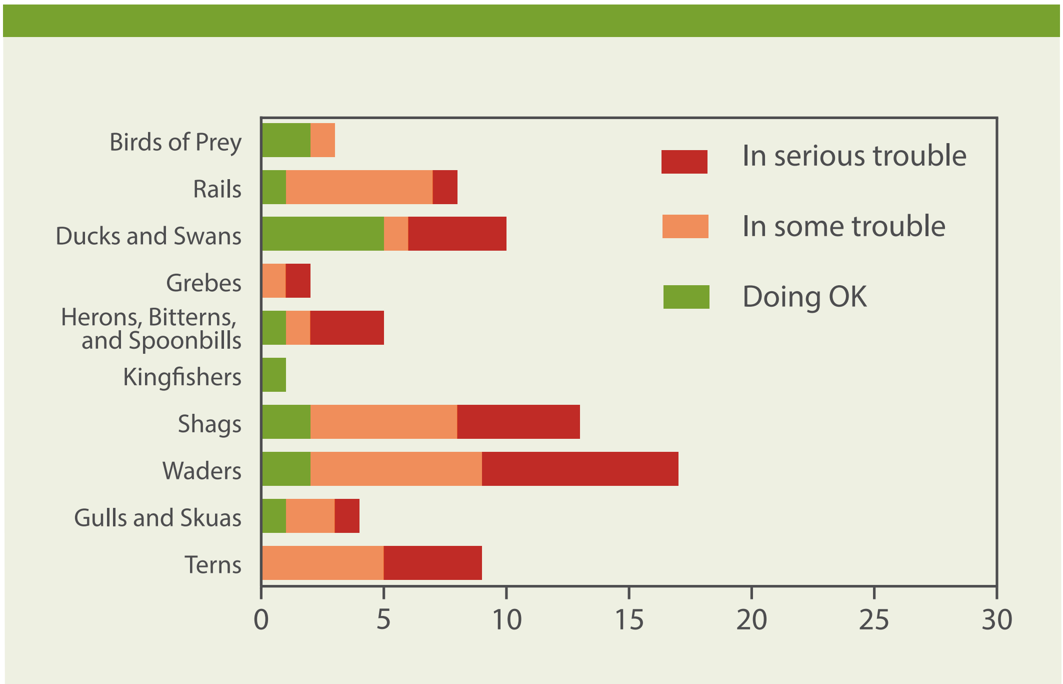
Oystercatchers, dotterels, snipes, stilts, and some others can be put into a group of 16 mostly endemic wading birds that range across the coast, wetlands, and riverbeds where many nest. All are vulnerable except two – the poaka (pied stilt) and the recently arrived spur-winged plover. The kakī (black stilt) is regarded as a taonga species by Māori, and is nationally critical.

Gulls and skuas

There are three gull and one skua species in New Zealand. While the large and aggressive black-backed gull (karoro) is in good shape, the much smaller endemic black-billed gull (tarāpuka) is the most threatened gull in the world.

Terns

The eight tern species and one species of noddy in New Zealand are all vulnerable. Only one – the black-fronted tern (tarapirohe) – is endemic, and it is in serious trouble.



Data: Department of Conservation

Figure 3.3 The conservation status of the ten groups of field, river, and coast birds.

3.4 Seabirds

'True' seabirds get virtually all their food from the open sea. In this section, they are put into six groups. The first three are all tubenoses – they have prominent tube-shaped nostrils that drain away excess salt. Here they have been grouped on the basis of size – albatrosses and mollymawks; petrels and shearwaters; and storm petrels and prions. The other three groups are gannets and boobies; penguins; and tropicbirds.

The conservation status of each of these groups is shown in Figure 3.4, and much more detail is given in the Appendix.

Albatrosses and mollymawks

There are four albatross and six mollymawk species in New Zealand. (Mollymawk, meaning 'foolish gull', is a historical name for the smaller species of albatross.) These are large birds – the toroa (southern royal albatross) has a wingspan as wide as that of the extinct Haast's eagle. None of the species in this group are doing OK, and four are in serious trouble.

Petrels and shearwaters

The 19 petrel and eight shearwater species are mid-sized tubenoses. The Chatham Island tāiko is one of the rarest seabirds in the world. In contrast, the tītī (sooty shearwater/ muttonbird) remains abundant on some islands, but the millions that once nested on the mainland are all but gone. Only five of the petrel and shearwater species are doing OK.

Storm petrels and prions

The six storm petrel and four prion species are vulnerable partly due to their small size. The tītī wainui (fairy prion) weighs little more than 100 grams. Only one – the black-bellied storm petrel – is in good shape. Two of the three storm petrel species that are in serious trouble are endemic.

Gannets and boobies

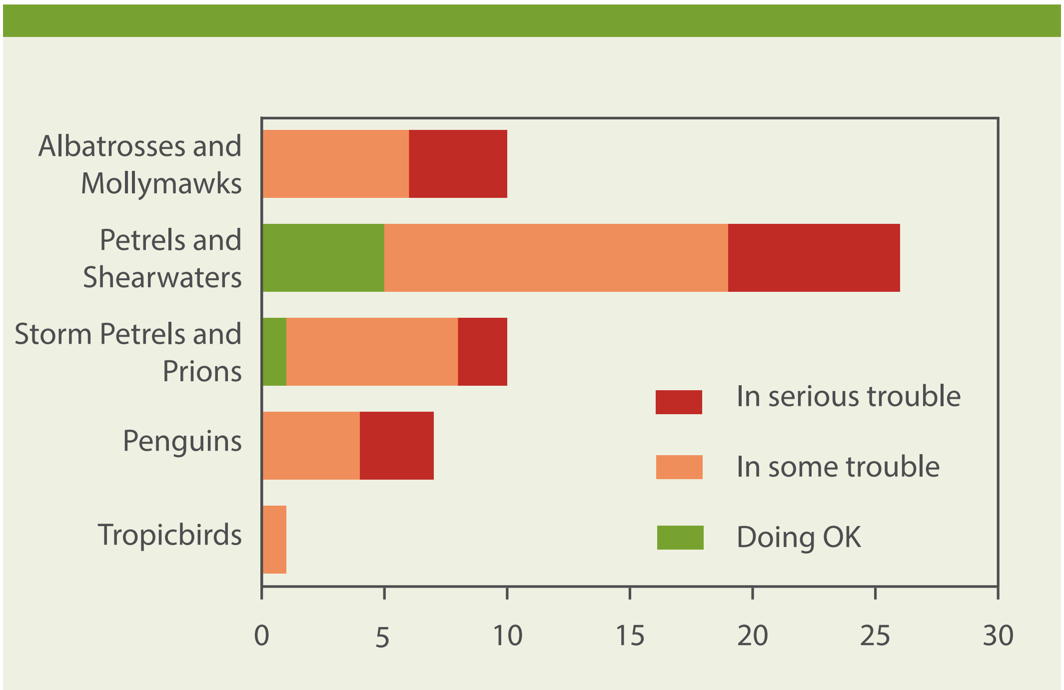
One gannet and one booby species live along New Zealand coasts. The tākapu (Australasian gannet) is faring well, but the masked booby is not.

Penguins

Of all the birds, penguins are the most accomplished swimmers and divers, with some species capable of reaching depths of 100 metres or more. Of the seven species that breed in New Zealand, three are in serious trouble, including the endemic yellow-eyed penguin (hoiho) and the Fiordland crested penguin (tawaki).

Tropicbirds

A single tropicbird – the amokura – breeds in the Kermadec Islands and has been classed as native to New Zealand.



Data: Department of Conservation

Figure 3.4 The conservation status of the five groups of seabirds.

4

Not all species are alike

An overview of the threat status of the 168 species of New Zealand native birds was given in Chapter 3. It showed that only a fifth are considered to be doing OK, and about a third are in serious trouble.

Such assessments are inevitably based on species – the "*currency of biology*".[43] But what is a species? And do all species merit the same conservation priority?

Is the pied stilt as valuable as the endemic black stilt? Are each of the six kākāriki species as valuable as the single kea species? How concerned should we be about a species such as the Caspian tern, which is endangered here but in good shape in other countries? Is a bird that is the sole occupant of an ecological niche especially valuable?

This chapter begins to explore such questions. It is divided into two sections.

The first section describes the difficulty of defining species and the two most common conceptual bases used by taxonomists. This matters because conservation actions are frequently expressed in terms of saving particular species.

The second section is focused on endemism. A high proportion of New Zealand's native birds are endemic – that is, they are found in no other country. This makes them particularly valuable because of their contribution to global biodiversity. But they are also especially vulnerable – many have spent millions of years adapting to an environment without mammals.

4.1 What is a species?

The dividing of plants and animals into species is far from an exact science. In 1859, Charles Darwin wrote: *"I look at the term species as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other..."*[44]

A century and a half later, there is still no universally accepted way of defining a species. There are more than 20 definitions with no sign of convergence. Most are based on either the biological species concept or the phylogenetic species concept.

Under the *biological species concept*, individuals belong to the same species if they breed together and produce viable offspring.[45]

Under the *phylogenetic concept*, species are grouped together in a way that attempts to reconstruct their evolutionary history.[46] The development of techniques that enable the DNA of one individual to be readily compared with another has increased the use of this approach.

Different definitions of species result in different numbers of species. In general, using the phylogenetic concept leads to longer lists of species, often when subspecies are elevated to species. This has been dubbed 'taxonomic inflation'.[47,48]

When the number of species increases due to taxonomic 'splitting', the number of species classified as endangered will almost certainly increase.[49,50]

This matters because conservation action is largely directed towards saving species that are endangered. But lists of species not only change, they generally grow ever longer.

The difficulty over defining species raises questions about the purpose of conservation and about the prioritisation of conservation actions.

"… while current conservation measures are often biased toward charismatic taxa, diagnosing biodiversity by ***counting species errs in the other direction by insisting that all species are equally important****. A large number of species does correspond to general ecosystem stability, but the identification of a species as such does not say anything about its evolutionary distinctiveness or ecological importance."*[51] (Emphasis added)

This issue of the relative importance of species is not just fodder for academic wrangling. Resources for conservation will always be limited and priorities must be set.

How might this apply to New Zealand's native birds? If all our native birds are not equally important, which should we worry about the most? And which are of least importance? Some aspects of this challenging topic are explored in the next section.

Source: Diana Sudyka

Figure 4.1 Charles Darwin recognised the difficulty of defining species, seeing it positively as evidence of evolution. In 1857, he wrote in a letter to Joseph Hooker that *"… varieties are only small species – or species only strongly marked varieties"*. **In the same letter, he refers to** *"hair-splitters and lumpers"* **(Darwin, 1887). These terms are still used today. Lumpers tend to classify varieties into single species; splitters tend to view varieties as separate species.**

4.2 Which birds are most precious?

Many of New Zealand's native plants and animals are endemic – that is, they are found in no other country. These endemic species are our greatest contribution to global biodiversity, and they are what makes our natural heritage so exceptional. Endemic birds are also likely to have evolved to play specialised roles within ecosystems.

Of the 168 species of native birds in New Zealand today, 93 are endemic. This makes them especially valuable. But are all endemic birds equally precious?

Taxonomists have placed all known species of birds into a hierarchical series of groups based on evolutionary heritage. Each species belongs to a genus, each genus belongs to a family, and each family belongs to an order. There are 23 orders of birds. A bird can be endemic at different levels of the taxonomic hierarchy – at the species level, at the genus level, at the family level, or at the order level (see Figure 4.2).

Kiwi stand out from the other endemic birds because they are endemic at the order level. They are the only living members of an order formed about 70 million years ago.[52,53]

Eleven of New Zealand's birds are endemic at the next highest level – the family level.

With the loss of the huia, the kōkako and the saddleback are the only remaining members of one family.

In this report, birds that are endemic at the order or family level are called 'deep endemics', because they originated in 'deep time' – more than 25 million years ago. These deep endemics are particularly precious because they have travelled such a long evolutionary path in New Zealand, making them different from birds elsewhere.

Are each of the six kākāriki species as valuable as the single kea species? The kea, the kākā, and the kākāpō are the only members of an ancient family and are therefore deep endemics. But the six kākāriki species are not – they are only endemic at the species level, and there are similar parakeets in other countries.

Further, each of the six kākāriki species – the red-crowned, the yellow-crowned, the orange-fronted, and the three island species – are closely related. *Genetic distance* is one measure of biodiversity.[54] The genetic distance between any two kākāriki species is much smaller than the genetic distance between any of the six kākāriki species and the kea.

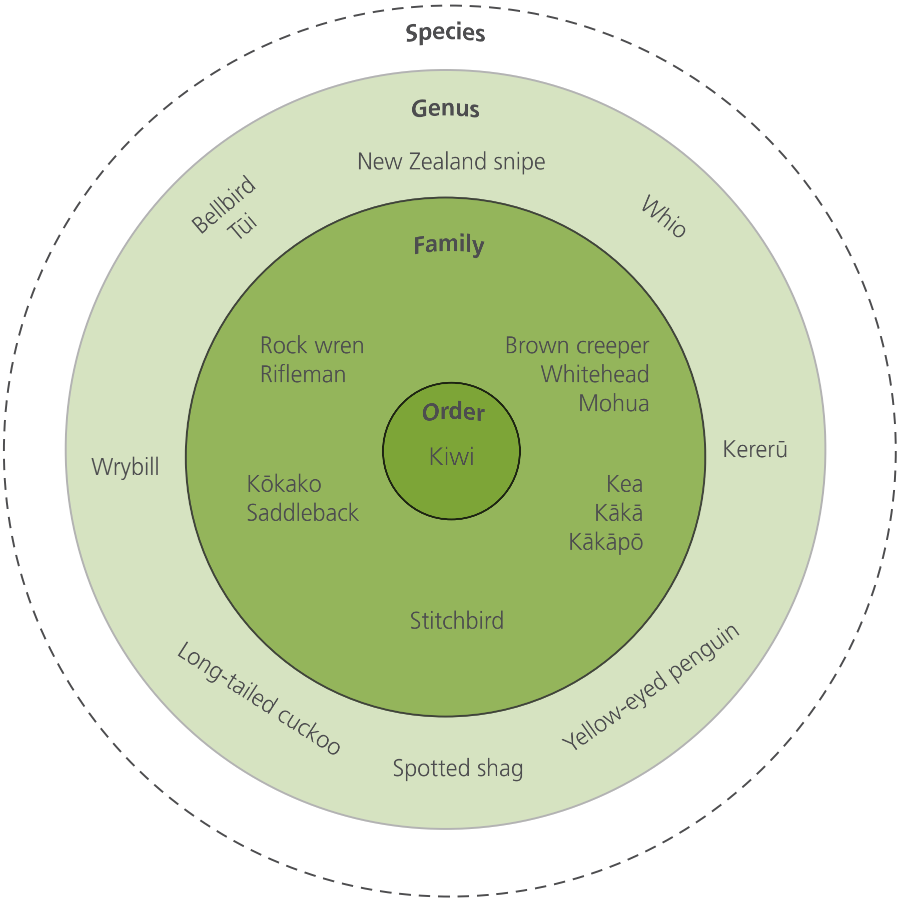


Figure 4.2 The ancestors of some endemic birds go back further in time than others. Kiwi (and the extinct moa) are endemic at the order level. Some birds are endemic at the *family* level – they belong to families found nowhere else in the world. Others are endemic at the *genus* level – they belong to genera found nowhere else in the world. The remainder are endemic at the species level.

Unsurprisingly, the endemic birds are generally in more difficulty than the other native birds. This is because they have spent millions of years adapting to an environment without humans and the animals they brought with them. Only 13% of the endemic birds are doing OK and 45% are in serious trouble.

Figure 4.3 shows how the range of four deep endemic birds – kōkako, mohua, kiwi, and kākā – has shrunk since the middle of the 19th century.[55]

However, it is not all bad news. Three endemic birds that have increased their ranges over the last few decades are the pīwakawaka (fantail), tūī, and the riroriro (grey warbler).[56]

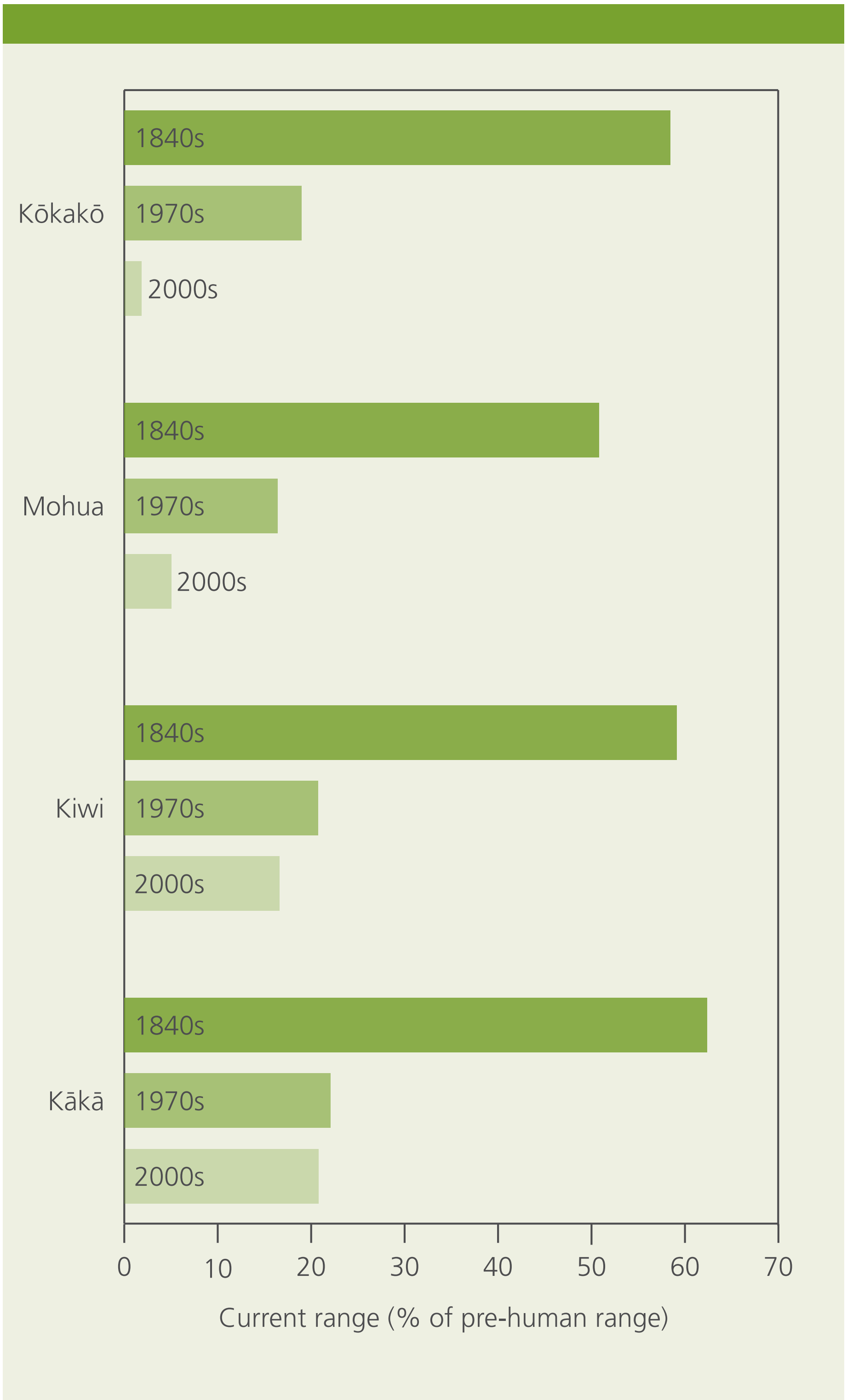
The pīwakawaka is a prolific breeder, and appears to be just as happy hunting for insects on farms and shrubland as in podocarp forests. The feisty tūī will fly a long way to find its favourite flowering plants and can now be found in many gardens in the North Island. The tiny riroriro is not fussy about where it lives and has become the most widely distributed endemic bird.[57]

There are also ways to think about the relative value of native birds that are not endemic; that is, birds that are also found in other countries. Some of these are considered threatened in other countries, and others are considered secure in other countries.[58]

For instance, the white-chinned petrel is in good shape in New Zealand but threatened overseas, and the reef heron is in serious trouble here but secure overseas. A higher priority should be put on protecting the former than the latter, as conservation of a species that is internationally endangered is a greater contribution to global biodiversity.

Some birds also play very important, and sometimes irreplaceable, roles maintaining healthy ecosystems, such as pollinating plants and dispersing seeds.

Finally, non-scientific values cannot, and should not, be ignored. Tītī are not endemic to New Zealand and are secure overseas, but they are in some trouble here and of great cultural importance to Māori. The takahē is only ‘shallowly’ endemic, but will always be greatly valued because of its astonishing discovery in Fiordland in 1948. And it would be a brave person that said the magnificent kōtuku – the great white heron – is unimportant because it is abundant in Asia and Australia.



Data: Department of Conservation

Figure 4.3 The range of a species is the geographical area within which it can be found. Kōkako, mohua, kiwi, and kākā are all deep endemic birds that once roamed over much larger areas than they do now.

The big three predators

For a long time the decline of native birds in New Zealand was driven by the loss of habitat. Today, it is clear that the most critical requirement for many native birds to thrive on the mainland is safety from predators. There are many animals that kill native birds, but there are three that consistently feature on the 'most wanted' list – possums, rats, and stoats. The target of Predator Free 2050 is to rid the country of these three predators by 2050.

This chapter is focused on these big three predators. It contains four sections.

The first section is a brief description of possums, rats, and stoats. Of these three, it is now understood that rats and stoats have the greatest impact on forest birds.

The second section is about the use of trapping and poisoning in suppressing populations of the big three predators.

In some years, forest trees flower prolifically and produce huge quantities of seeds. This phenomenon is known as masting. In mast years, the abundance of food leads to plagues of rodents and stoats, and thus to the death of millions of native birds. This is the subject of the third section.

The fourth section describes a number of important aspects of predator control that should remain, or become, the subject of research.

The big three predators that are the target of Predator Free New Zealand are the biggest killers of forest birds. But there are other predators that are major killers of the native birds that live in other habitats – in open country and in cities, in rivers and lakes, and along the coast and at sea. The next chapter is about these other predators.

5.1 Possums, rats, and stoats

Possums

Brushtail possums were brought to New Zealand over 150 years ago from Australia to establish an export fur trade. In their native Australia, possums are legally protected in every state. Possums have flourished in New Zealand, and there are about 30 million today.[59]

In New Zealand, the damage possums do to native forests has long been recognised. They are the major cause of the decline of trees such as pōhutukawa, rewarewa, kāmahi, māhoe, tawa, and rātā.

Understanding of the direct impact of possums on native birds is more recent. They eat eggs, chicks, and occasionally adults of some birds, but ship rats and stoats are the major predators in the forest.[60]

Rats

Three species of rat have been introduced into New Zealand – the kiore, the Norway rat, and the ship rat. Kiore have been almost entirely displaced by the other bigger rats.

Norway rats tend to live around water – in estuaries, marshes, lakes, rivers, and streams. Rats seen in cities and on farms are likely to be Norway rats.

Ship rats are the most prevalent by far. They are skilled climbers and live much of the time in trees. They begin to breed when only three or four months old, and thereafter will produce a litter once a month if enough food is available. Their destructive impact on forest birds is well documented.

Rats (and mice) are also a major food source of the third big predator – the carnivorous stoat.

Stoats

Stoats were introduced to New Zealand to kill rabbits in the 1880s. Tragically, stoats had little effect on rabbits, but took to the bush where they mainly fed on rodents, but also proved to be adept killers of native birds.

Stoat populations can increase quickly. Female stoats breed once a year in the spring. Male stoats visit the nest soon after the young are born and mate with the tiny female babies as well as with the mother. The young females leave the nest in mid-summer already pregnant, although their own young will not develop until the following spring – and then only if there is enough food. If food is plentiful, a single female can produce as many as 12 kits.

Source: Nga Manu Images

Figure 5.1 A ship rat destroying a pīwakawaka (fantail) nest.

Source: Graeme Taylor, Department of Conservation

Figure 5.2 A stoat larder – a cache of seven diving petrels and one grey-faced petrel found on an island off the west coast of Auckland.

5.2 Dealing to the big three

Possums, rats, and stoats are killed in a variety of ways that involve either trapping or poisoning. Most of the poisons used are put in baits in ground 'stations'. Two – brodifacoum and sodium fluoroacetate (1080) – are registered for aerial use; that is, they can be dropped over large areas from helicopters.

Ground control, using bait stations and/or trapping, is generally used in places with easy access, such as bush reserves or riverbeds, and near densely populated areas. Traps are generally designed to catch a particular type of predator.

Standard methods of trapping and ground baiting are labour-intensive. Traps must be checked and reset regularly, and poison baits must be replenished. Innovative technologies are being developed to improve the effectiveness of trapping and ground poisoning, and to reduce the associated labour costs.

A major innovation in trapping is the development of traps that reset themselves. One model on the market has been designed to kill up to 12 possums or 24 rats or stoats before the trap needs checking.

The success of re-setting traps depends critically on the development of lures that are long-lived and attract predators. Such lures are available for rats, but the development of such a lure for stoats is much more challenging. Stoats are carnivores, so they are attracted by lures made of meat, but even when the meat is dried, it only lasts three or four weeks. A stoat lure that attracts stoats over a large area and only needs replacing every few months or so would be a great advance.

A major innovation in poisons is PAPP (para-aminopropiophenone). Carnivores – including stoats – are particularly susceptible to PAPP, and it is already being used in bait stations. It takes at least 20 times as much PAPP, weight for weight, to kill an omnivorous rat than it does to kill a carnivorous stoat.[61]

Work is underway to develop a re-setting device for PAPP that would kill stoats. When triggered by a stoat, the device would spray PAPP on to its fur. The stoat would then lick it off and lose consciousness in a few minutes. As for the re-setting traps, the development of an attractive long-lived stoat lure would be a game changer.

Many from both the public sector and private sector are involved in this unprecedented wave of innovation in trapping and ground poisoning of possums, rats, and stoats. These include universities, Landcare Research, the Department of Conservation, and a new company, Zero Invasive Predators Ltd (ZIP). A great range of creative ideas are on the table. For instance, the Cacophony Project has the goal of making a device that will lure, identify, and eliminate predators, and monitor birdsong to measure the impact.

Only two poisons are registered for aerial use – brodifacoum and sodium fluoroacetate (1080). Brodifacoum has been successfully dropped from the air on to some offshore islands, but it is not considered as suitable as 1080 for dropping on the mainland.[62]

Despite innovations in trapping and ground poisoning, aerial application of 1080 remains essential for the foreseeable future. There are two reasons for this.

The first reason is the ability to suppress possums, rats, and stoats over large areas cost-effectively, in a very short time period, even when these areas are rugged and difficult to access.

Predator control at a landscape scale is vital for restoring abundant and resilient birdlife across the mainland. The bigger the safe area, the greater the number of birds and the number of species that can thrive. While a fantail will happily live within a hectare of forest, a kākā needs to range over hundreds of hectares, and a kererū can fly 100 kilometres between feeding areas.[63]

Aerial 1080 is also cost-effective, at about $30 per hectare. This figure includes the costs of communication, consultation, and obtaining consents.[64]

The second reason why aerial 1080 is needed for the foreseeable future is because it is the only way of knocking down the populations of rodents and stoats that 'irrupt' in mast years. Masting is discussed in the next section of this chapter.

Source: Philip Gleeson

Figure 5.3 ***Gastrolobium*** **is a genus of flowering plants endemic to Western Australia that contain fluoroacetate (the active part of 1080). The native animals of Western Australia are able to eat these plants safely because they have evolved to co-exist with them.**

5.3 Knocking down rat and stoat plagues during masts

When trees mast, they flower more prolifically and produce far more fruit and seeds than normal. This phenomenon is greatest in beech forests, but other trees such as rimu and kahikatea also undergo mast seeding.

Mast events provide abundant food for birds, and some species lay more eggs and successfully raise more chicks in mast years. But tragically, masts also provide abundant food for rats and mice.

With plenty to eat, populations of rats and mice 'irrupt' and their numbers soar. Stoats gorge themselves on the rodents and their numbers soar as well – plentiful food results in the birth and survival of many more young.[65]

Dropped at the right time, 1080 will knock down irrupting populations of rodents and stoats. Although the carnivorous stoats do not eat the baits themselves, they eat poisoned rats and mice and die through secondary poisoning.

In the spring of 2013, scientists observed that prolific flowering of beech trees was occurring across much of the country. Early in 2014, it became clear that a 'megamast' was underway, and the first Battle for Our Birds was launched.[66] Between August and December 2014, 1080 was dropped on 660,000 hectares of beech forest – only 16% of the total area of masting forest (Figure 5.4).

Analysis of the effectiveness of the 2014 Battle for Our Birds is taking place in stages.

The first stage is the measurement of the effect on predator populations. Monitoring of tracking rates at different sites before and after the 1080 drops show very big reductions in rat and stoat numbers, with a few exceptions.[67]

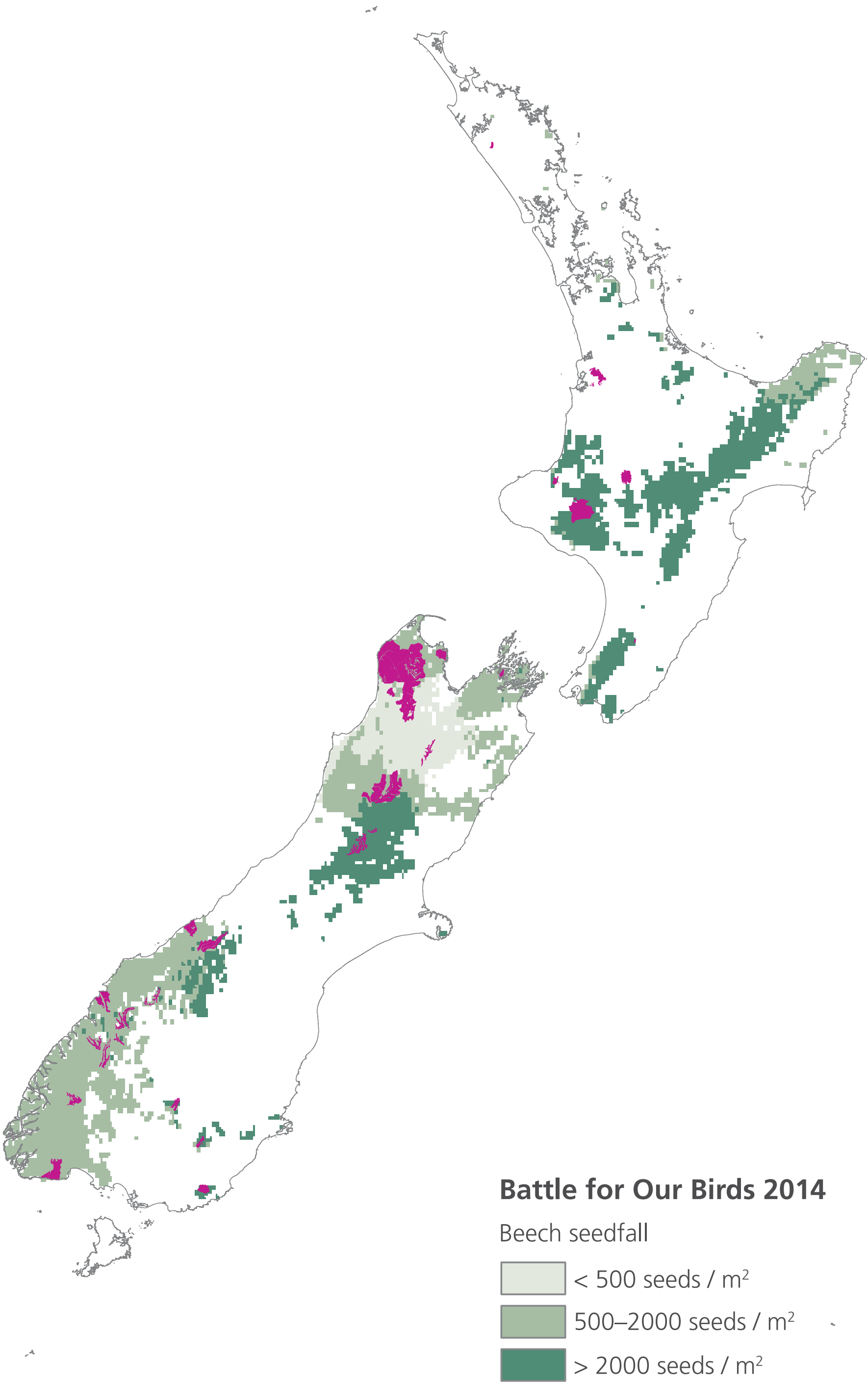
The second stage is the measurement of nesting success of birds. The time when birds are most vulnerable to predators is the nesting season. In spring, eggs, adult females sitting on eggs, and chicks are easy pickings. Substantial improvements in the nesting success of mohua, rifleman, rock wren, and South Island robin were found.[68,69]

The ultimate measure of effectiveness of predator control of any kind is the change in the number of birds in a population. Sometimes, despite successful knockdown of predators, other factors may prevent populations from increasing.[70]

In 2016, another major beech mast occurred, and a second Battle for Our Birds was fought.[71] The populations of rodents and stoats that soar during masts take an enormous toll on birds and other forest creatures. It is vital that such a battle is fought whenever a mast occurs.

Over recent decades, many endemic birds (especially the deep endemics) are left clinging on in remote forest refuges.

"New Zealand's colder forests, many of which are dominated by species of beech or rimu, are now its most important reservoirs of endemic forest bird populations."[72]



Data: Elliot and Kemp, 2016

Figure 5.4 The 2014 megamast. In the autumn of 2014, huge amounts of beech seed were produced in forests in the North Island as well as in the South Island, and on private land as well as within the conservation estate. The areas where the battle was fought (where 1080 was dropped) are shown in purple.

5.4 Vital ongoing research

While major breakthroughs in predator control from cutting edge science may well occur, they will not occur soon. The importance of research into developing and refining current methods for dealing with the big three predators cannot be overstated.

Nor should the challenge that these predators pose be underestimated. Thorough field testing of the effectiveness and impacts of new innovative ways of killing predators is vital. Aerial 1080 has been much studied in response to controversy over its use, and is regulated under multiple laws. But it can be tempting to assume that all is well with other methods. A kea dying from eating 1080 is national news, but a kiwi caught in a possum trap is no news at all.

Three important research areas are discussed in this section, but there will be others.

Rat rebound

It is not yet possible for an area to be kept free of possums, rats, and stoats, unless it is an island or a fenced sanctuary. Even then constant vigilance is required. On the unfenced mainland, the aim is predator suppression – the longer the better.

After a control operation, predator populations bounce back in two ways – *survivors* breeding within the control area, and *invaders* from outside the control area moving in.

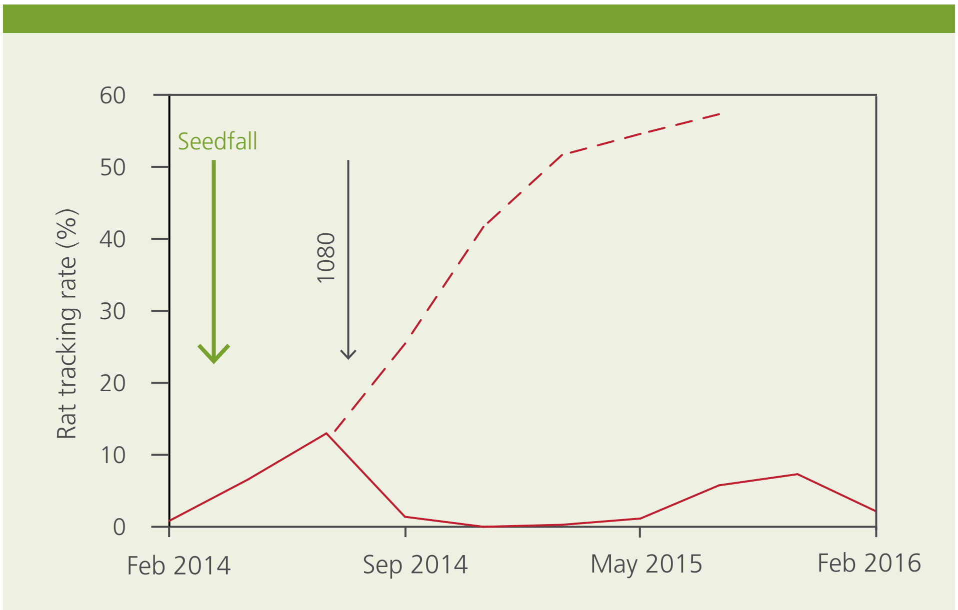
The greater the number of *survivors*, the faster the population will grow.[73] Very fertile podocarp forests can support large numbers of rats, so even a small percentage of survivors can start to repopulate a forest within six months.[74,75]

One fruitful area of research could involve exploring the use of combinations of different methods in some operations. For instance, rat populations are likely to be highest along fertile valley floors. The few rats that survive a 1080 drop are most likely to be in these areas, so lines of resetting traps or bait stations along valley floors may well be an effective way of keeping rat populations low for longer.[76]

The rate at which *invaders* come back into a control area depends on both the size and shape of the control area. In general, the smaller and narrower the control area, the faster the reinvasion will be. Rats can invade a kilometre into a control area within a year.[77]

The Department of Conservation often excludes some parts of a control area following consultation with landowners and communities. Medical officers of health also set buffer zones around tracks and rivers and lakes that are drinking water sources. Such 'holes' within a 1080 treatment area reduce the effectiveness of an operation because they increase both the number of *survivors* and the number of *invaders*, and thus speed up rat bounceback.

There are some options in the guidance document for protecting the public used by the medical officers of health. Predator control will be more effective if tracks are cleared and water intakes are closed for a short time, instead of setting buffer zones.[78]



Data: Department of Conservation

Figure 5.5 Rat rebound after the drop of 1080 during the 2014 megamast in Dart Valley in Mount Aspiring National Park. The solid red line shows the rat population monitored by using tracking tunnels. The broken red line shows how the rat population would have continued to grow if the 1080 drop had not been done.

Source: Mark Dwyer

Figure 5.6 Tutahanga Tepu of Ngāti Rereahu blesses toutouwai (robins) before they are released on Mt Taranaki in April 2017. Following an aerial 1080 operation on the northern slopes of the mountain, more than 2,000 traps that reset themselves have been put in place to keep predator numbers as low as possible.

Mice matter too

The interaction between populations of rats and populations of mice is another critically important area of research.

Mice can be predators in their own right, but the greater concern is the role they play, along with rats, in fuelling growth in stoat populations.

Rats compete with mice for food and can also prey on them. So fewer rats can lead to more mice. In some forests during a mast, mice are far more numerous than rats, and provide the primary food for stoats.[79]

Predator Free 2050 is focused on possums, rats, and stoats as the big three predators. But the tiny mouse is a fourth that cannot be ignored. The ideal is the simultaneous removal of all four predators – possums, rats, stoats, and mice.[80]

Both rat rebound and interaction between populations of predators are strongly affected by the type of forest. And in pure beech forests, the mouse–stoat dynamic is generally more important than the rat–stoat dynamic.[81]

Keeping vulnerable birds safe

Suppression of predators, rather than complete freedom from predators, is currently the name of the game. If native bird populations are to be restored on the mainland away from the safety of predator-free islands, a critical area of research is understanding how low levels of predators need to be for different birds to be safe.

Some birds are much more vulnerable to predators than others. These include mohua, tīeke, and kōkako – all precious deep endemics.

Cape Sanctuary is a 2,500 hectare area at Cape Kidnappers in Hawke's Bay, protected by a predator-proof fence that runs for just over 10 kilometres. The introduction of tīeke (saddleback) into Cape Sanctuary in 2013 illustrates the need for developing much more accurate ways of detecting the presence of predators.[82]

The current method for measuring the density of rats and some other predators is to use tracking tunnels. Rats run through these tunnels and leave behind their distinctive inky footprints on paper.

At Cape Sanctuary in 2013, the rat tracking level was found to be less than 1%. At that time, an area was considered 'safe' for tīeke if less than 5% of the tunnels contained rat tracks.[83] Subsequently, in April of that year, 120 tīeke were released into the sanctuary.

Two weeks later, nearly half of the tīeke had disappeared, and by October, less than 20 birds remained. The cause turned out to be a colony of Norway rats that had escaped detection. These were trapped and poisoned, and a small population of tīeke still exists in the sanctuary.[84]

This case illustrates the need for research into more accurate ways of detecting predators at low levels and identifying 'safe levels' for different birds.

Source: Duncan, Flickr CC BT-SA 2.0

Figure 5.7 Tīeke (saddleback) are particularly vulnerable endemic birds because they nest in cavities, and forage on the forest floor.

Source: Fiordland Wapiti Foundation

Figure 5.8 Since 2005, the Fiordland Wapiti Foundation has run a programme trapping stoats in five valleys near Milford Sound. The area is home to a population of whio (blue duck) – the torrent duck that is featured on the $10 note.

6

It’s not just possums, rats, and stoats

The possums, rats, and stoats that are the target of Predator Free 2050 are the biggest killers of forest birds. But there are other creatures that prey on native birds, particularly on those that do not live in the forest, but live in open country and in cities, in rivers and lakes, and along the coast and at sea.

This chapter is about the most significant of these other predators. It has four sections.

The first section shows how native birds can face threats from a range of very different predators.

The next two sections contain descriptions of a number of these predators.

The second section begins with mice. It then covers ferrets and weasels – the animals which, along with stoats, belong to the family of carnivorous mammals known as mustelids. The last predator described in this section is the innocuous-looking hedgehog.

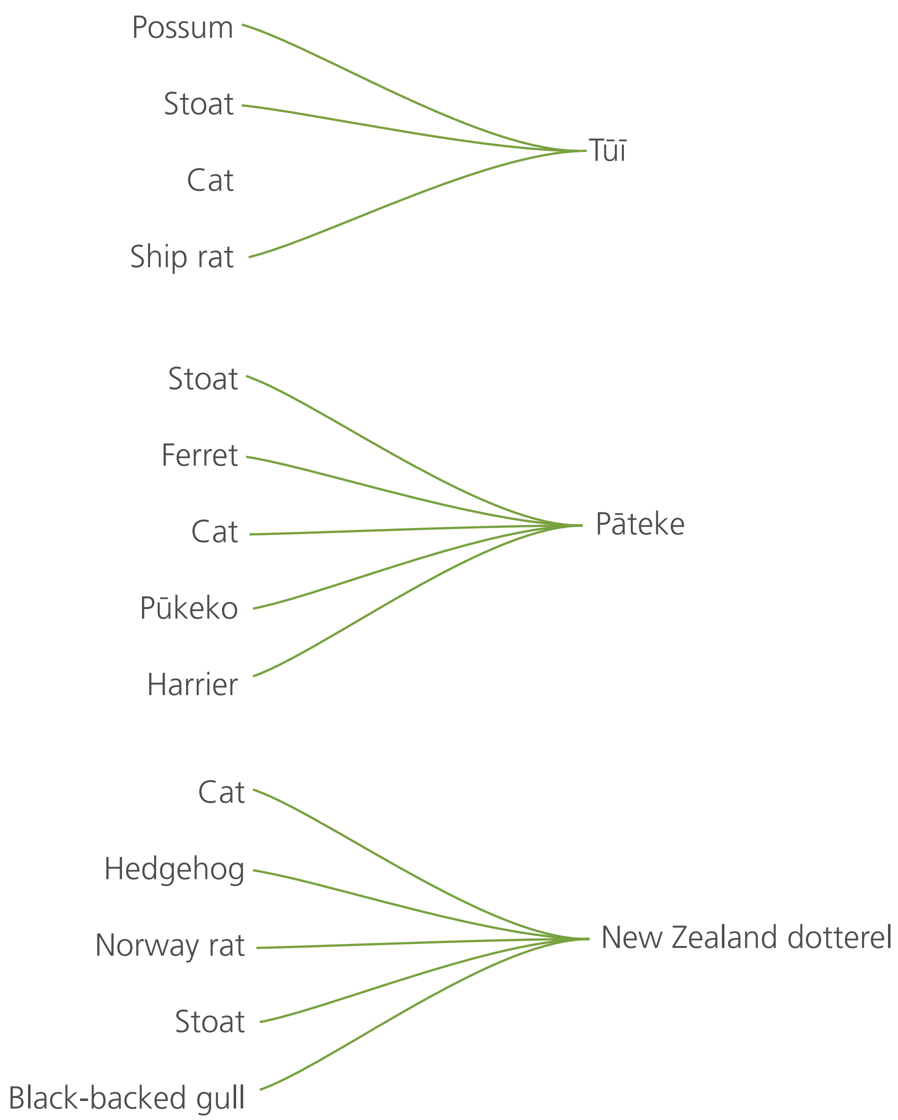
The third section deals with cats and dogs – much-loved companions to many New Zealanders. Although domestic cats and dogs do kill birds, the millions of aggressive feral cats that roam across much of the countryside are the greater problem by far.

The last section is about the unintentional killing of seabirds that can happen during fishing.

6.1 A range of predators

The animals that prey on native birds vary. In the stony riverbeds of the eastern South Island, feral cats, ferrets, and hedgehogs are big bird killers. In cities and towns, many domestic and stray cats are skilled bird hunters, though sometimes the birds make it easy for them by flying into windows and falling to the ground unconscious.

Figure 6.1 shows the major predators of three native birds in Hawke's Bay – the tūī, a forest bird; the pāteke, a waterbird; and the New Zealand dotterel, a shorebird. The predators include three native birds – the pūkeko, the harrier hawk, and the black-backed gull.



Source: adapted from Innes and Fitzgerald, 2016

Figure 6.1 The predators that are the main killers of three endemic birds in eastern Hawke's Bay. They are listed in order of their impact from the most damaging to the least damaging.[85]

6.2 Mice, mustelids, and hedgehogs

Mice

In the absence of other predators, mice can sometimes attack surprisingly large prey. In 2001, mice on a small island in the South Atlantic Ocean were found to be nibbling on live albatross chicks nearly 300 times their size.[86]

On New Zealand's subantarctic islands, ground-nesting birds such as snipe, pipit, and kākāriki have been observed to be more abundant on islands free of all predators compared with islands that have only mice on them.[87] However, this is likely to be at least partly due to the mice competing with the birds for food. Similarly, mice have been found high up trees in a fenced sanctuary in Waikato, so may well be eating bird eggs and chicks. But their bigger impact is almost certainly depriving birds of food because they eat so many worms and other invertebrates.[88]

The major impact that mice are having on native birds is the way they, along with rats, fuel the growth of the stoat population. Stoats are carnivores, so the more rats and mice there are, the more food there is for stoats. And the more food a female stoat eats, the more young she will bear.

Ferrets and weasels – the other two mustelids

Of the three mustelids introduced to New Zealand in the 19th century, the stoat remains the most damaging by far. However, the larger ferrets and the smaller weasels also prey on native birds.

Ferrets are most common in open country, particularly where there are plenty of rabbits for food. They are significant killers of ground-nesting wading birds, but unlike stoats, are poor swimmers and climbers.[89] Ferrets are known to prey on yellow-eyed penguins, blue penguins, and tītī (muttonbirds).[90]

Weasels are only patchily distributed around the country, preferring overgrown areas with thick ground cover. Weasels can run, swim, and climb just as well as stoats, but there are far fewer of them. They are known to prey on small birds such as riflemen and tomtits.

Hedgehogs

Hedgehogs appear to have been first brought to New Zealand out of sentiment – to, in the words of the Animal Acclimatisation Act 1861, *"contribute to the pleasure and profit of the inhabitants"*.[91] While hedgehog numbers have rapidly fallen in Britain, here Mrs Tiggy-Winkle has thrived and been dubbed a 'serial killer'.[92]

Hedgehogs will eat the eggs and chicks of ground-nesting birds, but are a much larger threat to waders, terns, and gulls than they are to forest birds because they do not like wet bushy areas. Along with cats and ferrets, hedgehogs are playing a major role in the decline of the country's only endemic tern and only endemic stilt – the tarapirohe and the kakī.[93] Both are in serious trouble.

6.3 Cats and dogs

Cats

Companion cats number more than a million – about half of New Zealand households have a pet cat. Philanthropist and businessman Gareth Morgan has weathered a storm of criticism for pointing out that even the most pampered domestic cat still retains its predatory instinct. The number of birds killed by domestic cats has been estimated at between 5 and 11 million a year, although many of these will not be native birds.[94]

Microchipping cats so they can be identified and returned to their owners has become much more common in recent years.[95] The Wellington City Council has made it compulsory for all cats in the city to be microchipped by 2018.

Stray cats rely directly or indirectly on humans for much of their food, and sometimes form colonies in cities and towns. It has been estimated that there are nearly 200,000 stray cats across the country.[96] The draft New Zealand National Cat Management Strategy has the elimination of stray cats as one of its goals.

Feral cats are unowned and unsocialised. It is widely thought that there are now many millions of feral cats in New Zealand. They are formidable killers. Dr John McLennan, environmental adviser to the Cape Sanctuary in Hawke's Bay, describes them as *"the most intractable predator"*. Since 2007, more than 1,400 feral cats have been killed within the sanctuary fence.

Feral cats tend to live in open country and around the edges of forests. However, they can be found in other habitats, including deep within podocarp forest on Stewart Island. They roam over huge areas – one Stewart Island study found the range of female feral cats to be over a 1,000 hectares, and that of male feral cats to be almost twice as large.[97]

Feral cats can kill many different native birds. On one of the muttonbird islands, cats wiped out the populations of yellow-crowned kākāriki, robins, brown creeper, New Zealand snipe, banded rails, diving petrels, and broad-billed prions.[98] In 1981, cats killed over half of the radio-tagged kākāpō on Stewart Island. And cats are major killers of the wading birds (including the adults) that live in the braided riverbeds of the eastern South Island.[99]

In New Zealand, most regional councils list feral cats in their pest management strategies, but only four invest in widespread suppression of cat populations.[100]

Currently, rabbit populations are worryingly high in many parts of the country, and feral cats are living up large on a diet of fresh rabbit and multiplying rapidly. Otago Professor Phil Seddon comments, *"Cats don't control rabbits … Rabbit numbers control cats. Rabbits are the drivers of the cat population."*[101]

The virus introduced to control rabbits in 1997 has largely run its course because many rabbits have developed immunity. It is likely another strain of the virus will be released soon.[102] But when this happens and rabbit numbers fall rapidly, the cats and other predators that feed on rabbits will eat whatever they can find, including birds and lizards. The birds will take a big hit, unless much greater efforts are made to kill feral cats.[103]

Source: Simon Stevenson / Department of Conservation

Figure 6.2 A feral cat fitted with a transmitter collar.

Source: Otago Daily Times

Figure 6.3 Plagues of rabbits are once again invading large areas of the country, providing abundant food for feral cats and other predators.

Dogs

Dogs (off lead) are a particular danger to kiwi. To the sensitive nose of a dog, the smell of a kiwi is very powerful.

In 1987 a single German shepherd abandoned in a Northland forest was found to have killed at least 13 kiwi and likely many more.[104] But while not all dogs are deliberate killers of kiwi, any dog can accidentally crush them to death.

Kiwi are exceptionally vulnerable to dogs because of their unusual anatomy. Along with ostrich, emu, cassowary, rhea (and once the moa), kiwi belong to the ancient order of birds known as the ratites. A ratite does not have a keel attached to its sternum – other birds have a strong keel bone to which their flight muscles are attached.

This is why a curious and gentle dog can easily kill an adult kiwi just by picking it up in its mouth. A single rib snapping and piercing a lung is enough to kill a bird. In Northland, dogs are now the main killers of adult kiwi, and it is not just one or two breeds that are responsible.[105] Kiwi avoidance training can help reduce the likelihood of a dog being attracted by the smell of a kiwi, but there are no guarantees.[106]

Dogs left to run free on beaches and riverbeds during breeding season can frighten ground nesting birds such as dotterels and penguins, leaving eggs and chicks exposed. Any dog found to be 'at large' threatening protected wildlife can be seized or destroyed.[107]

Source: Department of Conservation

Figure 6.4 Some dogs are conservation heroes. Here Jazz, a German wirehaired pointer, sniffs out a kakī chick so that it can be looked after. Other highly trained dogs are used to find stoats, feral cats, and rats.

6.4 Humans as 'unintentional predators' of seabirds

Seabirds often flock around fishing boats looking for food. Unfortunately, in New Zealand waters alone, thousands end up drowned in nets, caught on hooks or mortally wounded from hitting steel cables. The most common casualties are shearwaters, petrels, and albatrosses. The black petrel is in the most danger – it is caught while scavenging around boats close to where it breeds in the Hauraki Gulf.[108]

The endemic Antipodean albatross is undergoing a particularly rapid decline. This great bird with its three-metre wingspan wanders across the southern ocean from the Tasman Sea across to the coast of Chile. Its recent decline is correlated with an increase in surface longline fishing on the high seas and a change in the foraging range of the birds.[109] In the New Zealand fishing industry, hundreds of seabirds, including several species of albatross, are caught on longline hooks each year.

There is a solution. International best practice involves adding weights to the lines so the hooks and bait sink quickly out of reach of the birds, setting lines at night, and using bird-scaring devices. Under an international agreement, New Zealand has an obligation to conserve albatrosses and petrels. The Government is currently considering a proposal to make line-weighting mandatory.[110]

In 2004, New Zealand adopted a plan to reduce the incidental bycatch of seabirds in fisheries, whether they are commercial, recreational, or customary. The plan was updated in 2013, and a further update is scheduled for 2018.[111]

Since 2004, there has been progress in some areas. For instance, deepwater trawlers are using devices such as bird-scaring lines and bafflers to keep birds at a distance. As a result, the number of albatrosses killed by flying into steel cables in the squid trawl fishery has halved. Almost all skippers on commercial bottom longline fishing boats in the Hauraki Gulf have completed training on how to avoid catching seabirds, and are now involved in a camera trial to see how effective their efforts are.[112]

But there is still more to do. In particular, the understanding of what is actually happening on fishing boats is based on data recorded by observers who cover only a small proportion of the commercial fishing fleet.

The Government has recently decided to require electronic monitoring of commercial fishing by using on-board video cameras. The primary purpose is to monitor the fishing effort and catch, including the bycatch of fish for which quota is not held.[113] These monitoring systems should be designed so that the bycatch of seabirds is also recorded.

Source: Kath Walker

Figure 6.5 The Antipodean wandering albatross is sometimes caught on surface longline hooks in New Zealand waters and on the high seas. They wander across the South Pacific from Australia as far as Chile.

Source: Sanford Ltd

Figure 6.6 On trawl vessels, bafflers create a 'fence' around the stern of a vessel, which keeps the seabirds at a distance so they are unlikely to crash into steel cables.

Breakthrough genetic science to deal with predators

As discussed in Chapter 5, there is a wave of innovation in trapping and poisoning predators underway in New Zealand. This is likely to be accelerated by the Government's predator-free goal. Some of this innovation rests on novel applications of science. One example is the potential development of a stoat lure using synthesised pheromones.

One of the interim goals of Predator Free 2050 is to develop a *"breakthrough science solution that would be capable of eradicating at least one small mammal predator from the New Zealand mainland"*.[114] Achieving this would almost certainly require using genetic science techniques.

This chapter is about the quest for scientific 'breakthroughs' in predator control using the new tools of genetic science.

One tool of genetic science is 'genome mining' – analysing the DNA of predators in order to find weaknesses that can be exploited. Another is the system called CRISPR/Cas9, which can cut strands of DNA in a very precise, targeted fashion – much like a pair of scissors.

Three areas of current research that rely on genetic science to suppress and/or potentially eradicate mammal predators are described in this chapter.[115]

- The development of toxins that will kill only the target predator.
- The Trojan female, in which female predators pass on infertility to their sons.
- Gene drive, whereby all offspring of a predator inherit a particular trait.

These three research areas are not intended to be a complete description of the scientific effort underway. Rather, they are being used to illustrate some of the possibilities provided by the fast-evolving field of genetic science.

7.1 Toxins that only kill particular predators

Species-specific toxins kill only one kind of predator, and do not harm any other animal. Research is underway at Landcare Research to find or create such toxins.[116]

One line of research is focused on a toxin that is known to be selectively toxic to rats.

Norbormide was developed as a rat poison in the 1960s, but its use stopped in the 1980s because rats did not find it palatable. Researchers are creating chemical variants based on Norbormide. In cage trials, one variant has been shown to kill 100% of Norway rats and 80% of ship rats, and field trials are being planned.[117]

That Norbormide happens to be fatal for only rats is a lucky discovery. The more general approach is to *develop* species-specific toxins. The process of developing such a toxin for possums is underway.

The first stage involves 'genome mining' – analysing the DNA of the possum to find gene sequences that are both unique to possums and associated with vital biological functions such as respiration. The second stage involves finding a toxin that closes down the biological function the gene controls, causing death.

To date, genome mining has led to the identification of some promising gene sequences that are unique to possums and wallabies. It is hoped that candidate toxins will be identified by 2019. It would then be several more years before any toxins would be ready for use.

A toxin that kills only rats or only possums would not hurt other animals. But to be effective at a landscape scale, large quantities would need to be dropped aerially. Thus, such a toxin would also need to be affordable and leave no harmful residues in the environment.

7.2 The Trojan female technique

Another new approach to predator control that is being investigated is known as the 'Trojan female'. It takes its name from the myth of the Trojan horse – a giant wooden horse containing armed men used by the Greek army to capture the city of Troy. In this approach to predator control, the female predator is the Trojan horse, and she carries inside her a gene that makes her sons infertile.

There are two kinds of DNA in animals.

- Most of the DNA sits inside the nuclei of the cells of the animal. Half of this DNA is inherited from the father and half from the mother.
- The remainder of the DNA sits in a different part of the cells known as the mitochondria. All of this DNA is inherited from the mother.

Thus, a female rat, for instance, will pass on her mitochondrial DNA to all her offspring – to her sons as well as her daughters. The oddly named 'mother's curse' in biology refers to sons inheriting harmful genes from their mothers, while the same genes do not have the same effect on the daughters.

The Trojan female approach would begin with screening rats to find healthy females that will bear sons with low fertility. Then these females would be bred up in captivity. Their female progeny could then be released to spread the mutation through wild populations.

As with any research, there are many questions to be resolved.

The first is: Do individual females carrying mutations like male infertility exist? Examples have been found in fruit flies, mice, and hares. This augurs well for finding similar mutations in rats and other predators.[118]

Another question is whether such natural mutations have a strong effect on male fertility without harming the reproductive functioning of the females. Again, this also seems likely. Mutations with these characteristics have been recently found in fruit flies.[119]

So could the Trojan female technique be used to suppress predators in New Zealand? Modelling has suggested that it should be feasible, although inevitably there would be practical difficulties.[120]

It is possible that Nature would find a way to fight back against the Trojan female and restore male fertility.[121]

7.3 Gene drive

The idea of driving a gene through a population of animals was first raised in 2003.[122] Bill Gates is advocating the use of gene drive to eliminate malaria by driving the inability to spread malaria through mosquito populations.

Baby rats, like the young of most animals, inherit half of their chromosomes from the father and half from the mother. If one parent has a gene for a specific characteristic and the other does not, every baby rat has a 50% chance that it will inherit that gene.

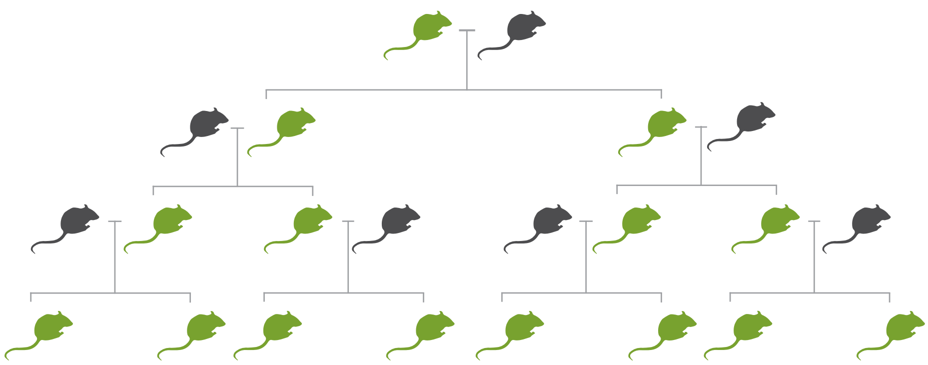
Gene drive technology can override this inheritance pattern, ensuring a desirable characteristic is inherited by virtually all the offspring. Moreover, the gene drive is inherited too, and so it continues for generation after generation.

A gene drive that only produces male offspring, for example, could be engineered into a rat using the CRISPR/Cas9 technique.[123] Thus, gene drive technology holds the potential for completely eradicating rats and other predators.

Gene drive is a technology with great potential. But it is also a high -risk technology because once released, it can spread by itself. Clearly, if gene drive is used to suppress or eradicate predators in New Zealand, safeguards will be all-important.[124]

One safeguard recommended by a group of leading researchers is:

"… all laboratories seeking to build standard gene drives capable of spreading through wild populations simultaneously create reversal drives able to restore the original phenotype."[125]



Source: adapted from Figure 1A in Esvelt, et al., 2014.

Figure 7.1 Gene drive overrides the normal inheritance pattern. The black rats are from the wild population. The top green rat has had gene drive inserted into it. Every descendant of that rat will inherit the gene drive.

8

Habitat – somewhere to live and thrive

As well as safety from predators, birds need habitat – somewhere they can live and thrive.

Historically, vast tracts of forests, wetlands, and native grasslands were cleared for cities, towns, and farms. Large-scale clearance is now mostly a thing of the past, although some birds are still losing important habitat.

There are four sections in this chapter.

The first section describes aspects of habitat that birds need to thrive. Some native birds are very particular about the nature of their habitat, while others are more adaptable.

The second section is about the animals that damage bird habitat – including possums, deer, goats, pigs, rabbits, and wasps.

The third section is about the exotic plants that damage bird habitat. Some invade and smother forest, and others spread across open country and infest open stony riverbeds.

The fourth section is about protecting and restoring bird habitat on land outside national parks and other reserves. Many native birds spend all or part of their lives on farmland, along rivers and around lakes, and along the coast.

8.1 Aspects of habitat that birds need

Once birds are safe from predators, the supply of food is likely to curb increases in bird populations.

New Zealand birds eat a great variety of foods. Fantails and grey warblers eat flying insects, while kiwi forage for grubs in the leaf litter on forest floors. Tūī, hihi, and korimako feed on the sweet nectar in flowers, and thus are important forest pollinators. Kererū follow fruiting trees over large areas.

Ducks – pārera and pāteke – eat aquatic insects and snails. Albatrosses and blue penguins eat squid, and shearwaters eat krill. Some vary their diets as they move between habitats throughout the year. Oystercatchers feed on worms and grubs in fields in summer and on shellfish in winter. Wrybills forage for insects under stones in rivers in summer, but in winter feed on small shrimps and crabs on mudflats.

Native birds also need suitable places to nest and raise their young.

Some are particular as to where they build their nests. Mohua and kākāriki are two of the species that nest in holes in trees. Unlike woodpeckers that carve out their own nesting holes, these birds nest in natural holes in old trees, so will not breed in young forest.

The nests of birds that lay their eggs on the ground are particularly vulnerable, not just to predators, but also to disturbance by flooding, vehicles, farm animals, and dogs. Kakī and wrybills lay their eggs among stones on riverbeds, and dotterels and fairy terns lay their eggs on sand.

The amount and types of habitat needed by birds varies from species to species. Some will fly between isolated remnants of habitat. But some forest birds, including rifleman and saddleback, are unable or unwilling to cross even quite short stretches of open land or water. Thus, they can become trapped in patches of bush, unable to leave to find more food, or to breed outside their own little group.[126] Habitat fragmentation can thus prevent some birds from becoming widespread across the mainland.

Some birds are highly adapted to particular habitats. The whio (blue duck) lives only in fast-flowing forest rivers and streams with sequences of pools and rapids.

Other birds are not fussy and can happily exist in different habitats if they are safe from predators. Kiwi and kārearea (New Zealand falcon) are thriving in some radiata pine forests.

Source: Department of Conservation

Figure 8.1 Birds need plants, but many plants need birds too. Tūī and korimako play a crucial role in the survival and spread of the spectacular native mistletoe. Without these honey-eating birds the pollen is trapped inside the mistletoe flowers. The birds tweak the tip of the flowers to get at the nectar, and in so doing flick the pollen on to their heads and transfer it to other flowers

8.2 Animals that degrade bird habitat

The impacts of introduced animals on native birds go well beyond direct predation – they affect the environment the birds rely on in various ways.

Possums are the most well-known destroyers of the bush. They eat the shoots, flowers, fruit, and seeds of many plants, including tawa, rātā, pūriri, tōtara, and kāmahi – the food that birds such as kererū rely on. Unchecked, possums can eat out the crowns of mature trees, potentially leading to collapse of the forest canopy.

Rats and ***mice*** also compete with birds for food. They eat worms and insects that birds feed on. Ship rats are skilled climbers; they scamper up trees to eat fruit and seeds. Rodents will also eat seedlings, stopping new plants from establishing.

Wasps are at some of the highest densities in the world in South Island beech forest. They eat huge amounts of honeydew, as well as many insects and spiders – food for birds and other native animals.[127,128]

Some animals do not compete directly with birds for food, but modify habitat by selectively browsing on favoured plants, thus causing changes in the composition of the vegetation.

Deer browse the forest floor, grazing on the fallen leaves of broadleaf trees. They also eat seedlings, leading to noticeable gaps in the age structure of the forest, and undermining regeneration. Around half of their diet is made up of broadleaf, lancewood, pōkākā, kāmahi, māhoe, and marbleleaf. In summer they graze on ferns in the bush, and on tussock and other alpine plants like mountain daisy at higher altitudes.[129]

Goats eat an even wider range of plants than deer, and their reach is more extensive because they can climb trees. Like deer, they undermine the regeneration of the forest.

Pigs root up and eat understory plants like nīkau, supplejack, and bracken, and like to wallow in mud-holes and wear their continuously growing tusks down on tree trunks.[130] They will also kill and eat birds nesting in burrows. The loss of eight colonies of Hutton's shearwater in the Kaikōura Ranges has been attributed to feral pigs, and only two colonies of this endemic seabird remain.[131]

Rabbits and ***hares*** eat many native and exotic plants, and, if not controlled, can easily sabotage new plantings. In shrublands, plants eaten by rabbits include five-finger, cabbage tree, Hector's tree daisy, clematis, and pōhutukawa. On sand dunes, rabbits will eat spinifex.[132] Hares will kill plants without eating them, by biting the tops off young trees to mark territory.

Source: James Reardon/Department of Conservation

Figure 8.2 A wasp feeding on honeydew in a beech forest

Source: Department of Conservation

Figure 8.3 A white goat and a black goat (asleep with a bellyful of foliage) high in a tree in Whareorino Forest in the King Country. In 2012, Department of Conservation hunters shot 3,420 goats in this area.

8.3 Plants that invade bird habitat

Like introduced animals, some introduced plants can have a big impact on bird habitat.

Some vines can climb high into trees and smother them. They do not generally penetrate deeply into forest, but where forest is more open, such as in the limestone country around Tākaka, they can be very damaging. These invaders include the clematis known as old man's beard, banana passionfruit, Japanese honeysuckle, and moth plant. Climbing asparagus does not actually climb high up trees, but it can creep along the forest floor smothering seedlings and other small plants.

Another potential invader of forests is Douglas fir – the only wilding pine species that can sometimes establish in the low light of native bush.

Along the coast, marram grass has been widely used to stabilise sand dunes, but aggressively outcompetes the native spinifex and pīngao. Marram grass builds steeper and more hummocky dunes than the native sand binders, and this reduces the available nesting habitat of native birds.[133]

In terms of the impact on birds, the most destructive plant invaders are almost certainly the lupins, broom, willow, poplar, and gorse that have become established on the braided riverbeds and adjoining drylands of the eastern South Island. Six species of endemic birds lay their eggs on stony ground and gravel – wrybill, black stilt, black-billed gull, black-fronted tern, banded dotterel, and the pied oystercatcher. The range of these birds has shrunk significantly over the last few decades, and all bar one are in serious trouble.[134,135]

The weeds that have invaded the braided riverbeds crowd out nesting sites and provide perfect cover for feral cats and other predators to creep up on nests. These weeds can also stabilise river islands and force water into fewer and deeper channels, reducing the shallow riffles where wading birds feed.[136]

Responsibility for keeping these open riverbeds free of weeds is often unclear. Some riverbeds are privately owned, but many are owned by the Crown, and 'administered' by Land Information New Zealand (LINZ). LINZ is responsible for controlling weeds and pest animals, but only spends about a million dollars each year for doing this on the land it administers.[137]

However, it is not just invasive plants that have made it increasingly difficult for these birds to find safe places to lay their eggs and raise their young. One major factor is the construction of stopbanks and hydro dams that have changed the natural flow and movement of these rivers. In the past, plants growing in riverbeds were frequently washed away by uncontrolled sporadic floods. More recently, the conversion of undeveloped river margins to more intensive agriculture in the eastern South Island has reduced the diversity and quality of the habitat of some birds.

Source: Nicholas Head

Figure 8.4 Lupins in a South Island braided river. Although they look beautiful for a month or so, they make it more difficult for the inland wading birds to find somewhere to nest, and provide perfect cover for feral cats, ferrets, and other predators.

Source: Alicia Warren, Department of Conservation

Figure 8.5 A black-fronted tern chick run over by a four-wheel drive vehicle – another kind of invader of habitat. As these vehicles have dropped in price and grown in number, more and more are driven along riverbeds and beaches. They can frighten birds into abandoning their nests, and run over chicks and eggs.

8.4 Protecting and restoring habitat on private land

If native birds are to become abundant on the mainland, protecting and restoring habitat on private land is vital for a number of reasons, including the following.

First, most of the conservation estate is forested and alpine, and some bird habitats are under-represented – lowland forest, wetlands, and coastal ecosystems, for instance. Indeed, relatively little of the conservation estate is in the North Island compared to the South Island.

Second, many public reserves are small and fragmented, and birds within them can become 'trapped' in patches of habitat.

Third, peninsulas are expected to play a valuable role in making the country 'predator-free', because they are largely bordered by sea, thus reducing the rate of reinvasion by predators.[138] Land on peninsulas is mostly in private hands.

The challenge of protecting New Zealand's natural heritage is too great for the state alone.

Across the country, habitat restoration and predator control is being undertaken by a great range of enthusiastic and dedicated individuals and groups, many working on private land. Moreover, many areas of Māori land are relatively undeveloped, and many iwi, hapū and whānau have launched their own initiatives to maintain and enhance habitat, and protect ngā tamariki o Tāne-mahuta.

Bird corridors along streams

Fencing off streams and planting vegetation along the banks – riparian planting – is being increasingly done across farms in New Zealand to improve water quality. Regional councils, the dairy industry, and many individual farmers and community groups are actively involved in planting alongside waterways.

As well as improving water quality, such riparian planting can create corridors for birds and other native wildlife, linking up fragmented patches of habitat. In Taranaki, for instance, planting along creek banks on the ring plain is creating corridors of vegetation that radiate out through farmland from the mountain to the sea. Since 1996, corridors with a total length of about 7,500 kilometres have been established.[139]

But if birds are to live within and move along these corridors, they must be safe. To some extent, wildlife corridors will also become highways for predators – possums, rats, and stoats will generally be reluctant to cross open country.

Control of possums within riparian planting is strongly advised – to help plants become established and to prevent the spread of bovine tuberculosis. Other animals – including rabbits, hares, and in some places, pūkeko – also need controlling to help plants become established. But if riparian plantings are to function effectively as bird corridors, rats, stoats, and feral cats must be controlled as well.

Source:Fairfax NZ

Figure 8.6 The black-billed gull (tarāpuka) is considered the most endangered gull in the world because its numbers are plummeting rapidly. These birds normally breed near dry stony riverbeds, but in the spring of 2016, a breeding colony of 500 birds set up home on a dairy farm in Canterbury. The farmer has protected them with an electric fence.

Source: Patti Vanderburg

Figure 8.7 Volunteers from the River-Estuary Care group are working to restore the Waikouaiti-Karitāne estuary just north of Dunedin. The estuary supports a wide range of aquatic and bird life, including tarāpuka (black-billed gulls), tūturiwhatu (banded dotterels), kōtuku kutupapa (spoonbills) and tōrea (oystercatchers).

Covenants and kawenata

One way to protect native ecosystems and species habitat on private land is to use a covenant – a legal agreement. The Queen Elizabeth II (QEII) National Trust has now established more than 4,000 covenants with landowners. These covenants are put on land titles and bind all future owners of that land in perpetuity.[140]

Interest in establishing covenants exceeds the resources of the Trust, so various criteria are used to prioritise.[141] One area of land might be a high priority because it provides a corridor linking other protected areas. Another might be a high priority because it is home to a rare bird species.

In the Bay of Plenty, 14 linked QEII covenants have created the Manawahē Ecological Corridor. Near Kaikōura, one of the only two remaining colonies of Hutton's shearwater is protected by a QEII covenant.

While a fence will keep cattle and sheep out of a covenanted area, it will not keep out the animals that prey on birds and other native fauna and damage habitat. Nor will a fence keep out invasive plants. The land is protected in perpetuity, but the ecosystem is under constant threat from invaders. While many landowners with covenanted land do work to protect the native life within the fence, the task is beyond others.[142]

The QEII Trust thus faces a difficult trade-off – using funding to better protect the life within existing covenanted areas versus establishing new covenants. Recently, the Trust has launched a fund to assist landowners to 'enhance' their covenants.[143]

Another form of covenant is available for kaitiaki of Māori land.

Ngā Whenua Rāhui was established in 1991 in response to concerns that the cost of protecting indigenous forest (rates, fencing, and pest control) was increasing pressure to sell or develop land.

Kawenata (covenants) can be set up to protect land of ecological and cultural significance, and are reviewed every 25 years, in order that future generations can make their own decisions about resources. However, unlike the QEII National Trust, the Ngā Whenua Rāhui Fund is also used to support the landowners in various ways, including assistance with planting and predator control.

Source: QEII Trust

Figure 8.8 A kārearea sits on a fence post near Lake Tekapo. A QEII covenant protects over 1,000 hectares of montane tarn wetland and dryland on Glenmore Station.

Source: Rob Suisted / Ngā Whenua Rāhui, with thanks to Tahamata Incorporation and Ransfield Incorporation

Figure 8.9 Dr Huhana Smith, Richard Anderson, and Rangimarkus Heke above the regenerating Te Hākari dune wetland on the Horowhenua coast. This wetland is under a Ngā Whenua Rāhui kawenata.

What should be planted where?

During this investigation, communities and others working to control predators and restore habitat on private land have expressed some frustration with policies and rules that seem unnecessarily restrictive. When it comes to habitat, two related concepts – *natural range* and *ecosourcing* – have become entrenched in conservation circles in New Zealand.

One of the goals in New Zealand's Biodiversity Strategy states that populations of all indigenous species should be maintained and restored *"across their natural range."*[144]

But Nature does not stand still – the dynamic forces of evolution are always present, and the ranges of species change over time.[145] And climate change will begin to affect the ranges of both plants and animals.

There seems to be only one good reason for confining species to their natural range.

> *"Unless range changes, unaided or anthropogenic, seem likely to do permanent and substantial harm to the biodiversity of New Zealand, they should be ignored. In effect, this is already the implicit policy with regard to exotic biota, and there is no reason why it should not apply to native biota."*[146]

Indeed, it may be very sensible to deliberately expand the range of some species. For instance, kauri dieback disease is threatening the continued existence of these magnificent trees in Northland and Coromandel. A cure cannot be guaranteed, and there is a strong case for planting kauri far south of its natural range.

Ecosourcing is a stronger version of keeping plants within their natural ranges. It is the practice of collecting seeds from plants in a local area, growing seedlings, and planting the seedlings back in the same local area.

The argument given for ecosourcing is that plants are highly adapted to local conditions, and that 'local is best' for a variety of reasons, such as climate gradients. [147]

On the other hand: *"Is there a reasonable case for supporting increased genetic mixing between plant populations to restore greater population resilience?"*[148] And Nature does its own mixing as seeds and pollen are dispersed by birds, insects, and wind.

Understanding of genetic science is growing rapidly, and it is important that this concept of ecosourcing be re-examined. It is not an inviolable principle, yet appears to have achieved such a status in New Zealand. Auckland Council, for example, has a guideline that divides the region into 12 ecological districts, and *"requires ecosourced plants be used as part of resource consent conditions"*.[149]

Policies and rules that are unnecessarily restrictive carry an opportunity cost. Ensuring seeds are ecosourced may make them more expensive and take energy and attention away from bigger issues like predators or invasive exotic weeds.

The issue of adaptation and genetic diversity as applied to birds is discussed in some depth in the next chapter.

Source: Alex Mitchell

Figure 8.10 A wattle bird in a wattle tree. A small population of kōkako live on the island of Tiritiri Matangi in the Hauraki Gulf. In the past there were two species of kōkako – North Island kōkako with blue wattles and South Island kōkako with orange wattles. The latter is almost certainly extinct, though some people have not lost hope. On Tiritiri Matangi, the kōkako rely on the seeds of Australian wattle trees for food in winter.

Bird genetics – resilience and restoration

This chapter is about the application of genetic science to the management of native birds in two situations.

The first situation is when an isolated population of birds has become inbred, or is in danger of becoming inbred. For instance, genetic analysis has shown that most of the little spotted kiwi on Long Island in the Marlborough Sounds are brothers and sisters.[150] Moving a few birds between different isolated populations to counter the risk of inbreeding is known as genetic rescue.

The second situation is concerned with the restoration of native birdlife in different parts of the country. Again, this requires moving birds from one area to another. But should this be done if genetic analysis shows distinct regional differences have developed? For instance, North Island brown kiwi are currently managed as four separate populations that are not to be mixed, despite all being a single species.

There are six sections in this chapter.

The first section describes the four forces of evolution. The fourth force is migration – individuals moving into a population and widening its gene pool. Migration has been greatly reduced in New Zealand birds as populations have become smaller and more isolated.

The second section is about the possibility of restoring the evolutionary force of migration. This has not been a priority in the conservation of native birds in New Zealand.

The third section covers inbreeding and genetic rescue. Black robin, little spotted kiwi, and kākāpō are used to illustrate the issues.

The fourth section is about the translocation of birds to restore populations on the mainland. It includes two case studies – one concerned with North Island brown kiwi and one concerned with kākā.

The fifth section highlights the need for clear principles and policies to guide when and how translocations are done.

The sixth section is about different approaches to risk and the use of the precautionary principle.

9.1 The four forces of evolution

Nature is constantly changing. Over millions of years, species of plants and animals appear and disappear. Over shorter time scales, the gene pools of species change. An understanding of the evolutionary forces that change genetic makeup is essential for managing the genetic diversity of New Zealand's native birds.

There are four evolutionary forces that change gene pools – mutation, natural selection, genetic drift, and migration.[151]

Mutation

Mutation occurs when a gene changes from one form to another. These mutations occur randomly, but can become permanent and passed on to offspring.

Mutation is the origin of all new genetic variation. If the changed form (allele) of the gene gives the plant or animal a characteristic that is beneficial, it can become locked in by the second force of evolution – natural selection.

Natural selection

Natural selection is the evolutionary force with which we are most familiar because of the scientific revolution that followed the publication of Darwin's *On the Origin of Species.*

If an individual has a characteristic that enables it to survive and breed more successfully than others, it will have more offspring, and some of them will inherit that beneficial characteristic.

At some distant point in time, a mutation in an ancestor of the wrybill led to a curve in the bill of some of its offspring – a curve that enabled them to reach food more easily. Through natural selection, all wrybills today have curved bills.

Natural selection only occurs when there is a gain to be made.

Genetic drift

Genetic drift is a process that erodes genetic diversity. Purely by chance, some forms of genes are passed on to subsequent generations more than others, and some are lost entirely.

This random genetic drift occurs in all populations all of the time, but is particularly significant in small isolated populations in which its effects are magnified by inbreeding.

Charles Darwin, who married his first cousin, became concerned about the risk of inbreeding in the aristocracy due to their propensity to marry within their class.[152] The relatively high incidence of haemophilia in the royal families of Europe in the 19th century was due to genetic drift and inbreeding – it was not an adaptation to living in palaces.

Many New Zealand birds are in small populations on offshore islands or in isolated pockets of habitat on the mainland, and have lost significant amounts of genetic variation as a consequence of genetic drift.

Migration

Migration is a process that increases genetic diversity. In this context, it refers to individuals moving into a population and thus widening its gene pool. The evolutionary process of migration is often called gene flow, because genes 'flow' from one population to another.

In the plant world, wind-blown pollen is one kind of migration. In the bird world, birds fly (or walk) from one population to another and set up house with mates that are a little different genetically.

Over the last two centuries, the fourth evolutionary force – migration or gene flow – has been significantly reduced in New Zealand native birds.

Source: Tony Whitehead

Figure 9.1. The wrybill is an endemic wading bird that shows a clear adaptation to its environment. It is the only bird in the world with a bill that curves laterally, always to the right, which it uses to prise out insect larvae under rounded riverbed stones.

There are two reasons why migration – the fourth evolutionary force – has been greatly reduced in New Zealand birds.

The first is the division of some bird populations on the mainland into isolated smaller populations. As farms, towns, and cities have spread across the landscape, habitat for birds has not only shrunk but become fragmented. Some bird populations are remnants of mainland populations clinging on in a few refuges.

The second reason is the creation of sanctuaries on islands. A great success of New Zealand conservation has been the eradication of predators from offshore islands, enabling them to be used as sanctuaries for birds. Kapiti Island, for example, is home to more than 20 species of native birds.

The existence of small isolated populations of birds raises the spectre of inbreeding. Inbred birds may struggle to produce fertile viable offspring. A population with low genetic diversity is also likely to be less able to cope with challenges like the arrival of a new parasite or a warming climate.[153]

9.2 To mix or not to mix?

As outlined in Chapter 4, the development of genetic science has enabled the discovery of ever-finer distinctions between different populations of the same bird species – hence, taxonomic inflation. Such distinctions are the result of two forces of evolution – natural selection and genetic drift.[154] The assumption that natural selection is the more important has been a widely held view in New Zealand – a view that has had a significant influence on conservation management.

Certainly an isolated population of birds is likely to adapt to some extent to its local environment through natural selection. But genetic drift is inexorable – it happens all the time. Moreover, drift towards genetic homogeneity occurs most rapidly in small isolated populations, especially where there are few offspring in each generation.[155]

An isolated population of birds may be inbred yet still grow in numbers. But the longer it is left isolated, the more inbred it will become, and the less valuable it may be for repopulating the mainland.

Despite this, the general approach in New Zealand has been to keep populations separate.

> *"As far as we are aware, … only in New Zealand is there a widely held view that threatened bird species are less susceptible to the effects of inbreeding depression than species elsewhere".*[156]

The reluctance to mix birds from different populations can have two consequences on conservation management in New Zealand.

The first consequence is that birds have not been transferred from one population to another to reduce the risk of inbreeding until the need for genetic rescue is indisputable. While it is expensive to translocate birds, leaving them in small isolated populations drifting to oblivion will be costly too.

The second consequence is the setting of (potentially unnecessary) restrictions on the translocation of birds for restoring populations. Clearly, restrictions of various kinds are needed. For instance, moving a diseased bird into a healthy population would clearly be a bad thing to do. But the restrictions on mixing birds of different provenances should be thoroughly examined.[157]

The next two sections illustrate these two issues using some short case studies.

9.3 Inbreeding and genetic rescue

Three bird species that are suffering from inbreeding are black robin, little spotted kiwi, and kākāpō.

Black robin

The black robin is found only on the Chatham Islands. This species was saved from imminent extinction in the 1980s by the remarkable longevity and fecundity of the sole productive female, known as 'Old Blue'.

The population of five surviving black robins has now grown to more than 250 on two islands – Māngere and Rangatira. Since all surviving birds are descended from 'Old Blue', they are very inbred. Signs of genetic deterioration in black robins are deformed beaks, poor plumage, and reduced breeding success.[158]

Although black robins overall are inbred, keeping them separated on two islands is likely to make the situation worse.[159] Introducing gene flow between the two populations is essential for maintaining the genetic variation that remains in the species. This would only involve moving a few birds from each island to the other every few years.

Little spotted kiwi

The little spotted kiwi is one of five species of kiwi and was once widespread. A handful of birds a century ago has grown to about 2,000, spread across 11 separate populations.[160]

Despite the increase in numbers, at least one population is showing signs of inbreeding depression. Most of the 50 little spotted kiwi on Long Island are siblings, the direct offspring of the single founding pair. The inbreeding appears to be causing malformed embryos, reduced hatching success, and lower survival rates. The authors of a study of the Long Island population concluded that a translocation of birds from other locations could help with the genetic rescue of the population.[161]

The Department of Conservation has now recognised the need to move little spotted kiwi around to maximise the remaining genetic diversity, and has recently drawn up a translocation proposal for the species.[162]

Kākāpō

Kākāpō were once widespread across New Zealand. Confirmation that these birds still existed in Fiordland in 1958 and on Stewart Island in 1977 caused great excitement, but the population continued to decline. About 35 years ago, the remaining 63 birds were transferred to island sanctuaries, and the population has grown to 154.[163]

All but one of the 63 founders were from Stewart Island. A single male – named Richard Henry after New Zealand's first park ranger – came from Fiordland. As a result, genetic diversity in the species is low and the effects of inbreeding are apparent. Many eggs are infertile, and only a third hatch successfully. The breeding success of the most genetically homogeneous females is particularly low.[164]

The birds with Fiordland genes – the descendants of Richard Henry – appear to be essential for any genetic rescue of the species. Some of the Fiordland genes affect immunity.[165]

Research is underway to sequence the genomes of the kākāpō. It is hoped that this information can be used to maximise the remaining genetic diversity in the population. This could include collecting sperm from selected males and artificially inseminating the 'optimal' females.[166]

Beyond this, the only way to increase the genetic diversity of the kākāpō would be to genetically engineer the birds themselves. This possible way of saving endangered species has been dubbed 'facilitated adaptation' and is being discussed in the scientific literature – though not specifically for kākāpō.[167]

Drifting toward homogeneity

Once an isolated population of birds has drifted towards genetic homogeneity, it may lack resilience in the long term. Genetic variation can be lost in a few decades, but it takes thousands of years for mutations to build it up again. The black robin, the little spotted kiwi, and the kākāpō are three species that have little genetic variation, and sit precariously on the brink of extinction.

There are others in the same situation or close to it. And it is not just isolated populations on offshore islands that are becoming more genetically homogeneous. For instance, there is no migration between the various populations of pāteke (brown teal) on the mainland, and there is limited genetic variation within every population bar a single population in Northland.[168]

Translocations between small populations of birds for maintaining genetic diversity have been done in New Zealand.[169] But there is currently no consensus or guidance on when this should be done.[170]

The cases of the black robin, little spotted kiwi, and the kākāpō show the importance of preserving genetic diversity. It is vital that the maintenance of genetic diversity be an integral part of managing populations of native birds long before the effects of inbreeding become evident.

Source: Department of Conservation

Figure 9.2 The black robin population today stands at around 300 individuals, having previously declined to just five – and only one breeding female, known as 'Old Blue' (pictured).

Source: Andrew Digby/Department of Conservation

Figure 9.3 Sinbad the kākāpō is one of the few birds with the precious Fiordland genes.

9.4 Moving birds to restore populations on the mainland

During this investigation, it has become evident that there is strong disagreement about the translocation of birds to restore populations on the mainland. Two examples of this are outlined in this section – one concerned with North Island brown kiwi and the other concerned with kākā.

North Island brown kiwi

North Island brown kiwi are the most numerous of the five kiwi species. They are managed by the Department of Conservation as four separate populations – Northland, Coromandel, Eastern, and Taranaki.[171] These populations do not differ enough to be considered species (or even subspecies) in their own right.

But how different are these birds? Do their genetic differences reflect major adaptations to local conditions, or is it just genetic drift? Would birds from one region thrive in another? Would some migration between populations be harmful or beneficial?

'Kiwis for kiwi' is a charity with the vision of taking *"kiwi from endangered to everywhere"*. It plans to establish a large genetically diverse population of over 800 North Island brown kiwi in the largest fenced sanctuary in the country – Sanctuary Mountain Maungatautari in Waikato. The aim is to use these kiwi as a source for other restoration projects in the region. In order to do this, they need to get kiwi from elsewhere.

One potential source is Pōnui Island. This island in the Hauraki Gulf has a large population of kiwi. The number of kiwi exceed the carrying capacity of the island, and few of the chicks survive to set up territories of their own. Adding some of these birds to the existing population of kiwi at Maungatautari would be far cheaper than obtaining birds from the wild on the mainland.

However, Kiwis for kiwi has not been granted permission to move any kiwi from Pōnui to Maungatautari because they are considered to have *"no genetic value whatsoever for use in restoration"*.[172] Currently, Kiwis for kiwi is investigating the option of taking eggs from wild kiwi in the Taranaki population and incubating them.[173,174]

Kākā in Abel Tasman National Park

Project Janszoon is a trust working with the Department of Conservation and others to restore the ecology of the Abel Tasman National Park over a 30-year time frame.

Kākā were once widespread across the country. When protected from predators and with adequate food, small populations can multiply rapidly.

These large, gregarious parrots are now very rare in Abel Tasman National Park. Project Janszoon is planning to restore thriving populations of kākā back into the park, through a combination of predator control and translocations of birds from elsewhere.

Currently, kākā are divided into two subspecies – North Island kākā and South Island kākā. An analysis in 2006 found little genetic difference between birds in different parts of the country.[175] This prompted Project Janszoon to propose translocating some birds from the thriving population at Zealandia in Wellington in 2013.

This proposal was vigorously debated. On the one hand, Zealandia would be a relatively cheap source of kākā. On the other hand, the Zealandia kākā are likely to be genetically similar because there were only 14 birds in the founding population.[176]

In June 2015, the Department of Conservation issued a permit to the trust for translocating kākā. But only birds that originated from the northern South Island could be moved under this permit. This would entail catching kākā in the wild in the Nelson Lakes area – an expensive and risky enterprise.

A second genetic analysis in 2015 also found no basis for distinguishing between North Island kākā and South Island kākā.[177]

In 2016, a revised permit was issued that does allow for birds to be translocated from outside the northern South Island from 2019 onwards. However, this can only be done if attempts to establish a population using birds from the wild are unsuccessful.[178]

Source: Zealandia

Figure 9.4. A kākā taking flight at Zealandia in Wellington. The number of kākā in and around the sanctuary has grown from an original population of 14 birds to about 800 individuals today.

9.5 An urgent need for translocation policy based on clear principles

Translocations of birds are expensive and risky, and should not be done without good reason.

The maintenance of genetic diversity by moving birds from one small population to another is one very sound reason. But there are some important questions to consider when translocations are proposed for other reasons.

Translocations can be done to re-establish bird populations. The kiwi case study was concerned with a proposal to move kiwi from an offshore island into a sanctuary on the mainland. The kākā case study was concerned with a proposal to move kākā from a sanctuary on the mainland to a national park.

Questions to consider in such situations include:

- Will there be adequate genetic diversity in the re-established population?
- What is the cost of translocating birds from sanctuaries compared with the cost of trapping birds in the wild and then moving them?

Translocations of birds are often sought by community groups. The arrival of new birds and the accompanying ceremony are understandably very motivating for people who have spent many hours suppressing predators and restoring habitat. For Māori, in particular, seeing birds that were once lost come back brings hope and pride.

But again, there are important questions that should be asked. Would the money spent on a translocation achieve much more if it was spent on suppressing predators and restoring habitat over a wider area?

The Department of Conservation does not have a *policy* on the translocation of birds – the *why* and *when* it should be done. (It does have a set of *procedures* governing the process from application through to reporting – the *how* birds should be translocated.)

A translocation policy must be based on a clearly articulated set of principles.[179] Without clear guidance, this difficult area will continue to be vigorously debated, leading to slow and inconsistent decision-making.

A book titled *Genetic Management of Fragmented Animal and Plant Populations* by Richard Frankham and seven co-authors is to be launched by Oxford University Press at the International Congress for Conservation Biology in July 2017. A shorter, simpler practical guide will follow, and should provide a sound basis for rethinking the genetic management of New Zealand's flora and fauna.[180]

9.6 Being precautionary? Different attitudes to risk

In discussions on contested environmental issues such as the translocation of birds, it is not unusual to hear appeals to the precautionary principle. Such appeals can close down discussions. This is because the principle is sometimes viewed as inviolable, despite there being no consensus on its meaning.

In 1992, the Rio Declaration defined the precautionary approach to protecting the environment as:

> *"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*[181]

In other words, when it comes to the environment, full scientific certainty will always be elusive, and we cannot prevent environmental degradation without taking action.

However, the current Kiwi Recovery Plan states that:

> *"Where possible, a precautionary principle will be applied to management of the genetic structure of these taxa until the importance of their genetic diversity is fully understood."*[182]

Here the precautionary principle is taken to mean do not act without full scientific certainty – the opposite of the Rio Declaration.

In his landmark 2011 book *Thinking, Fast and Slow,* Daniel Kahneman links the precautionary principle to the human tendency of loss aversion. This tendency is sometimes expressed as 'losses loom larger than gains' or 'better safe than sorry'. Strong aversion to loss may in part explain the reluctance to move kiwi from Pōnui Island and kākā from Zealandia.

Over recent years, the private sector has become increasingly involved in conservation in New Zealand. During this investigation, it has become clear that there are tensions between private and public sector players.

It is likely that one source of this tension is different attitudes to risk – different degrees of loss aversion. Those who work in the public sector are generally averse to taking risks – taking an action that has a bad outcome and ends up on the front page of the newspaper is to be avoided. In contrast, private sector players have a much greater appetite for risk.

Whatever the reasons for the tensions between public and private sector players are, they need to be identified and worked through. The deep knowledge and experience of the public sector and the entrepreneurship of the private sector are both needed in the great enterprise of conserving New Zealand's natural heritage.

10 Conclusions and recommendations

With virtually no native mammals, New Zealand was once a land dominated by birds. Some, including the towering moa and the much-prized huia, have gone forever. Of the 168 species that remain, 80% are in trouble, and some are close to extinction.

It is possible to turn this around, but it will take clear thinking and planning, significant investment, the efforts of many New Zealanders, and a great deal of ingenuity and innovation.

Safety from predators is the first requirement. For native birds to flourish on the mainland, they need, first and foremost, to be protected from the introduced animals that kill them.

Somewhere to live and thrive – habitat – is the second requirement. Some birds are very particular about what they eat and where they nest, while others are more flexible.

A degree of genetic diversity is the third requirement. Birds living in small isolated groups can become so alike that their long-term survival is in doubt.

Much good work is already being done. Government initiatives include the Battle for Our Birds and the ambitious goal of becoming predator-free by 2050. The Department of Conservation continues to be of central importance. Private initiatives and the endeavours of hundreds of community groups are testament to the wider commitment of the New Zealand public.

Over recent decades, New Zealand has had some great successes in conservation. However, it is now time to rethink why and how we seek to preserve our natural heritage.

Great effort has been put into saving individual species – without this, the kākāpō and the black robin would have joined the moa and the huia. But trying to bring birds back from the brink of extinction is very expensive and difficult, if not impossible. We need to put much more effort into stopping birds getting into this state.

Clearing islands of predators so they can be used as refuges for threatened species has been invaluable for stopping some species from disappearing forever. However, some of these islands are at their carrying capacity – on some, birds are dying for lack of food and space.

Moreover, small populations of birds, whether they be on offshore islands, in mainland sanctuaries, or in remnants of habitat, will drift toward genetic homogeneity, increasing their vulnerability. We must focus on clearing predators from large areas of habitat that can support bigger populations of birds.

Our natural heritage is not confined to the conservation estate. Nor can the Department of Conservation be solely responsible for its preservation. Some of our birds find their natural habitat on farms, and some will happily live in cities.

It is also important to think clearly about what is possible or even desirable to achieve. The clock cannot be rolled back to a time when these islands were pristine wilderness, brimming with birds, and completely without people.

The recommendations in this chapter are aimed at helping us 'rethink conservation'. There is much more to protecting our natural heritage than saving birds, but if we can restore our bird populations, our ecosystems as a whole will benefit.

There are seven sections in this chapter, each leading to one or more recommendations from the Commissioner.

The first three sections are concerned with the most important and urgent need of New Zealand's native birds – safety from predators. The recommendations address the following issues.

- The development of a plan for Predator Free 2050, beginning with the identification of a portfolio of priority areas for predator control.
- Research into predator control that should be strongly supported.
- The development of a programme for engagement with the public on the use of genetic techniques to control predators.

The fourth section is concerned with the restoration of habitat – somewhere for birds and other native creatures to live and thrive. Some aspects for consideration when developing policy are recommended.

The fifth section is concerned with the effective management of genetic diversity in birds and other fauna. A measure of genetic diversity in bird populations is importance for resilience.

The sixth section addresses the need for more funding for protecting and restoring our natural heritage. A biodiversity border levy on visitors to New Zealand is recommended, along with increased use of user pays for the provision of infrastructure and services on the conservation estate.

The seventh section is concerned with supporting and coordinating the hundreds of community groups that work to control predators and restore habitat. The number of these groups has grown rapidly as conserving our natural heritage has engaged the hearts and minds of many New Zealanders.

10.1 Predators - Starting a plan for Predator Free 2050

The Government's announcement of the Predator Free 2050 goal has been rightly lauded as a big step forward. It is ambitious and inspiring, and has attracted attention around the world. While the business case prepared in support of the goal is an excellent starting point, it is not a plan of action – it provides little detail of how we are to get there from here. And this is what is now needed.

Trying to prepare a detailed plan stretching out to 2050 would be unwise. Rather, the plan should be a living document that can be frequently edited and updated.

The starting point should be geographic – developing a portfolio of areas in different parts of the country where it makes sense to focus efforts on clearing predators. What would be the criteria for choosing such areas?

First, clearing an area of predators is not an end in itself – it is a means to an end. That end is the restoration of abundant, resilient, and diverse birdlife, and lizards, frogs, bats, snails, and insects. So a primary criterion for choosing areas to focus efforts on is the potential for native wildlife to flourish in the absence of predators. This might mean focusing on areas rich in different wildlife species. And it might mean focusing on some areas where the deep endemic birds can still be found.

Second, while the presence of predators is the major threat to native wildlife, other things matter too. An area might be cleared of predators, but still be unable to support abundant birdlife because of the damage to the habitat by goats or wasps.

Third, the areas chosen should be in different regions of New Zealand, include different ecosystems, and not be restricted to the conservation estate.

Fourth, committing to clearing predators from large areas is important. Large safe areas can support more abundant wildlife. Large safe areas can also support larger populations of any species, thus maintaining greater genetic diversity. Also, reinvasion by predators from outside occurs more slowly in large areas than in small areas.

Fifth, there is merit in targeting peninsulas because the sea is a natural barrier that will slow reinvasion by predators.

Sixth, the potential for connecting different areas through wildlife corridors should be considered.

Finally, the support of local communities for restoring natural heritage – and for the methods used to kill predators – may be an important factor.

Another dimension of a plan for Predator Free 2050 would need to be coordination with other initiatives to restore natural heritage. There are many such initiatives underway, some involving large areas. A Crown entity – Predator Free 2050 Ltd – has been created, but it is not evident how this organisation will interact with the Department of Conservation and the great range of different players, all with different mandates and priorities.

Clarity will be needed on what needs to be done in targeted areas, and on who is responsible for what. Until predators are eradicated, if this proves possible, they will always reinvade cleared areas.

Maintenance of suppression is vital. Without commitment to ongoing control of predators, it may not be worth beginning to clear them from some areas.

Then there are questions of resources – Where does funding come from and how can it be optimally spent? Finally, there must be some way of assessing progress.

Thus, creating a portfolio of priority areas for predator control, though not trivial, is only a first step. These priority areas should be large.

Such a portfolio should be developed based on advice from a committee of the best scientific minds drawing on the criteria above. The committee would need to consult iwi, local authorities, and others, including those behind major initiatives such as Project Janszoon and Cape to City.

I recommend that the Minister for the Environment and the Minister of Conservation direct officials to establish an expert committee to advise on a portfolio of large priority areas for sustained and effective predator control that will allow birds and other native wildlife to thrive.

10.2 High priority research for predator control

The vision of making New Zealand 'free' of predators by 2050 is, in large part, based on the possibility that developments in genetic science can make the wide-scale suppression, and even eradication, of predators a reality.

But 2050 is more than three decades away. Most of our birds are already in trouble, and the same is true for other native wildlife. We cannot wait for long-term breakthrough science before stepping up predator control. If we do, the patient will die before the hospital is built.

Fortunately, there is a wave of innovation underway in the development and use of trapping and poisoning, both within the private sector and in Crown research institutes. This must continue.

During this investigation, three key areas for research have been identified and these are the subject of the recommendations below. Some work is underway, but all three need to be supported as high priorities.

Predator return

For the foreseeable future, the use of aerial 1080 is critical for knocking down populations of possums, rats, and stoats cost-effectively over large areas. But after any predator control operation, predators always return – whether they are invaders from outside the control area or the progeny of survivors.

Research into ways of extending the knockdown period should be given a high priority. For instance, the knockdown period after a 1080 drop may be significantly extended by putting resetting traps and bait stations along 'rat highways' on fertile valley floors.

One source of reinvasion after an aerial operation is the buffer zones placed around tracks and waterbodies. Those setting such restrictions should understand that excessive buffer zones can substantially undermine the effectiveness of an aerial drop. Such restrictions should be based on a scientific assessment of actual risk, not perceived risk.

Rodents – rats and mice – rebound first, and stoats follow. Rebound occurs most quickly in warmer, more fertile podocarp forests than in colder, less diverse forests. Using 1080 optimally to prevent the devastation of a mast seeding is well understood. But more research is needed on minimising rodent bounceback in other forest types.

A related important area of research is the interaction between populations of rats and populations of mice. Mice are not one of the target predators in Predator Free 2050, yet mice will multiply in the absence of rats and provide food for stoats. In some ecosystems, mice are the only rodents. The effectiveness of 1080 in killing mice is variable, and research is needed to understand why.

Keeping vulnerable birds safe

If native bird populations are to be restored on the mainland away from the safety of predator-free islands, they must be safe.

Some birds are much more vulnerable to predators than others. These include mohua, tīeke, and kōkako – all precious deep endemics. When particularly sensitive birds are being re-introduced to an area, the presence of only a few predators can wipe them out.

There is a critical need for research into *how low* levels of predators need to be, in order for different bird species to be safe. Associated with this is the need for more accurate ways of measuring predator densities when they are at low levels.

Feral cats

Like mice, feral cats are not targeted in Predator Free 2050. Yet these skilled killers almost certainly number in the millions in the countryside and along forest margins. They will be breeding particularly quickly where there is an unlimited supply of fresh rabbit.

Feral cats and mustelids are particularly susceptible to the poison PAPP, which kills them rapidly and humanely. PAPP is currently used in bait stations for stoats, and work is underway on developing a long-lasting lure to entice stoats to the bait. But there appear to be no plans in New Zealand for its widespread use on feral cats or for the development of a cat lure.

In Australia, feral cats are recognised as a great threat to their native species. Work is underway there measuring the effectiveness of different cat lures, such as the sounds of cats on heat and birds in distress. Australian research on feral cats should be followed closely because of the potential for its use in New Zealand.

I recommend that the Minister for the Environment, the Minister of Conservation, and the Minister of Science and Innovation direct officials to give a high priority to the following areas of research.

a) Slowing the return of predators after a control operation;

b) Optimising the use of 1080 in different forest systems;

c) Improving the effectiveness of 1080 for controlling mice;

d) Understanding the predator levels that are safe for different bird species, and developing techniques for measuring predators at low densities; and

e) Developing new baits and lures for the control of feral cats.

10.3 Breakthrough methods for predator control using genetic science

The modern era of biology began over 60 years ago with the discovery of the double helix structure of DNA. Since then, the understanding and tools provided by genetic science have been applied to more and more areas, including conservation.

There are at least three areas of research into predator control underway in New Zealand that rely on genetic science – toxins that kill only one species of predator; the Trojan female technique, which produces infertile sons; and gene drive, which increases the prevalence of a particular trait in a predator population. As knowledge grows, more possibilities will arise.

The nature of research is that there are no guarantees of success in the laboratory, let alone practical application in the real world. One approach may be very effective, but would face many hurdles in becoming registered for use; another may be the opposite. It is important that all options be kept open, and that research money is not prematurely funnelled into one area.

Approaches that rely on some kind of genetic modification are likely to encounter strong opposition from some. But the use of genetic science does not necessarily involve modifying genomes. Nor does the use of genetic modification necessarily involve transferring genes from one species to another.

Some techniques, like the Trojan female and gene drive, once introduced, will spread through predator populations by themselves. This attribute will make such techniques very cost-effective, but is likely to create public concern.

Informed and early public discussion about different methods for using genetic science for predator control will be essential. Such discussion should not only cover the risks associated with such methods but also the promise they hold – the widespread control and potential eradication of the predators that are killing many millions of birds and other native wildlife every year. The Royal Society of New Zealand has set up a panel of experts on gene editing.

I recommend that the Minister for the Environment, the Minister of Conservation, and the Minister of Science and Innovation direct officials to begin developing a programme of staged engagement with the general public on the potential uses of genetic techniques to control predators.

10.4 Habitat - somewhere for birds to live and thrive

The habitat for New Zealand's native birds is not just forest, and it is not all within national parks and other reserves. Restoring abundant, resilient, and diverse birdlife back on to the mainland will involve bringing birds back to farmland, coasts, riverbeds, and cities.

Covenants on private land

An increasingly common way of protecting a native ecosystem on private land is the use of a covenant. But while a fence will keep cattle and sheep out of a covenanted area, it will not keep out other introduced animals that prey on birds or damage habitat. (In the same way, putting land into the conservation estate does not guarantee its protection.)

There are a range of types of covenants set up by different organisations, including the kawenata set up by Ngā Whenua Rāhui. The QEII National Trust is the major player, and has now established thousands of covenants protecting areas of private land in perpetuity. With the demand for new covenants, it is difficult for the QEII Trust to assist landowners with controlling pests in covenanted areas. The same will apply to other organisations that establish covenants. But some of the areas under these covenants contain ecosystems that are underrepresented.

Bird corridors

Fencing off streams and planting vegetation along the banks is increasingly being done on farms across New Zealand to improve water quality. As well as reducing the flow of pollutants into water, riparian vegetation can link remnants of habitat, thus providing corridors for birds and other wildlife to extend their range. But as in covenanted areas, predator control will be needed to keep the birds safe.

A collaborative process is currently underway to develop a National Policy Statement on Indigenous Biodiversity. There is potential for this to cover the win-win for biodiversity and water quality that can be provided by riparian planting.

Invasive plants

In terms of the impact on birds, the most destructive plants invading bird habitat are almost certainly the lupins, broom, willow, poplar, and gorse that have become so dense on the braided riverbeds and adjoining drylands of the eastern South Island. These weeds are not the only factor causing the decline of the six endemic inland waders, but they are a major one – crowding out nesting sites and providing cover for feral cats and other predators to creep up on nesting birds.

Responsibility for keeping these open riverbeds free of weeds is often unclear. In most cases, the responsible party is Land Information New Zealand, but biodiversity is not a priority for this agency.

The state of the braided riverbeds is of increasing concern. The inclusion of the Tasman and Godley rivers in the Aoraki/Mt Cook National Park, as currently proposed, would be a move in the right direction since biodiversity is a priority for the Department of Conservation.

Restoring habitat - what should be planted where?

When preserving or restoring our natural heritage, it is important to be clear about what it is that we seek to achieve. In relatively untouched parts of the country, such as virgin forest in national parks, most would agree with the aim of keeping them as close as possible in the state they were in before humans arrived.

But elsewhere, we need to recognise that people and nature must thrive alongside one another. The British conservation scientist Dame Georgina Mace addressed this challenging topic recently in New Zealand when she delivered the Royal Society Rutherford Memorial Lecture.

Policies and rules governing the restoration of habitat that are unnecessarily restrictive can add cost, frustration, and delay, and thus reduce what can be achieved.

There are two related concepts that need examination – *natural range and ecosourcing.*

The natural ranges of plants have changed in the past and will do so again. There will be cases for keeping some plants inside their natural range, and cases for not doing so.

Neither should ecosourcing be regarded as an unviolable principle. Pollen and seeds are carried from place to place by wind, insects, and birds.

I recommend that the Minister for the Environment and the Minister of Conservation direct officials to consider the following in policy development:

a) **Increasing the control of predators within covenanted areas and riparian vegetation;**

b) **Addressing the degradation of the habitat of braided rivers and dryland margins; and**

c) **Clarifying the circumstances where the concepts of natural range and ecosourcing should be applied and not applied.**

10.5 Bird genetics - inbreeding and restoration

Efforts to save birds on the brink of extinction have rightfully focused on keeping the few remaining individuals alive. If they had not, kākāpō, black robin, and hihi would have become extinct. More recently, attention has started to shift to managing the genetic diversity of some species to make them more resilient and increase the likelihood of their long-term survival. This can often be done by translocating – moving – a few birds from one isolated population to another.

Translocations are also sometimes used to re-establish and supplement bird populations. The arrival of new birds is understandably very motivating for community groups and iwi who have worked long and hard to control predators and restore habitat.

However, translocations are expensive and risky. In some cases, the money spent on a translocation might achieve more if it were spent on expanding predator control over larger areas, or on creating habitat corridors so the birds can more readily spread of their own accord.

The Department of Conservation does not have a *policy* on the translocation of birds. What it does have is a set of standard operating procedures governing the *process* that must be followed for a translocation to be approved. These procedures lay out *how* a translocation is to be carried out, but not *why* and *when* it should be done.

Some reference is made in the Department of Conservation procedures to International Union for Conservation of Nature (IUCN) guidelines. But these guidelines are high-level, and have not been articulated in a New Zealand context.

Some efforts are underway to address this gap for individual fauna. But without a policy based on a clear set of principles, decisions on genetic rescue and translocation are inconsistent. Moreover, the line between science and opinion is often blurred, adding to the problem.

There are other ways in which the lack of a policy on genetic diversity within a species is leading to management decisions that should be questioned. Unnecessary restrictions generally add cost to any enterprise. For instance, regional, and even subregional, populations of North Island brown kiwi are being managed separately to preserve small genetic differences. But in a predator-free future where kiwi are abundant, birds from different regions will meet and sometimes mate. So, why not now?

The genetic management of New Zealand's flora and fauna needs a firm and consistent foundation. The forthcoming book and practical guide by Richard Frankham soon to be published by Oxford University Press should provide a sound starting point.

I recommend the Minister of Conservation directs officials to:

a) **Develop principles and policies for the effective management of genetic diversity in native birds and other fauna; and**

b) **Develop a translocation policy that outlines why and when translocations should be undertaken, and ensures translocation decisions are made transparently and consistently.**

10.6 Investing in our natural heritage

New Zealand is a country with an extraordinarily rich and unusual natural heritage, and is widely recognised as a biodiversity hotspot. The degree of endemism is particularly high. Many of our plants and animals are found nowhere else in the world, including more than half of our bird species.

Nearly two million tourists came to New Zealand last year. Few, if any, came to go shopping. Almost all would have come because they saw photographs of stunning landscapes. Not all of them would have actually visited a national park, but that is what drew them here. Wilderness is becoming increasingly scarce around the world, and in scarcity lies value.

For a long time, conservation was seen as the business of the Department of Conservation and regional councils. Encouragingly, philanthropists, private land owners, companies, and hundreds of community groups are now investing money and time and enthusiasm into conservation.

But preventing the devastation caused by predators on a landscape scale is expensive. In 2014, the Battle for Our Birds cost about $20 million. That battle was fought using cost-effective 1080, but it was only fought over 16% of the area of forest that was masting and causing rodent and stoat populations to soar. To control predators in all masting forest in 2014 would have cost about six times as much. And then there are warmer, more fertile forests in places like Northland where rat numbers are high every year.

The Department of Conservation must, at the same time, protect natural heritage and enable people to experience that natural heritage. The number of international tourists is projected to double in the next five years, and this will put increasing pressure on tracks, bridges, huts, visitor centres, toilets, car parks, and all the other infrastructure that supports the visitor experience.

The duty of care to protect people visiting a national park will always trump the protection of the biodiversity within the park. Early this year, a norovirus outbreak swept through a popular tramping route in Nelson Lakes. Containing the outbreak involved disinfecting every hut and toilet on the track. Helicopters were needed to reach remote areas. While this had to be done, it would have diverted resources away from activities like predator control.

As this was being written, the Government announced that more funding is to be given to the Department of Conservation for tourism infrastructure. This will help, but the principle of 'user pays' for infrastructure and services needs to be applied further. The Department of Conservation has recently decided to charge higher fees for huts and campsites. However, this will not help the congestion on the Tongariro Crossing where more toilets are desperately needed. One possible new source of revenue is to charge for car parks, as is done in some places in Canada, Australia, and the United Kingdom.

There are also precedents for charging for access to national parks in other countries. For instance, a seven-day pass to visit Yellowstone National Park costs US$30 in the United States. But under the Conservation Act, charging anyone for access is currently prohibited in New Zealand.

Free access to the conservation estate – the right to wander without restraint into our wild places – is deep in the psyche of many New Zealanders. That right should be protected. But the Conservation Act could be amended to allow for charging overseas visitors for access.

The more that user pays charges can cover the provision of infrastructure and services, the more money there will be available for protecting birds and other ecological treasures, *provided* Vote Conservation is not reduced.

The cost of administration and compliance is frequently raised as a criticism of user pays on the conservation estate. There must be ways of addressing this using modern technology.

The increasing investment in conservation by philanthropic trusts, private land owners, and many others is very encouraging. But the task ahead of us is immense. Only a fifth of our bird species are secure, and a third are in serious trouble. The situation is similar for lizards, frogs, insects, and other native fauna. And, at the time of writing, news has come that myrtle rust has arrived in New Zealand threatening pōhutukawa and mānuka.

Another hugely important issue for this isolated country is biosecurity. New Zealand already has a border levy as an efficient way of paying for biosecurity enforcement at ports and airports.

Currently, there is a call for a similar levy that would provide revenue for biodiversity. The great majority of visitors to New Zealand come because of the unique natural beauty of these islands. There is a strong case for a Nature levy at ports and airports to provide another source of revenue for protecting our natural heritage.

I recommend that the Minister of Tourism, the Minister of Finance, and the Minister of Conservation direct officials to investigate new sources of revenue for conservation, including:

a) Requiring visitors to New Zealand to pay a Nature border levy; and

b) Additional ways of charging visitors to New Zealand for the provision of infrastructure and services on the conservation estate, in order to free up more of Vote Conservation for the protection of biodiversity.

10.7 Supporting and coordinating community groups

Across New Zealand, hundreds of community groups are working hard on conservation. Some focus on controlling predators, others on restoring habitat, and others on protecting a specific species. But all are devoting time, effort, and passion to protecting New Zealand's rich natural heritage.

During this investigation, staff visited a number of community groups in different parts of the country, and heard about the challenges and frustrations that they face.

The process of setting up a non-profit community group, obtaining grants, and managing funds requires specialist skills. Carrying out conservation work also requires a range of skills, such as the kind of traps to use and how to operate them, what species to plant where, and the requisite health and safety measures.

There are many organisations that provide funding, but all place different restrictions on how the funds are to be used. Most will provide money for the obvious needs – traps and plants. But many do not allow grants to be spent on administration or financial management, despite these activities being vital for a group to be effective. One group coordinator commented that the hardest person for a group to find is a treasurer.

Reporting requirements attached to funding are important for accountability and, in theory, for measuring effectiveness. However, when many grants are small (several thousand dollars) and funding is short term (one to three years), the burden of submitting regular detailed reports can be disproportionate. This is even more so when groups rely on several small grants from different organisations – each with their own requirements for reporting.

Funding organisations are often reluctant to renew funding for groups that have been successful in a previous round. Instead, they move on to other groups. This often leads to groups having to continually look for new funding sources. If they cannot secure new funding, the effort they have already put into conservation will be largely wasted – activities like predator control and weeding must be sustained over time to be effective.

In contrast to the current approach, funding organisations should give priority to groups that have already made significant conservation gains to ensure that the benefits are not lost. Such groups will have also demonstrated their ability to be in for the long haul. This is not to say that no new groups should be funded, but in many cases, it will be better to encourage people to join a group that already exists than to form a new group.

The number of people keen to become actively involved in conservation is likely to grow, particularly as baby boomers reach retirement age. Targeted support for, and better coordination of, community groups would make this great collective effort more effective and more rewarding for those involved.

Support and coordination can be provided through the creation of regional hubs. These could provide services such as:

- administrative and accounting expertise;
- assistance with funding applications and reporting;
- training and certification in trapping and laying poison, including health and safety;
- advice on plant choices and habitat restoration; and
- sharing of information among groups.

Coordination is also vital – dozens of community groups working in small separated areas dotted across a region will struggle to have an impact at a landscape scale.

Regional organisations that aim to coordinate and support the efforts of community groups in different ways are being formed in some regions.

One example that hits the mark is the Bay Conservation Alliance, which was recently established in the Western Bay of Plenty. Its aim is to provide *"a professional support team tasked with 'taking the load' off volunteers so that they can get on with the practical work"*.[183]

Another example is Wild for Taranaki – a trust with the purpose of coordinating action and raising funds for protecting biodiversity in the region that is financially supported by the regional council. It offers workshops and training to its members, and employs a regional biodiversity coordinator.

I recommend that the Minister of Local Government, the Minister for the Environment, and the Minister of Conservation direct officials to work with councils to establish regional biodiversity hubs to coordinate and support community conservation groups.

Notes

1 Beaglehole, 1962, p.125.

2 Langton, 2000, p.250.

3 McNab, 1994.

4 Note that having fewer eggs may be for a variety of reasons (Franklin and Wilson,2003).

5 Some species of New Zealand birds have particularly strong body odour compared to those from other countries, making them even more vulnerable to detection by predators that hunt by smell. Two of the most pungent birds are the kākāpō, which has been described as smelling 'sweet' or 'musty', and the kiwi, which has a strong ammonia-like smell.

6 Robertson et al., 2013.

7 Holdaway, 1989.

8 Ewers et al., 2006.

9 Atkinson, 2006, p.51.

10 See New Zealand Birds Online entries regarding Little Barrier snipe, Chatham Island fernbird, Imber's petrel, Forbes' snipe, Chatham Island rail, Lyall's wren, and South Island piopio (http://nzbirdsonline.org.nz/).

11 Clarke and Dzieciolowski, 1991.

12 Nugent et al., 2001.

13 3.5 million hectares of native forest (27% of what remained) was cleared during the 1890s. Ministry for the Environment, 1997.

14 Star, 1997.

15 Star, 2002.

16 Potts, 1878, p.6.

17 Taylor, 2007.

18 Nightingale and Dingwall, 2003.

19 Grzelewski, 1999.

20 National parks "shall be preserved as far as possible in their natural state: except where the Authority otherwise determines, the native plants and animals of the parks shall as far as possible be preserved and the introduced plants and animals shall as far as possible be exterminated" (National Parks Act 1952, s3(2)(a)).

21 Miskelly, 2014.

22 Towns and Broome, 2003.

23 Resource Management Act 1991 s6(c). The protection of indigenous fauna is not a matter of national importance, only the protection of their habitat. This is an instance where the law has fallen behind the scientific understanding of the enormous impact of predators on birds and other indigenous fauna.

24 Burns et al., 2012.

25 Elliott and Suggate, 2007.

26 The original claimants were Haana Murray (Ngāti Kurī), Hema Nui a Tawhaki Witana (Te Rarawa), Te Witi McMath (Ngāti Wai), Tama Poata (Ngāti Porou), Kataraina Rimene (Ngāti Kahungunu), and John Hippolite (Ngāti Koata).

27 Waitangi Tribunal, 2011, p.147.

28 Following enactment of the Te Urewera Act in 2014, Te Urewera ceased to be a national park. Other co-governance agreements include Te Waihora Co-Governance Agreement, which recognises Ngāi Tahu's mana whenua over the Te Waihora/Lake Ellesmere catchment.

29 Wilson, 2006.

30 In 2000, the Department of Conservation (DOC) released an Action Plan for Seabird Conservation in New Zealand (Taylor, 2000), the first document to provide a summary of the status, threats, and priority actions required for each seabird taxa in New Zealand. In 2012 the Royal Forest and Bird Society launched a campaign to increase public awareness of New Zealand's seabirds.

31 In the 2015 Budget, $11.2 million was allocated to kiwi conservation (Barry, 2015).

32 Key, 2016.

33 Ozarski, 2015, p.11.

34 New Zealand Cabinet, 2016; DOC, 2016.

35 Barry, 2016.

36 Two other species, the South Island kōkako and the South Island brown teal, are classified as 'data-deficient', and are most likely extinct.

37 Figure 3.1 is taken from Townsend et al. (2008, p.11). The latest application of the New Zealand Threat Classification System to birds – Conservation status of New Zealand birds, 2017 – is the source of the threat rankings in Chapter 3 and in the Appendix.

38 `There are two bird species that have been included in this report because they have been given threat rankings, despite being non-resident natives; that is, they fall outside the dotted line in Figure 3.1. The bar-tailed godwit and the lesser knot are classified as 'migrants' because although they spend time in New Zealand; they do not breed here. 'Vagrants' are species only rarely found in New Zealand – the emperor penguin known as Happy Feet, which came ashore at Peka Peka in 2011, was a much-loved vagrant. 'Colonisers' are birds that have established a breeding population in New Zealand since 1950 without any human assistance – the Australian coot is a coloniser.

39 The threat rankings of all the bird taxa are given in the Appendix. In this chapter, where the threat rankings of the subspecies and/or isolated populations of a species differ, the following process has been followed.

- If the split of the species is based on a mainland/offshore island divide, then the species has been assigned the threat ranking of the mainland taxon. For example, there are three diving petrel taxa – one living on the mainland, and two living on islands. The diving petrel species has been assigned the threat ranking of the mainland taxon; that is, 'in some trouble'.
- If the split of the species is based on a North/South Island divide, then the species has been assigned the lower threat ranking. For example, there are two rifleman taxa – one living in the North Island and 'in some trouble', and the other living in the South Island and 'doing OK'. The rifleman species has been assigned the lower threat ranking; that is, 'doing OK'.
- There are four cases that do not fit into either category – weka, subantarctic snipe, grey duck, and Kermadec petrel – where the threat ranking has been assigned after examining aggregate populations and trends.

40 'Extinct' and 'Not threatened' are clear. But 'At risk' of what? Of slipping into 'Threatened'?

41 Townsend et al., 2008, p.11.

42 The ruru is a bird of prey, but lives mainly in the forest.

43 Agapow et al., 2004, p.162.

44 Darwin, 1859.

45 The biological species concept was proposed by Ernst Mayr. He defined a species as a "group of interbreeding natural populations that are reproductively isolated from other such groups" (Mayr, 2000).

46 'Phylo' is the Greek word for tribe, and 'genesis' is the Greek word for 'origin'.

47 Isaac et al., 2004.

48 Agapow et al. (2004) compared the effect on the number of species of using phylogenetic and non-phylogenetic classifications. "It is startling that taxonomically well-studied groups like mammals, arthropods, and birds showed large and roughly similar increases (87%, 77%, and 88% respectively)" (p.168).

49 This is because the average population and the average range of a species will decrease (Isaac et al., 2004, p.308; Agapow et al., 2004, p.169).

50 A taxonomic system for British birds has been developed by the British Ornithologists' Union (Helbig et al., 2002). It relies more on the biological species concept than on the phylogenetic species concept. In summary: "We believe that taxa should only be assigned species rank if they have diverged to the extent that merging of their gene pools in the future is unlikely." (p.519).

51 Agapow et al., 2004, p.172. See also Mace, 2004.

52 This order is Apterygiformes, from the Greek meaning 'without wings'.

53 The ancestors of birds endemic at the family level arrived in New Zealand between 25 to 70 million years ago. The ancestors of birds endemic at the genus level arrived in New Zealand between 1 to 25 million years ago. The ancestors of birds endemic at the species level arrived in New Zealand between 15 thousand and 1 million years ago (McDowall, 1969; Fleming, 1962).

54 Weitzman, 1993.

55 The estimates of ranges in the 1970s and the 2000s come from two national bird surveys. During the 1970s, hundreds of keen bird watchers spent many hours searching for and recording the presence of native birds across the country. In 1985, the Ornithological Society of New Zealand published its first bird atlas (Bull et al., 1985). Thirty years later, a second national bird survey was undertaken, resulting in the publication of a second bird atlas in 2007 (Robertson et al., 2007).

56 Walker and Monks, 2017, pp.21–22.

57 Robertson et al., 2007, p.262.

58 In New Zealand's threat classification system, the qualifier TO is added to the conservation status of bird species considered threatened overseas, and the qualifier SO is added to the conservation status of bird species considered secure overseas (Townsend et al., 2008).

59 Shepherd et al., 2014.

60 Brown et al., 2015, p.7.

61 Estimates of lethal doses are based on the LD50 method; that is, the amount that has a 50% chance of killing the animal. LD50s are expressed in terms of milligrams of poison per kilograms of body weight. The LD50 of PAPP for stoats is 9.3 mg/kg, and the LD50 for rats ranges from 177 to 697 mg/kg (Eason et al., 2014). The average weight of a stoat is about 250 grams, and the average weight of a ship rat is about 140 grams.

62 Brodifacoum is relatively inhumane and can persist in the environment for a long time. It is the active ingredient in rat poisons like Talon. Rats were eradicated with a brodifacoum drop on Ulva Island, off Rakiura/Stewart Island in 1995, but because rats can swim several hundred metres, a second drop was done in 2011 when numbers had begun to build up again (DOC 2011). More recently, brodifacoum was used to eradicate Norway rats on Campbell Island and mice on the Antipodes Islands – the latter was done through the Million Dollar Mouse project (http://milliondollarmouse.org.nz/). Aerial broadcast of brodifacoum has been very seldom used on the mainland, and only within pest-proof fences (Fisher et al., 2011).

63 Leech et al., 2008; Mudge, 2002; Powlesland et al., 2011.

64 `The cost of operations – helicopters plus bait – is about $20 per hectare. Information supplied by OSPRI and DOC, February 2017.

65 Possum populations do not irrupt during masts since they only bear one or two young each year.

66 The first coordinated programme to counteract masts at multiple sites, dubbed 'Battle for Our Birds', was launched by Dr Nick Smith, the then Minister of Conservation at the end of January 2014.

67 The impact of the 2014 Battle for Our Birds on populations of rats and stoats can be seen in Figures 6 and 7 of Elliott and Kemp (2016). The density of predators was measured before and after the drops using footprint tracking tunnels. One major problem in dealing with masts is the inability to do all aerial drops at the optimal time. The best time to drop 1080 during a mast is when the rat populations have begun to climb, but before the female stoats have gone to earth to prepare for the birth of their young. The optimal time varies from site to site. In 2014, delays due to weather, availability of helicopters, and the granting of permits were as long as four months. At some sites, there was a "disappointing and rapid" bounce back of

rodents within a few months (Elliott and Kemp, 2016, p.206). This issue is discussed in the next section.

68 Figure 8 in Elliott and Kemp (2016). The most vulnerable birds in a mast are species like mohua and rock wren that nest in cavities.

69 Bykill – the death of native birds from eating 1080 – is often raised as a concern, but it was a much bigger issue in the past when carrot baits were sown in high densities. The amount of 1080 sown per hectare has steadily fallen from more than 25 kg per hectare in the 1970s. In 2016, it was down to 2 kg per hectare, and even lower sowing rates are being trialled. Now cereal baits dyed green or blue so that birds cannot see them are used on conservation land. Kea, by virtue of their inquisitive nature, do sometimes peck at 1080 baits, and now a number are radio-tagged so they can be monitored during 1080 operations. With new protocols in place, the net effect of a 1080 drop on a kea population has been shown to be positive. In 2014, 4 out of 49 radio-tagged kea at several sites died from 1080 poisoning. But in 2016, all radio-tagged kea in Kahurangi National Park survived, and the nesting success was far greater where 1080 was dropped than in other areas (27% compared with 2% nesting success). Almost all of the 24 deaths of radio-tagged kea (out of a total of 222 monitored birds) have been in Arthur's Pass and Fox Glacier. These deaths appear to be related to more interactions with people, and thus a greater tendency to try novel foods. Kea in these areas also have higher levels of lead from eating old lead nails and flashings, and this may affect their behaviour (pers. comm., Josh Kemp, Department of Conservation, 2017).

70 At the time of writing, data on chnages in the numbers of birds were still being analysed. There are many factors that influence the growth or decline of bird populations. For instance, the biggest mainland population of the nationally endangered orange-fronted kākāriki is in the Hawdon Valley in Arthur's Pass National Park. Despite predator tracking rates falling in response to 1080 operations, the population has continued to decline (Elliott and Suggate, 2007). One reason may be the presence of the more aggressive yellow-crowned kākāriki. Other reasons may be that this refuge into which the species has been driven is too cold and harsh or that numbers are too low to detect any increase.

71 It is not expected that climate change will lead to more frequent mast events. The temperature differences between successive summers have now been shown to be a major predictive factor of masts (see Kelly et al., 2013).

72 Walker et al., 2017, p.vi. Two national bird surveys have been done in New Zealand – one in the 1970s and one in the early 2000s. The results of many thousands of observations of birds were published in the two bird atlases (Bull et al., 1985; Robertson et al., 2007). Both atlases were published by the Ornithological Society of New Zealand. One of the findings in the analysis of the data by Walker et al. (2017) is that over the 30 years between the two surveys, the deep endemic birds, in particular, retreated to refuges in cold forests.

73 If a 1080 drop kills 98% of the rats in an area, the remaining 2% will begin to breed again. This will occur faster in warmer, more productive forests because the initial population of rats is higher – 2% of 100 rats is 2, 2% of 1,000 rats is 20.

74 This does not, however, mean that the operation has been pointless. Knocking rats down to low levels even for a short time can result in far fewer stoats being born that year and protect birds through the breeding season.

75 Brown et al., 2015, pp.12–13.

76 However, it does not seem feasible that traps could deal with mice that multiply once rats are removed.

77 Griffiths and Barron, 2016.

78 Note, however, the 1080 in any baits dropping into water is diluted rapidly, and then it biodegrades. Following a 1080 drop, water bodies in the vicinity are monitored, including any sources of drinking water. If any residues are found, drinking water supplies must not be used until the concentration of 1080 drops to below 2 parts per billion. Since 1990, over 3,000 samples have been taken, with traces of 1080 found in less than 100. Between 1990 and 2011, only 6 samples have been found with concentrations above the Ministry of Health trigger level of 2 parts per billion, and none of these were from a public drinking water supply. Since 2011, no samples have been found to contain 1080 above the trigger level. (Data sourced from Landcare Research for the September 1990 to February 2011 period, and EPA Annual Reports for the period ending December 2015.)

79 Aerial 1080 is generally less effective at killing mice than rats. Kill rates for mice are about 25% compared with 95% for rats (Broome et al., 2009, pp.55, 64).

80 Parkes et al., 2017, p.157.

81 See King and Murphy, 2005, p.278, and Table 54, pp.268–269.

82 McLennan, 2013, pp.51–54.

83 Work with kōkako found that the species could survive when tracking rates of ship rat were reduced to less than 5%. This level has been adopted by conservation managers as a 'rule of thumb' for New Zealand passerines.

84 Staff at Cape Sanctuary have been working on a modified tracking tunnel index, where the tunnels are monitored for a full 7 days – rather than the standard single night. Saddleback appear to be able to survive if tracking rates of Norway rats over the 7 nights are only 1–2% (pers. comm., John McLennan, 7 April 2017).

85 This figure has been adapted from the figure titled 'What do Cape-to-City birds need?' in Innes and Fitzgerald (2016, p.15).

86 Cuthbert and Hilton, 2004. See also Dilley et al. (2015), and Dilley et al. (2016). Mice have been shown to eat eggs and chicks of other seabirds that breed in winter on islands – the time of year when mouse populations typically collapse due to lack of food.

87 Information from the Million Dollar Mouse website (http://milliondollarmouse.org.nz/).

88 Innes et al., 2014.

89 Sanders and Maloney, 2002.

90 Clapperton and Byrom, 2005, p.297.

91 Brockie, 1975.

92 Jones, 2014, para.5. "Hedgehogs don't possess the sharp 'killing' teeth of other predators like cats and stoats, so, when attacking a chick or adult bird, they tend to bite and gnaw away until the bird is exhausted, causing it a long and painful death."

93 Sanders and Maloney, 2002.

94 Farnworth, 2013, p.33. One study found that putting collars with bells on cats halved the number of birds caught (Gordon et al., 2010). A fence that confines

cats to property boundaries (the Oscillot® System) is now available in New Zealand. Some cat breeders now recommend keeping cats indoors to extend their lifespan – a practice common in many countries to prevent cats being hit by cars or contracting disease.

95 The percentage of domestic cats microchipped increased from 12% in 2011 to 31% in 2015 (New Zealand Companion Animal Council, 2016, p.10). Microchipping is done by a vet or other trained professional. Costs vary, though some initiatives offer the service for free. It then costs $15 to register the microchip with the New Zealand Companion Animal Register.

96 National Cat Management Strategy Group, 2016, p.7.

97 Harper, 2004, p.19.

98 Herekopare Island. The extermination of these bird species occurred over a period of 45 years when cats were the only mammals on the island (Gillies and Fitzgerald, 2005, pp.323–324).

99 In a study of ground-nesting birds in the Upper Waitaki Basin, cats were responsible for nearly half of the 'lethal events' that reduced the populations of banded dotterels, black-fronted terns, and black stilts (Sanders and Maloney, 2002).

100 These are Northland, Auckland, Bay of Plenty, and Southland. Some others do invest in suppression at some sites. Marlborough, Otago, and the West Coast do not recognise feral cats as pests at all.

101 Guthrie, 2016.

102 The virus released (illegally) in 1997 to control rabbits is the 'rabbit haemorrhagic disease virus' (RHDV). It is commonly known as calicivirus. Approval for the release of a more virulent strain of calicivirus called K5 is currently being sought by Landcare Research and others.

103 After the calicivirus was released in 1997, DOC implemented an intensive predator control programme in the upper Waitaki Basin. In a three-month period, 1,067 hedgehogs, 328 ferrets, 196 cats, 96 rats, and 69 stoats were killed (Keedwell and Brown, 2001). See also Murphy et al. (2004).

104 Taborsky, 1988.

105 Dogs known to have killed kiwi in Northland include farm dogs, hunting dogs, and family pets including Rottweilers, Labradors, fox terriers, and a poodle (Pierce and Sporle, 1997). "In Northland, it has been shown that the average lifespan of an adult brown kiwi is only 13–14 years rather than the 30–40 years in all other brown kiwi populations due mainly to predation by dogs." (Germano et al., 2016, p.12).

106 'Kiwis for kiwi' website (https://www.kiwisforkiwi.org/).

107 Dog Control Act 1996, s 59.

108 In the 2014–15 fishing year, there were nearly 5,000 seabirds killed in the commercial trawl and longline fisheries. The black petrel is the species with the highest risk ratio from commercial fisheries (Ministry for Primary Industries, 2016a, pp.252, 268).

109 Pers. comm., Graeme Elliott, 29 April 2017.

110 See Ministry for Primary Industries (2016b) and Agreement on the Conservation of Albatrosses and Petrels. Amended by the Fifth Session of the Meeting of the Parties Santa Cruz de Tenerife, Spain, 4–8 May 2015.

111 Information from Ministry for Primary Industries, 2 May 2017.

112 See details of the Deepwater Fleet Vessel Management Plans and the actions taken by the Black Petrel Working Group on the Southern Seabird Solutions website (http://www.southernseabirds.org/).

113 New Zealand Cabinet Committee Paper "Improving fisheries management through an Integrated Electronic Monitoring and Reporting System (IEMRS) and Enabling Innovative Trawl Technologies (EITT)" (24 April 2017).

114 New Zealand Cabinet, 2016.

115 These are three of the areas of research being funded through the Biological Heritage National Science Challenge.

116 Information for this section has been supplied by Dr Brian Hopkins, Landcare Research, 15 March 2017.

117 Norbomide kills rats within three hours, more quickly than 1080, which takes a day, and far more quickly than brodifacoum, which takes up to a week.

118 Gemmell et al., 2013.

119 Patel et al., 2016.

120 Gemmell et al., 2013.

121 Patel et al., 2016, p.15.

122 Burt, 2003.

123 The term CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats. The feasibility of using a gene drive to skew sex ratios in naturally breeding populations of mice is being explored. It is predicted that fewer than 10% of the immediate offspring will be female (Piaggio et al. 2017, p.101).

124 Oye et al., 2014.

125 Esvelt et al., 2014, p.16..

126 Innes and Fitzgerald, 2016, p.14.

127 Honeydew is a sugary substance produced by small native insects that live in the bark of beech trees. During certain times of the year, introduced wasps can eat up to 90% of the honeydew in a forest (Beggs, 2001). Wasps have also been observed to prey on recently hatched birds.

128 Until recently, the only way of killing wasps was to poison individual nests. Now a protein-based wasp bait containing the insecticide fipronil – Vespex™ – is available that enables many nests to be poisoned from one bait station. Wasps gather the bait up and take it back to their nests. In December 2016 the community-led Wasp Wipeout project was launched in the Nelson-Tasman region. The project has used crowd-funding to support the placement of Vespex bait-stations, with the goal of creating a wasp-free corridor around conservation and urban areas in the region.

129 Nugent et al., 1997; Ewans, 2010.

130 McIlroy, 1995, p.340; Thompson and Challies, 1988, p.75.

131 National Possum Control Agencies, 2008, p.10.

132 Norbury, 1996, p.18.

133 On Stewart Island, dotterels nest high inland, but they feed and breed in the open sandy and stony areas of the dunes. DOC has been controlling marram grass on Stewart Island for more than 20 years (DOC, 2006).

134 The pied oystercatcher is in some trouble, and the non-endemic pied stilt, which also nests in this area, is doing OK.

135 Walker and Monks, 2017, pp.40, 45.

136 O'Donnell et al. (2016) provides a discussion of the pressures facing birds in braided rivers, and includes a good description of the impacts of weeds on river habitats and best practice for managing weeds.

137 LINZ spends about $2 million annually on controlling weeds and pest animals, but about half of this usually goes towards controlling lake weeds.

138 DOC, 2016, p.7; New Zealand Cabinet, 2016, p.7.

139 Taranaki Regional Council, 2017. Taranaki Regional Council does envisage riparian plantings as habitats for wildlife and corridors for bird and fish migration (Taranaki Regional Council, 2010).

140 There are other covenants that can be established to protect native ecosystems. For instance, the Nature Heritage Fund has established 395 covenants in perpetuity since 1990 (Molloy, 2016).

141 Currently, the QEII Trust receives 150–210 expressions of interest from landowners each year, but is only able to enter into 110 new covenants. The Trust generally pays for the surveying of a new covenanted area and half of the cost of fencing it.

142 The QEII Trust does monitor the condition of covenanted areas, and often gives advice about predator and weed control.

143 The Stephenson Fund is a contestable fund open to all registered QEII covenantors to apply to for assistance.

144 Goal Three of the New Zealand Biodiversity Strategy: "Maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain their genetic diversity" (Department of Conservation, 2000).

145 Thus the concept of natural range is somewhat elusive. At what point in time is the natural range of a species 'right'? Just before humans arrived, or when Europeans began to settle in New Zealand, or now?

146 McGlone and Walker, 2011, p.57.

147 See, for instance, Simpson, 2009.

148 MacGibbon, 2009, p.83.

149 Auckland Council, 2013.

150 68% of the population are siblings (Taylor et al., 2017, p.807).

151 For a comprehensive description of the four forces of evolution, see Russell (2002).

152 Burkhardt and Secord, 2010, p.xxiii.

153 The opposite of inbreeding – outbreeding – can also be a problem. Birds that are genetically too distant from each other will also produce less fit offspring. For instance, the very endangered endemic black stilt sometimes mates with the much more numerous pied stilt on riverbeds in South Canterbury. The hybrid offspring have low fertility and relatively short lives.

154 These are distinctions that show up in the gene pool. Some distinctions between two populations of the same species may not be genetically based but due to environmental differences such as diet.

155 Some of New Zealand's endemic forest birds produce relatively few offspring. For instance, kiwi lay one or two eggs a year, and kererū lay two or three eggs a year (Heather and Robertson, 2005, pp.168–170, 349).

156 Jamieson et al., 2006, p.40.

157 Provenance means place of origin. The provenance of a work of art or an antique – the record of its ownership – is used when deciding whether it is authentic or not. The word is used in conservation science to denote local genetic variation – or the assumption of local genetic variation.

158 Pers. comm., Dr Melanie Massaro, 24 March 2017. The entry for black robin in New Zealand Birds Online states that "Inbreeding depression is expressed through lowered reproductive output. Long-term persistence of populations is uncertain."

159 Forsdick et al., 2016.

160 In 1912, five little spotted kiwi were moved to Kapiti Island. The remaining little spotted kiwi on the mainland then disappeared. As a result of successful breeding on Kapiti Island, 10 further populations were established – on seven islands (Tiritiri Matangi, Motuihe, Red Mercury, Hen, Long, Chalky, and Anchor), and in three mainland sanctuaries (Zealandia in Wellington, Cape Sanctuary in Hawkes Bay, and Shakespea on the Whangaparāoa Peninsula).

161 Taylor et al., 2017, p.810.

162 Pers. comm., Dr Jen Germano, Kiwi Recovery Group Leader, April 2017.

163 Some kākāpō are on Anchor Island in Dusky Sound, some are on Whenua Hou (Codfish Island) off the west coast of Stewart Island, and some are on Little Barrier Island in the Hauraki Gulf.

164 White et al., 2015.

165 O'Connor, 2016. Since 2002, there have been outbreaks of infection, causing cloactitis ('crusty bum') among the kākāpō. There are questions over whether these outbreaks have a genetic basis (Gartrell et al., 2005; White et al., 2015).

166 Kākāpō recovery webpage (http://kakaporecovery.org.nz/). See also Robertson (2006) and White (2012).

167 See, for example, Thomas et al. (2013).

168 Bowker-Wright et al., 2012, p.184.

169 For example, see Innes et al. (2013).

170 For example, the Shore Plover Recovery Plan notes "Consideration should be given to obtaining eggs for the captive-breeding programme from the Western Reef population to increase the genetic diversity among captive stock and within

reintroduced populations" (DOC, 2001, p.11). In comparison, the Draft Kiwi Recovery Plan notes that management actions should keep isolated populations separate because this will maintain genetic variation within kiwi species (Germano et al., 2016, p.16).

171 It is only last year that new research suggested that the North Island brown kiwi had been isolated into four populations by the end of the last ice age, about 20,000 years ago (Weir et al., 2016). But 20,000 years is a short period of evolutionary time.

172 Allendorf et al., 2016. The two reasons given for this opinion appear somewhat contradictory. The first is a concern that the birds are descended from only 13 founders, so may lack genetic diversity and be inbred. The second is that the birds are of 'mixed provenance'. The 13 founders came from Northland and Taranaki – which would increase their genetic diversity. There are already some North Island brown kiwi of mixed provenance on the mainland (Pers. comm., Dr Isobel Castro, April 2017).

173 Kiwis for kiwi has estimated that this will cost $947,500.

174 The Department of Conservation requires a more thorough application if kiwi hatched from eggs are to be moved more than 50 kilometres from the source of the eggs. Maungatautari is 60 kilometres from the closest potential source of eggs (Department of Conservation, 2010, p.7). Another restriction on translocations of North Island brown kiwi is that the Northland population of brown kiwi has been divided into four subpopulations, which are to be kept separate.

175 Sainsbury et al., 2006.

176 Website of the Zealandia Eco-Sanctuary (http://www.visitzealandia.com)

177 Dussex et al., 2015.

178 DOC permit for kākā translocations to Abel Tasman National Park, September 2016 (Ogle, 2016). The key conditions in the permit include the following (paraphrased):

- The contribution of northern South Island kākā should be maximised in all releases into the park.
- Attempts to establish a captive population of northern South Island birds should continue.
- Up to eight additional captive-raised females of South Island provenance may be released into the park.

If no more than three female chicks have been obtained for the captive breeding programme by the end of the 2018/19 summer, then the restrictions on breeding and releasing kākā from sites outside the northern South Island will be relaxed.

179 Note that the draft Kiwi Recovery Plan refers to "sound genetic principles", but it does not say what these principles are (Germano et al., 2016).

180 In a 2015 paper, Richard Frankham provides a set of guidelines for managing genetic rescues (Frankham, 2015).

181 United Nations General Assembly, 1992, Principle 15.

182 Holzapfel et al., 2008, p.35.

183 Application from Bay Conservation Alliance to Western Bay of Plenty District Council Community Committee for financial support, 1 March 2017.

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Appendix

This appendix supplements the information on the conservation status of New Zealand's native birds presented in Chapter 3. It contains the (high level) threat rankings of all native bird species, subspecies, and isolated populations taken from the Conservation Status of New Zealand Birds, 2016. .

The three high-level threat rankings are presented here using the more accessible terminology used in Chapter 3 – 'Doing OK', 'In some trouble', and 'In serious trouble'.

Where a species has been divided into a number of subspecies and/or isolated populations, the threat ranking of each is represented by an X. Thus, one subspecies of the rifleman is doing OK, but the other is in some trouble.

Green rows denote bird species that are endemic; that is, found in no other country. (Migratory birds are classed as endemic if they breed in New Zealand.)

The bold crosses indicate the threat ranking assigned to the sepcies as a whole (based on the process identified in note 39).

Forest birds

Perching birds

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Tītipounamu / Rifleman	*Acanthisitta chloris*	**X**	X	
Tuke / Rock wren	*Xenicus gilviventris*			**XX**
North Island kōkako	*Callaeas wilsoni*		**X**	
South Island tīeke / Saddleback	*Philesturnus carunculatus*		**X**	
North Island tīeke / Saddleback	*Philesturnus rufusater*		**X**	
Pōpokatea / Whitehead	*Mohoua albicilla*		**X**	
Mohua / Yellowhead	*Mohoua ochrocephala*		**X**	
Pīpipi / Brown creeper	*Mohoua novaeseelandiae*	**X**		
Hihi / Stitchbird	*Notiomystis cincta*			**X**
Korimako / Bellbird	*Anthornis melanura*	**X**	XX	
Tūī	*Prosthemadera novaeseelandiae*	**X**		X
Pīhoihoi / New Zealand pipit	*Anthus novaeseelandiae*		**XXX**	X
Mātātā / Fernbird	*Bowdleria punctata*		**XXXX**	X
Chatham Island warbler	*Gerygone albofrontata*		**X**	
Riroriro / Grey warbler	*Gerygone igata*	**X**		

Kakaruai / South Island robin	*Petroica australis*		**XX**	
Toutouwai / North Island robin	*Petroica longipes*		**X**	
Miromiro / Tomtit	*Petroica macrocephala*	**XX**	XX	X
Kakaruai / Black robin	*Petroica traversi*			**X**
Pīwakawaka / New Zealand fantail	*Rhipidura fuliginosa*	**XX**	X	
Warou / Welcome swallow	*Hirundo neoxena*	**X**		
Tauhou / Silvereye	*Zosterops lateralis*	**X**		

Parrots

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Kākāpō	*Strigops habroptilus*			**X**
Kea	*Nestor notabilis*			**X**
Kākā	*Nestor meridionalis*		**X**	X
Red-crowned kākāriki	*Cyanoramphus novaezelandiae*		**XXX**	
Orange-fronted kākāriki	*Cyanoramphus malherbi*			**X**
Yellow-crowned kākāriki	*Cyanoramphus auriceps*	**X**		
Forbe's kākāriki	*Cyanoramphus forbesi*			**X**
Reischek's kākāriki	*Cyanoramphus hochstetteri*		**X**	
Antipodes Island kākāriki	*Cyanoramphus unicolor*		**X**	

Kiwi

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Kiwi / North Island brown kiwi	*Apteryx mantelli*		**X**	
Kiwi pukupuku / Little spotted kiwi	*Apteryx owenii*		**X**	
Roa / Great spotted kiwi	*Apteryx haastii*			**X**
Rowi / Ōkārito brown kiwi	*Apteryx rowi*			**X**
Tokoeka / Southern brown kiwi	*Apteryx australis*			**XXXX**

Pigeons

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Parea / Chatham Island pigeon	*Hemiphaga chathamensis*			**X**
Kererū / New Zealand pigeon	*Hemiphaga novaeseelandiae*	**X**		

Cuckoos

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Koekoeā / Long-tailed cuckoo	*Eudynamys taitensis*		**X**	
Pīpīwharauroa / Shining cuckoo	*Chrysococcyx lucidus*	**X**		

Ducks

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Whio / Blue duck	*Hymenolaimus malacorhynchos*			**X**

Field, river, and coast birds

Birds of prey

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Kārearea / New Zealand falcon	*Falco novaeseelandiae*		**XX**	X
Ruru / Morepork	*Ninox novaeseelandiae*	**X**		
Kāhu / Swamp harrier	*Circus approximans*	**X**		

Rails

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Takahē	*Porphyrio hochstetteri*			**X**
Pūkeko	*Porphyrio melanotus*	**X**		
Weka	*Gallirallus australis*	X	**XX**	X
Mioweka / Banded rail	*Gallirallus philippensis*		**X**	
Auckland Island rail	*Lewinia muelleri*		**X**	
Koitareke / Marsh crake	*Porzana pusilla*		**X**	
Pūweto / Spotless crake	*Porzana tabuensis*		**X**	
Australian coot	*Fulica atra*		**X**	

Ducks and swans

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Pāteke / Brown teal	*Anas chlorotis*		X	
Auckland Island teal	*Anas aucklandica*			X
Campbell Island teal	*Anas nesiotis*			X
Tētē moroiti / Grey teal	*Anas gracilis*	X		
Kuruwhengi / Australasian shoveler	*Anas rhynchotis*	X		
Pārera / Grey duck	*Anas superciliosa*			X
Pāpango / Scaup	*Aythya novaeseelandiae*	X		
Pūtangitangi / Paradise shelduck	*Tadorna variegata*	X		
Kakīānau / Black swan	*Cygnus atratus*	X		

Grebes

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Weweia / Dabchick	*Poliocephalus rufopectus*		X	
Pūteketeke / Southern crested grebe	*Podiceps cristatus*			X

Herons, bitterns, and spoonbills

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Matuku moana / White-faced heron	*Egretta novaehollandiae*	X		
Matuku moana / Reef heron	*Egretta sacra*			X
Matuku hūrepo / Australasian bittern	*Botaurus poiciloptilus*			X
Kōtuku / White heron	*Ardea modesta*			X
Kōtuku ngutupapa / Royal spoonbill	*Platalea regia*		X	

Kingfishers

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Kōtare / Sacred kingfisher	*Todiramphus sanctus*	X		

Shags

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Campbell Island shag	*Leucocarbo campbelli*		X	
Kawau / King shag	*Leucocarbo carunculatus*			X
Kawau / Otago shag	*Leucocarbo chalconotus*		X	
Auckland Island shag	*Leucocarbo colensoi*			X
Chatham Island shag	*Leucocarbo onslowi*			X
Bounty Island shag	*Leucocarbo ranfurlyi*		X	
Kawau / Foveaux shag	*Leucocarbo stewarti*			X
Pitt Island shag	*Stictocarbo featherstoni*			X
Kawau tikitiki / Spotted shag	*Stictocarbo punctatus*	X	X	
Kawau / Black Shag	*Phalacrocorax carbo*		X	
Kawaupaka / Little shag	*Phalacrocorax melanoleucos*	X		
Kawau tūī / Little black shag	*Phalacrocorax sulcirostris*		X	
Kāruhiruhi / Pied shag	*Phalacrocorax varius*		X	

Waders

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Ngutu parore / Wrybill	*Anarhynchus frontalis*			X
Tōrea tai / Chatham Island oystercatcher	*Haematopus chathamensis*			X
Tōrea / South Island pied oystercatcher	*Haematopus finschi*		X	
Tōrea pango / Variable oystercatcher	*Haematopus unicolor*		X	
Tūturiwhatu / Banded dotterel	*Charadrius bicinctus*		X	X
Tūturiwhatu / New Zealand dotterel	*Charadrius obscurus*		X	X
Black-fronted dotterel	*Elseyornis melanopes*		X	
Subantarctic snipe	*Coenocorypha aucklandica*		X	XX
Tutukiwi / Snares Island snipe	*Coenocorypha huegeli*		X	
Tutukiwi / Chatham Island snipe	*Coenocorypha pusilla*			X
Kakī / Black stilt	*Himantopus novaezelandiae*			X
Poaka / Pied stilt	*Himantopus himantopus*	X		

Tūturuatu / New Zealand shore plover	*Thinornis novaeseelandiae*			X
Spur-winged plover	*Vanellus miles*	X		
Huahou / Lesser knot	*Calidris canutus*			X
Kuaka / Bar-tailed godwit	*Limosa lapponica*		X	

Gulls and skuas

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Tarāpuka / Black-billed gull	*Larus bulleri*			X
Tarāpunga / Red-billed gull	*Larus novaehollandiae*		X	
Karoro / Southern black-backed gull	*Larus dominicanus*	X		
Hākoakoa / Brown skua	*Catharacta antarctica*		X	

Terns

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Tarapirohe / Black-fronted tern	*Chlidonias albostriatus*			X
Tara-iti / Fairy tern	*Sternula nereis*			X
Antarctic tern	*Sterna vittata*		X	
Tara / White-fronted tern	*Sterna striata*		X	X
Sooty tern	*Onychoprion fuscata*		X	
Taranui / Caspian tern	*Hydroprogne caspia*			X
Pacific white tern	*Gygis alba*			X
Grey ternlet	*Procelsterna cerulea*		X	
White-capped noddy	*Anous minutus*		X	

Seabirds

Albatross and mollymawks

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Toroa / Antipodean wandering albatross	*Diomedea antipodensis*			XX
Toroa / Southern royal albatross	*Diomedea epomophora*		X	
Toroa / Northern royal albatross	*Diomedea sanfordi*		X	
Toroa pango / Light-mantled sooty albatross	*Phoebetria palpebrata*		X	

Toroa / Southern Buller's mollymawk	*Thalassarche bulleri*		XX	
Toroa / Chatham Island mollymawk	*Thalassarche eremita*		X	
Toroa / Campbell Island mollymawk	*Thalassarche impavida*			X
Toroa / Salvin's mollymawk	*Thalassarche salvini*			X
Toroa / White-capped mollymawk	*Thalassarche cauta*		X	
Grey-headed mollymawk	*Thalassarche chrysostoma*			X

Petrels and shearwaters

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Kaikōura tītī / Hutton's shearwater	*Puffinus huttoni*			X
Pakahā / Fluttering shearwater	*Puffinus gavia*		X	
Rako / Buller's shearwater	*Puffinus bulleri*		X	
Wedge-tailed shearwater	*Puffinus pacificus*		X	
Tītī / Sooty shearwater	*Puffinus griseus*		X	
Subantarctic little shearwater	*Puffinus elegans*		X	
Toanui / Flesh-footed shearwater	*Puffinus carneipes*			X
Little shearwater	*Puffinus assimilis*		XX	
Pycroft's petrel	*Pterodroma pycrofti*		X	
Tāiko / Chatham Island tāiko	*Pterodroma magentae*			X
Kōrure / Mottled petrel	*Pterodroma inexpectata*		X	
Tītī / Cook's petrel	*Pterodroma cookii*		X	
Chatham Island petrel	*Pterodroma axillaris*			X
Black-winged petrel	*Pterodroma nigripennis*	X		
Kermadec petrel	*Pterodroma neglecta*		X	X
Soft-plumaged petrel	*Pterodroma mollis*		X	
Tītī / Grey-faced petrel	*Pterodroma macroptera*	X		
White-headed petrel	*Pterodroma lessonii*	X		
White-naped petrel	*Pterodroma cervicalis*		X	
Tāiko / Westland petrel	*Procellaria westlandica*		X	

Tāiko / Black petrel	*Procellaria parkinsoni*			X
Kuia / Grey petrel	*Procellaria cinerea*		X	
White-chinned petrel	*Procellaria aequinoctialis*	X		
South Georgian diving petrel	*Pelecanoides georgicus*			X
Kuaka / Diving petrel	*Pelecanoides urinatrix*	X	XX	
Pāngurunguru / Northern giant petrel	*Macronectes halli*		X	
Snare's Cape petrel	*Daption capense*		X	

Storm petrels and prions

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Kermadec white-faced storm petrel	*Pelagodroma albiclunis*			X
Takahikare-moana / New Zealand white-faced storm petrel	*Pelagodroma marina*		X	
New Zealand storm petrel	*Fregetta maoriana*			X
White-bellied storm petrel	*Fregetta grallaria*			X
Black-bellied storm petrel	*Fregetta tropica*	X		
Grey-backed storm petrel	*Garrodia nereis*		X	
Fulmar prion	*Pachyptila crassirostris*		XXX	
Tōtōrore / Antarctic prion	*Pachyptila desolata*		X	
Tītī wainui / Fairy prion	*Pachyptila turtur*		X	
Pararā / Broad-billed prion	*Pachyptila vittata*		X	

Gannets and boobies

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Tākapu / Australasian gannet	*Morus serrator*	X		
Masked booby	*Sula dactylatra*			X

Penguins

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Hoiho / Yellow-eyed penguin	*Megadyptes antipodes*			X

Tawaki / Fiordland crested penguin	*Eudyptes pachyrhynchus*			X
Snares crested penguin	*Eudyptes robustus*		X	
Erect-crested penguin	*Eudyptes sclateri*		X	
Eastern rockhopper penguin	*Eudyptes filholi*			X
Australian little penguin	*Eudyptula novaehollandiae*		X	
Kororā / Little penguin	*Eudyptula minor*		XXXX	

Tropicbirds

Common name	Latin name	Doing OK	In some trouble	In serious trouble
Amokura / Red-tailed tropicbird	*Phaethon rubricauda*		X	

This is the exhibit marked "NRS-2" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Miriam Sophie Bookman
Solicitor
WELLINGTON

Solicitor of the High Court of New Zealand

"NRS-2"

PREDATOR FREE 2050

Predator Free 2050 is an ambitious programme to rid New Zealand of three of the most damaging introduced predators threatening our natural taonga, our economy and primary sector.

Ridding New Zealand of possums, rats and stoats by 2050 is a New Zealand-wide goal requiring new technologies and a coordinated team effort across communities, iwi, and the public and private sectors.

The Predator Free 2050 programme will deliver huge benefits across New Zealand – for the social and cultural links with our environment, for our regional economies through primary industries and tourism, and for our threatened native species.

Building from a strong base

New Zealand is a world leader in conservation technology and research. We have already made progress once unthinkable because of:

- Tens of thousands of committed community volunteers and private landowners already working on habitat protection
- Philanthropic and community-led initiatives, including fenced sanctuaries, large-scale predator control projects such as Cape to City in the Hawkes Bay and Project Janszoon in Abel Tasman National Park, and predators being targeted across whole suburbs
- Significant investment in predator management by councils and OSPRI
- New predator-control techniques, such as self-resetting traps and predator-specific toxins
- Continual refinement of techniques to make them safer and more cost-effective, such as GPS-guided aerial application of 1080.

We have cleared all predators from more than 100 islands and many fenced sanctuaries, and trials are under way to secure other mainland sites without using fences.

New Zealand dotterel/tūturiwhatu.
Photo: Herb Christophers

Department of Conservation
Te Papa Atawhai

A goal that can be achieved

Predator Free 2050 builds on the efforts already under way across communities, iwi, private businesses, philanthropists, scientists and government.

Although we do not currently have the technology to achieve a predator-free New Zealand, one focus of the Predator Free 2050 programme is to develop a breakthrough eradication technology.

The Government is showing its commitment with an extra $7 million a year. This is on top of more than $70 million already spent each year on predator control by DOC, councils and OSPRI. Contributions from businesses, iwi, communities, and philanthropists are additional to this.

New funding will go towards:

- Large-scale collaborative predator-control projects
- Breakthrough scientific research into control and eradication
- Increased support for community-led projects
- Improving the current control tools and technology

Existing predator-control activities are essential to sustain our threatened species now, and are teaching us lessons for securing their future.

The Government set four interim 2025 goals for the programme:

1. Suppress target predators on a further 1 million hectares
2. Eradicate predators from blocks of at least 20,000 hectares without the use of fences
3. Eradicate all predators from offshore island nature reserves
4. Achieve a breakthrough science solution capable of eradicating at least one small mammal predator

Ship rat eating native snail.
Photo: Ngā Manu Images

Introduced predators: *the bad guys*

Possums, rats and **stoats** kill millions of native birds every year and have pushed many species to the brink of extinction. Managing just these three predators for agriculture and conservation costs more than $70 million per year.

Predator Free 2050 will:

- Remove the major threats to our native wildlife
- Enhance economic returns from agriculture and forestry and reduce the risk of disease
- Create new opportunities for regional development
- Reinforce New Zealand's trade and tourism brand
- Provide a legacy for future generations.

How to get involved

There are many opportunities for you to get involved at an individual or community level. Check out:

- **doc.govt.nz/predator-free-2050**

To offer financial support, email:

- **predatorfree2050@doc.govt.nz**

Silvereye/tauhou.
Photo: JJ Harrison (CC BY-SA 2.0)

This is the exhibit marked "**NRS-3**" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Miriam Sophie Bookman
Solicitor
WELLINGTON

Solicitor of the High Court of New Zealand

1080 and the battle against Bovine TB

Bovine tuberculosis (TB) is a serious, highly infectious disease found in cattle and deer herds, causing weight loss and death.

Bovine TB

Possums are the main source and carrier of bovine TB in New Zealand, and the main self-sustaining reservoir of the disease in the wild. In the early 1970s, it was discovered that possums were the source of chronic infection in cattle herds. Bovine tuberculosis infection transfers relatively easily from possums to cattle and deer due to the proximity of farmland to bush areas in New Zealand. Possums and ferrets are responsible for over 70% of new infection in cattle and deer herds, with infected possums known to live in around 40% of New Zealand [1].

A major threat to our economy

Dairy and meat exports are worth more than $14 billion *annually* to New Zealand [2]. Rising international animal health standards and growing concern about food safety are now major factors governing and threatening access to premium overseas markets.

As at May 2014, New Zealand had 71 cattle and deer herds infected with bovine tuberculosis. This equates to around 0.10%. Many of our trading competitors, including Australia, are classed as being free of the disease [3].

As a nation with bovine TB infection, New Zealand is banned from exporting live cattle and deer to TB-free countries, including North America and Australia.

With pus on its fur, this is how TB could spread to a herd. Photo: Graham Nugent

If TBfree's bovine TB eradication programme were to stop, the potential cost to New Zealand as a country has been estimated at $5 billion over 10 years [4].

Possum with bovine TB infective lymph nodes

You may also be interested in:

- The story of bovine TB's spread in New Zealand (http://www.landcareresearch.co.nz/kino/kararehe-kino-23/dispersal-of-a-non-motile-species)
- How do forest buffers help control the spread of bovine TB (http://www.landcareresearch.co.nz/kino/kararehe-kino-23/buffers)

How are possums counted?

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The WaxTag method
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Possum monitoring techniques
Download File
(/uploads/2/9/5/8/29588301/possum_monitoring_1

Farmers benefiting from pest control

Through a nationally coordinated programme comprising ground and aerial control methods and advances in TB-testing for cattle and deer, and stock movement control, TBfree, the agency charged with eradicating bovine TB from New Zealand, formerly the Animal Health Board (AHB), has in the past decade reduced the number of TB-infected herds by more than 90%. Aerial 1080 operations account for only 8% of TBfree's control programme, which also uses traps and a range of pest control toxins.

Click here to read about farmer's experiences with bovine TB infected herds (/uploads/2/9/5/8/29588301/making_tb_history_-_e-book.pdf)

[1] TBfree New Zealand (2014). Bovine TB facts. Retrieved from www.tbfree.org.nz.
[2] TBfree New Zealand (2014). The economic cost of TB. Retrieved from www.tbfree.org.nz.
[3] Department of Agriculture, Fisheries and Forestry, Australian Government (2012). Australia's Freedom from Bovine Tuberculosis. Retrieved from www.daff.govt.au.

SUPPORTING ORGANISATIONS

(/uploads/2/9/5/8/29588301/[illegible]/29588301/8937396

Forest & Bird GIVING NATURE A VOICE | FEDERATED FARMERS OF NEW ZEALAND | Department of Conservation Te Papa Atawhai | OSPRI | Friends of Flora Est. 2001

(/uploads/2/9/5/8/29588301/[illegible]/29588301/2985377

The Isaac Conservation and Wildlife Trust | MOHUA MOHUA CHARITABLE TRUST | National Pest Control Agencies | DairyNZ | environment SOUTHLAND Te Taiao Tonga

(/uploads/2/9/5/8/29588301/4[illegible]301/2536745_orig.jpg)

beef+lamb new zealand | PestNET

This website is operated by the Pest Control Education Trust (//facebook[illegible])

About the Trust (/about-the-trust.html) | Contact the Trust (/contact-us.html)

Donate

"NRS-4"

Eradicating bovine tuberculosis from cattle, deer and wildlife in New Zealand

Search

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Bovine TB facts

Bovine TB - What you need to know

1. Bovine TB is an infectious disease caused by the bacterium Mycobacterium bovis. It can affect a wide range of animals. In New Zealand, cattle and deer are the species most at risk of contracting the disease.
2. Possums and ferrets are the main vectors (carriers) of bovine TB in New Zealand. About half of new herd infections in TB risk areas can be traced back to infected possums or ferrets.
3. Bovine TB is a disease that affects all New Zealanders. Eradicating TB is vital to maintaining the production and reputation of the country's valuable dairy, beef and deer exports.
4. TBfree is a nationwide programme of livestock testing and pest control that exists to eliminate the disease. To do this, we aim to eradicate the disease from livestock by 2026, from possums by 2040 and from New Zealand by 2055.
5. OSPRI runs a nationwide testing programme alongside a National Identification and Tracing programme (NAIT). Around four million TB tests are carried out on cattle and deer every year, and infected animals are slaughtered.
6. To control the spread of the disease among infected herds and herds in high TB risk areas, all herds must be registered and stock tagged correctly.
7. To stop possums and ferrets, responsible for carrying TB and spreading the disease to cattle and deer, we survey and control wild animals across large areas of private and public land.
8. The combination of wildlife control, livestock movement restrictions and effective disease management has led to a drop in infected herd numbers from 1700 in the mid-1990s to 43 in 2016.

This is the exhibit marked "NRS-4" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Solicitor of the High Court of New Zealand

Miriam Sophie Bookman
Solicitor
WELLINGTON

9. Infected possums are known to live in about 40 per cent of New Zealand. OSPRI's TBfree programme invests in research to continually improve how the disease is diagnosed and the methods used to control pests.
10. Everyone can help make New Zealand TB-free. Supporting our world-class programme of disease management, movement control, pest control and research by registering all livestock with NAIT can make TB history.

0
Like

"NRS-5"

This is the exhibit marked "**NRS-5**" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Miriam Sophie Bookman
Solicitor
WELLINGTON

Solicitor of the High Court of New Zealand

Evaluating the use of 1080:

Predators, poisons and silent forests

June 2011

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

Acknowledgements

The Parliamentary Commissioner for the Environment would like to express her gratitude to those who assisted with the research and preparation of this report, with special thanks to her staff who worked so tirelessly to bring it to completion.

Photography

Cover: West Coast, South Island, New Zealand.
Parliamentary Commissioner for the Environment archives.

This report and other publications by the Parliamentary Commissioner for the Environment are available at: **www.pce.parliament.nz**

Contents

Commissioner's overview

As I write this overview it is business as usual in the bush. This might conjure up images of tūī popping open mistletoe flowers, fantails flitting from tree to tree behind trampers and the calm of a grove of tree ferns. But in much of our great forests, the reality is far less halcyon. Sadly business as usual is more likely to mean stoats patrolling kiwi nests waiting for chicks to hatch, rats hunting down frogs, geckos and insects, and possums stripping mistletoe, fuchsia and rātā.

Last summer while on holiday I mentioned to a friend that I was investigating the use of the pesticide known in New Zealand as 1080. She responded "*That will be very difficult; there are such good arguments on both sides.*" What I have discovered through this investigation is that this is not so. While I respect the sincerity of those who oppose the use of 1080, without it our ability to protect many of our native plants and animals would be lost. And without 1080, keeping bovine tuberculosis at bay to protect dairy herds, and protecting young trees in plantation forests would be much more difficult and expensive.

In New Zealand, 3,500,000 kilograms of pesticide is used every year, and the amount of 1080 used is less than one-thousandth of this - about 3000 kilograms. Yet despite this, despite years of research, exhaustive reviews and the setting of many controls governing its use, 1080 remains controversial, and the call for a moratorium on 1080 from some Members of Parliament was a major impetus for this investigation.

Along with a number of other poisons, 1080 is used in bait stations on the ground, but it is the dropping of it from helicopters that elicits the greatest concerns. And this is understandable; scattering poison from the skies just feels like a really bad thing to do. So why is it done?

The great majority of our native plants and animals occur naturally nowhere else in the world. This makes them especially vulnerable to invaders from other countries, since there was no need to evolve defences against them. Birds did not need to fly if there were no ground predators to hunt them down.

This investigation is focused on three pests that do immense damage to our great native forests, as well as to other ecosystems and to the economy more generally – possums, rats and stoats. Most of us still think of possums as the major enemy, but over the last 15 years or so, scientists have developed a much deeper understanding of the destruction caused by rats and stoats. Increasingly, stoats, not possums, are spoken of by conservationists as 'enemy number one'.

The interaction between rats and stoats is particularly important. When there is plenty of food, rodent populations boom, providing meat for the carnivorous stoats. So-called 'mast events' are particularly tragic. In the very years when certain tree species flower profusely, when millions of seeds drop to the ground to enable birds to lay more eggs than usual, the rat and stoat populations irrupt and the chicks are doomed.

It was a surprise in this investigation to discover that possums, rats and stoats are only controlled on one eighth of Department of Conservation land. We may well be looking at a future where many of our special plants and animals can be found only on offshore islands with extremely limited access to the public and in sanctuaries behind big fences. Without active pest management, kiwi chicks have a one-in-twenty chance of making it to adulthood.

1080 is a substance that occurs naturally in many plants in Western Australia and other countries. That it exists naturally is no argument in its favour – so does hemlock. Plants that contain 1080 evolved it as a defence against browsing animals. Consequently, possums and other native animals in Western Australia have become immune over eons of evolutionary time. This has made it possible for 1080 to be aerially dropped over millions of hectares in Western Australia to kill foxes, feral cats and wild dogs.

An ideal method for controlling possums, rats and stoats would kill them effectively and enable native trees and animals to flourish, it could be used tactically to rapidly knock down irrupting populations of rats and stoats during mast events, and it could be used cost-effectively over large remote rugged areas as well as on small accessible reserves.

Such an ideal method would also have no unwanted effects. It would not kill or harm native birds, fish, lizards and insects, and it would not kill introduced animals that are not pests. It would not leave long-lasting residues in water and soil or endanger public safety. And it would kill possums, rats and stoats humanely as well as effectively.

In this investigation, 1080 and its alternatives (to the extent possible) are compared with this imaginary ideal, and 1080 scored surprisingly well. It is not perfect, but given how controversial it remains, I for one expected that it would not be as effective and safe as it is. In large part this is due to the many improvements in practice and controls that have been put on its use over the years.

In order to fully understand the concerns about 1080, my staff and I have had lengthy discussions with a variety of people at the forefront of the opposition to its use. We have striven to understand the nature of their concerns and studied the written material they have produced. Certainly some operations have not been well done; there is always room for improvement and there is always the possibility of human error, intentional or otherwise.

It must be extremely upsetting to lose a cherished dog to 1080, but only eight dogs have died this way in the last four years. The sad reality is that many many more will die on roads each year and no one is proposing a moratorium on traffic. It is important to keep risks in perspective.

The Department of Conservation often refers to 1080 as "one of the tools in the toolbox". This may give the impression there are alternatives that can do the same job, but this is not the case.

Indisputably trapping has a role to play, particularly in bush margins and reserves, along with a number of other poisons besides 1080. But ground operations can never be as effective or as cost-effective as aerial operations in large rugged remote areas.

One commonly used poison is cyanide. It has the advantages of killing humanely and breaking down quickly in the environment, including in the carcasses of poisoned animals. But because of this it cannot kill stoats; because stoats are carnivores, the only way to kill them in large numbers is secondary poisoning, that is, feeding on poisoned possums and rodents.

Another commonly used poison is brodifacoum, but brodifacoum has a higher risk of by-kill than 1080 because it persists in the environment for a long time, and it is particularly inhumane.

There are other alternative poisons to 1080 under development, but while they have some advantages over 1080, they cannot replace it. Biological control options held promise for a time, but research funding has stopped due to lack of progress, and probably also because most of the options involved genetic engineering.

The Prime Minister's Chief Science Adviser Sir Peter Gluckman frequently calls for policy decisions to be based on evidence. A solid body of evidence supporting the continued use of 1080 has been built up over the years; the large number of notes and references at the back of this report are testament to this.

It is my view based on careful analysis of the evidence that not only should the use of 1080 continue (including in aerial operations) to protect our forests, but that we should use more of it. And it is not as if much is being used now. Currently there is more Crown funding given to the Animal Health Board to kill carriers of bovine TB than the Department of Conservation spends on controlling possums, rats and stoats over the entire conservation estate.

It is seldom that I come to such a strong conclusion at the end of an investigation. But the possums, rats and stoats that have invaded our country will not leave of their own accord. Much of our identity as New Zealanders, along with the clean green brand with which we market our country to the world, is based on the ecosystems these pests are bent on destroying. We cannot allow our forests to die.

J. C. Wright

Dr Jan Wright
Parliamentary Commissioner for the Environment

1 Introduction

For around 65 million years New Zealand was surrounded by ocean separated from other major land masses – a small country of islands at the edge of the world. It is that remoteness which has shaped the unique, primeval landscape that New Zealanders know and love. And it is that isolation that provided a unique set of conditions creating plants, birds and other animals unlike anywhere else in the world. Birds and insects evolved without the threat of predatory land mammals. Wētā scurried across the bush floor instead of mice, while the giant Haast's eagle as top predator was New Zealand's flying version of wolves and tigers.

This distinctiveness is well recognised internationally. The OECD has stated that *"In a global context, New Zealand has a special responsibility for biodiversity conservation, since a high percentage of its 90,000 native species are endemic and unique."* [1]

While New Zealand is not alone in facing a challenge to protect its native species, we cannot afford to underestimate the size of the problem. Around 90 percent of our birds and insects are found nowhere else in the world, along with 80 percent of our plants and all of our 60 reptiles, 4 frogs and 3 bats. In contrast, Great Britain has only one unique native animal – a small bird known as the Scottish crossbill.[2] And in a recent study of 179 countries, New Zealand was ranked as having the highest proportion of threatened species.[3]

The threat to our biodiversity takes several forms. Historically, land clearance and modification had huge impacts on native species and ecosystems, although those days are largely behind us and around 30 percent of the country is now reserved in the public conservation estate. But every day, imports cross our borders with the potential for biosecurity breaches. And climate change is likely to threaten the survival of some of our plants and animals.

However, the biggest and most immediate risk lies at the feet of just a few introduced species. Possums, rats and stoats in particular continue to devastate our forests and the creatures that live within them. These predators are widespread throughout the country and are the greatest threat to the continued survival of many of our native birds.[4]

We do not have the luxury of time. Only one eighth of the conservation estate has any pest control at all, and without active management many of our iconic species are in danger of extinction.

Without much greater action we are heading towards a future where our most iconic bird, the kiwi, may only be found in fenced sanctuaries and offshore islands.[5] Already the dawn chorus has disappeared on much of the mainland.

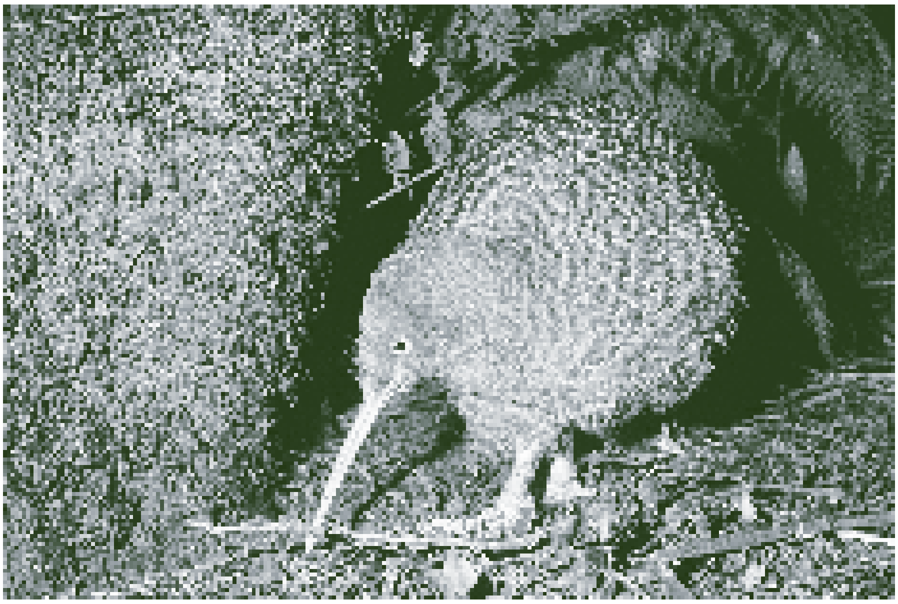
This is the context for the discussion of the use of 1080.

The active component of the poison known as 1080 occurs naturally in many plants found in Western Australia and parts of Africa. These plants evolved the poison as a defence against browsing animals.[6] The poison was patented in Germany – as a mothproofing agent in the 1920s and as a rat poison in the 1930s[7] – and in time came to be used for controlling rats, coyotes and rabbits, primarily in the United States and Australia. The name '1080' originates from the invoice number given to a batch submitted for testing, and the manufacturer adopted 1080 as the brand name.[8]

New Zealand has been using 1080 as a tool for the control of pests for over 60 years although it remains highly contentious. In 1994 the first Parliamentary Commissioner for the Environment, Helen Hughes, reviewed the use of 1080, and most of her recommendations for tighter control were adopted.[9] In 2007 the Environmental Risk Management Authority (ERMA) undertook a thorough review of 1080 in order to determine if the controls on its use should be changed or strengthened.[10]

Despite these reviews and a very large body of research about the effectiveness and risks of 1080, opposition to and public concern about 1080 has not abated; indeed it appears to be stronger than ever.

This was illustrated by statements from various political parties ahead of the 2008 election. Among Members of Parliament there is disagreement over how 1080 should be regarded, with a range of opinion from outright banning to questions over effective management and communication to strong advocacy. The use of 1080 is also vigorously debated at the local council level, particularly in the Westland and Taupō districts.



Source: Department of Conservation

Figure 1.1: The roroa (great spotted kiwi) is one of five kiwi species. Like all kiwi species, roroa are threatened by introduced predators, particularly stoats who can eat over half of the chicks produced in a season.

1.1 Purpose

The Parliamentary Commissioner for the Environment is an independent Officer of Parliament, with functions and powers granted through the Environment Act 1986. Her role allows a unique opportunity to provide Members of Parliament with independent advice in their consideration of matters that may have impacts on the environment.

Given the ongoing controversy regarding 1080, this investigation has been undertaken to provide Members of Parliament, members of the public and other interested groups with an independent assessment of 1080 that is not overly technical and is accessible to the general reader. It is an exploration of the ecological threat facing New Zealand and the physical tools and techniques of how to deal with that threat. Those interested in the detail that sits behind the assessment will find it in the many pages of notes and references that follow the body of the report.

The report is focused on the use of 1080 for killing possums, rats and stoats to protect native forests and the animals in them, not on its use to protect agriculture and forestry.

This report has been produced pursuant to subsections 16(1)(a) to (c) of the Environment Act 1986.

1.2 Structure

The remainder of this report is structured as follows:

Chapter 2 describes the vulnerability of our native species to introduced predators and why possums, rats and stoats in particular are such a great threat to biodiversity.

Chapter 3 examines how pests are controlled in New Zealand, who the main agencies are, and the legislative framework under which they operate.

Chapter 4 introduces the analytic framework that is used in the following three chapters to assess 1080 and alternatives.

Chapter 5 evaluates how well 1080 works by answering a series of questions related to its effectiveness.

Chapter 6 investigates concerns about 1080 by answering a series of questions related to its safety and humaneness.

Chapter 7 examines how well the alternatives to 1080 – trapping, other poisons and biological control – stack up.

Chapter 8 contains the conclusions of the investigation and six recommendations from the Commissioner.

1.3 What this report does not cover

This report does not cover:

- The state and effectiveness of the whole national pest management system.
- The conduct or outcomes of specific operations, except occasionally as examples.
- Detailed analysis of community perceptions and attitudes towards the use of 1080.
- The Animal Health Board's actions in controlling bovine tuberculosis (TB) in any detail.
- Concerns held by some Māori regarding the physical, cultural and spiritual impact of using 1080.
- The controls and regulations around the registration and use of 1080 in detail.

Source: Damian Davalos

Figure 1.2: Hihi (stitchbirds) are the smallest of the three native honeyeaters - the other two are tui and bellbirds. Hihi nest in tree holes, so are very vulnerable to predation by possums, rats and stoats.

2

Our forests under attack

New Zealand has one of the highest extinction rates of native species in the world, largely due to predation by introduced mammals. Introduced mammals are costly to our economy as well as our environment. Rabbits and hares can badly damage pasture and seedlings in plantation forests. Possums, wild deer and stoats can carry bovine TB and infect cattle and farmed deer.

This chapter explains why our native plants and animals are so unusual and why they are so vulnerable to predators that have come from other countries. The focus is on our remarkable native forests, as this is where the impacts of mammals are so great and where the use of the pesticide 1080 remains so controversial.

"Most of New Zealand's birds have still not learned that mammals can be dangerous."[11]

2.1 Our extraordinary environment

"[New Zealand] shows us what the world might have looked like if mammals as well as dinosaurs had become extinct 65 million years ago, leaving the birds to inherit the globe."[12]

New Zealand's native plants and animals are unlike any others in the world.

Sixty-five million years ago 'proto-New Zealand' separated from the ancient supercontinent Gondwanaland and took a group of existing plants and animals with it.[13] The animals included insects, amphibians, reptiles and birds, but crucially this separation of landmasses occurred before the main evolution of mammals. Consequently, except for three species of bats, there were no land mammals in New Zealand before humans arrived.[14]

Because there were no land mammals, our plants and animals have not developed defence mechanisms to deal with them, or have lost mechanisms they once had.[15] For instance, the leaves of our plants do not contain poisons to deter browsing mammals, while many of our birds and insects have lost the ability to fly. And while this 'predator naivety' served our species well for a long time, it left them ill-equipped to deal with the arrival of humans and their mammalian companions.

2.2 Mammals arrive and many prosper

Over the last 700 years, humans have introduced over 50 species of mammals into New Zealand. Some arrived by accident as stowaways. Some were introduced intentionally – for food, for fur, and for recreational hunting. Others were introduced to deal to earlier arrivals; for instance, stoats were brought in to control rabbits. Almost three quarters of the arrivals are now well established and thriving.[16]

The first mammals came in the ancestral waka (canoes) of the Māori in the thirteenth century – kurī (dogs) and kiore (rats). Kurī were used for hunting and food, but became extinct as a recognisable breed after the arrival of European settlers and interbreeding with European dogs.[17] Kiore were also an important source of protein. Indeed some tribes set restrictions on killing and created forest reserves for kiore to breed.[18]

When European settlers arrived they brought a wide range of other mammals. Governor Grey's zebras were short-lived, but the descendants of his wallabies remain a pest in some parts of the country.[19] Others such as sheep and cattle became an integral part of our economy. However, some introduced mammals have become serious pests, threatening our native plants and animals and the productivity of much of our economy.

Introduced pests are the greatest threat by far to New Zealand's native plants and animals

Pest mammals are now found almost everywhere in New Zealand, from the coast to well above the treeline. Possums browse among tree tops feeding on leaves and fruits, and also prey on invertebrates and the eggs and young of native birds. At least 19 species of native forest birds, including kiwi, whio (blue duck), kererū, kākāpō, kākā, kākāriki, mōhua (yellowhead), hihi (stitchbird), tīeke (saddleback) and kōkako are under attack from introduced mammals.[20] Predation by rats and mice has been responsible for declines or extinctions of many of our insects and lizards, including wētā, beetles, skinks and geckos. Rats and mice may also alter or stop forest regeneration through eating seeds and seedlings.[21]

Introduced predatory mammals do not only threaten the survival of individual species. Their actions can also disrupt or destroy the functioning of whole systems. For example, tūī and korimako (bellbirds) are major pollinators of native mistletoes,[22] while native trees like tawa, miro and pūriri rely on kererū and other native birds for the dispersal and germination of their fruit.[23] Therefore, lower numbers of these birds will affect how well the forest functions as a whole, with the potential to place forests at risk of collapse.

Predation by introduced pests has become by far the greatest threat to New Zealand's native plants and animals, although loss of habitat and disease also play a role.[24]

2.3 The biggest threats to our forests

There are a number of mammals that threaten our native ecosystems – possums, deer, wild pigs, rats, feral cats and stoats to name a few. However, in terms of forests there are three that consistently feature on the 'most wanted' list – possums, rats and stoats.

Possums

Brushtail possums were brought to New Zealand over 150 years ago from Australia to establish an export fur trade.[25] The total number originally imported was 200 to 300 and most were introduced into the lower South Island and around Auckland. These first introductions were followed by an active period of breeding possums in captivity in New Zealand and releasing animals throughout the country. However, during the early 1920s the damaging effects of possums on native forest became an increasing concern. It culminated in the late 1940s when all protections for possums were removed and limited poisoning was made legal. Recently, the development of blends of merino wool and possum fur has once again made the fur valuable.

Possums are found almost everywhere in New Zealand, and there can be as many as 25 per hectare in preferred habitats.[26] A recent study estimated there are around 30 million possums in New Zealand.[27] They are the major cause of the decline of trees such as pōhutukawa, rewarewa, kāmahi, māhoe, tawa and rātā and can change the composition and structure of native forests.[28] They destroy the nests of kererū,[29] and North Island kōkako.[30] Possums have also been recorded killing adults or young of tītī (sooty shearwaters or muttonbirds), kāhu (harrier hawks), pīwakawaka (fantails) and tāiko (Westland black petrels).[31]

In their native Australia, possums are a natural part of the environment, are not a conservation threat, and are legally protected under Australian law.

Source: Nga Manu Images

Figure 2.1: Since their arrival in New Zealand, brushtail possums have spread throughout the country. They have a varied diet, feeding on many native trees, birds and invertebrates.

Rats

Four species of rodents have been introduced into New Zealand. These are the kiore or Polynesian rat, the house mouse, the Norway or brown rat, and the ship or black rat.

Kiore have been almost completely displaced by European rodents and are now found only in a few parts of New Zealand.[32]

Mice are plentiful in native forests. Importantly for this report, mice populations will boom (or irrupt) in response to the abundance of food produced in 'mast events', and along with rats provide plentiful food allowing stoats to thrive. (Mast events are described in Section 2.4.)

Norway rats prefer wetland habitats and are much less common than ship rats in forests.

Ship rats are the most prevalent of the three rat species and the greatest rodent threat to our native forests and the creatures that live in them.

Box 2.1: Kiore and European settlers

The first Polynesian explorers brought the kiore with them, as a stowaway or deliberately as a food resource. The kiore, about a third of the size of other rats, was widespread by the time of European settlement.

Kiore underwent periodic population irruptions in years when beech trees produced exceptionally large amounts of seed. In 1890 the impact of what is now known as a 'mast event' on the town of Picton was eloquently described:

"…the whole town was pervaded with the odour of dead rats. It took the place of pastille in the drawing-rooms, and overpowered that of sanctity, even, in the churches."[33]

Ship rats live in all types of native and exotic forests from the coast to the treeline.[34] They are very agile climbers and can spend a large proportion of their time up in the tree canopy. This, along with being nocturnal, means that they are not easily seen. They are generalists when it comes to food, and will eat both plants and animals all year around.

Ship rats are most abundant in lower elevation mixed podocarp-broadleaf forests that contain species like tawa, lemonwood, rimu, rātā and miro, where there is plenty of food and places to nest. They are generally less common in pure beech forests, except after heavy beech tree seeding in mast events.

The devastating impacts of these rats on native birds can be clearly seen on Big South Cape Island near Stewart Island, which was invaded by ship rats in 1962. Rat numbers exploded to high levels, and within three years, nine species of birds had declined or disappeared from the island, including South Island saddlebacks, Stead's bush wren and the Stewart Island snipe.[35] On the mainland, rats are known to contribute to declines in populations of forest birds such as North Island kōkako, kererū, kākāriki, mōhua, and brown creeper.[36]

Stoats

Stoats, ferrets and weasels all belong to a family of carnivorous mammals known as mustelids. First released in the South Island towards the end of the nineteenth century, they were brought in as 'natural enemies' of the rabbits, which were causing such damage to the pastures and thus the economy of the colony. This introduction occurred despite the protests of scientists at the time.[37] Stoats and ferrets in particular are now well established.

Weasels are patchily distributed throughout New Zealand, preferring overgrown areas with thick ground cover. They remain relatively rare in New Zealand.[38]

Ferrets are most common in native grasslands and farmland, but can also be found in scrub, wetlands, along waterways, and on the edges of forests. They can be major predators of birds, particularly birds that live in the sorts of habitats that ferrets favour. They are known to have killed penguins, black stilts, wrybills, variable oystercatchers, New Zealand dotterels and weka, as well as lizards and insects.[39] In addition, they are a major carrier of bovine TB, particularly in the South Island. However, in comparison with stoats their impact on native forests is not large.

Stoats can live anywhere they can find prey, from the coast to the treeline and beyond, and in farmland, scrub, native and exotic forests, and tussock grasslands. Populations of stoats undergo periods of explosive growth as a result of huge increases in mice and rat numbers following mast events.

Stoats produce one litter of young per year in the spring, and anywhere from 2 to 20 young can be born. Male stoats will visit the nest when the young are only a few weeks old and mate with both the mother and the female babies – even though they are still blind, deaf and hairless and about one twentieth the size of the male. The young females will leave the nest in mid-summer already pregnant, although their own young will not develop until the next spring.[40] It is because female stoats come 'pre-loaded' with young that the presence of even one individual stoat can establish a population on predator-free islands and in fenced reserves. In 2011, $75,000 was spent to catch a single stoat on Kapiti Island.[41]

Source: Nga Manu Images

Figure 2.2: Ship rats prey on insects and some birds, including kōkako, kākāriki and mōhua. Rats form a major part of the diet of stoats.

Stoats can be described as the 'perfect predator'; birds that nest on the ground or in holes on trees have no escape. Up to 60 percent of kiwi chicks are eaten by stoats.[42] Stoats are territorial animals and intimately know the locations of nests and roosts within their territory. Researchers filming kiwi nests have observed stoats repeatedly visiting burrows while the eggs were being incubated, waiting for the chicks to hatch. Kākāpō and hihi are now only found on islands or sanctuaries completely free of predators and it is believed they cannot survive where stoats are present.[43]

Why focus on the big three?

Possums, rats, and stoats all eat eggs and young birds. All are widespread and well-established throughout New Zealand and difficult to control. Stoats are carnivores so do not browse on plants, but rats and possums have a huge effect on plant life. And the combination of all three together at the same time is particularly devastating. Between them, they damage not only plants and animals, but affect all aspects of forest functions, from birdlife to seed propagation.

It is comparatively recently, only within the last 15 years or so, that scientists have learned how these three predators interact with each other. This is especially so for rats and stoats. And it is only within the last 10 years at most that tactical approaches to the control of all three have been developed.

Boom years are now times of population collapse for native birds

2.4 Death in a time of plenty - the masting cycle

It is a tragic irony of the New Zealand bush that in the very years when many birds have evolved to breed most successfully, rodent and stoat populations boom and cause tremendous damage. The cause is what are known as 'mast events'.[44]

Approximately every four to six years, some trees flower abundantly and produce much larger numbers of fruit and seeds than usual. The phenomenon is greatest in beech forests, but trees such as rimu will also undergo mast seeding.

Before mammals arrived in New Zealand, these mast years of abundant food allowed birds to raise many more chicks than in normal years. Kākāpō will only breed in a mast year,[45] while other species like mōhua and kākāriki will successfully raise more chicks in mast years due to the greater availability of food.[46]

Tragically, these boom years have now turned into times of population collapse for native birds in forests where mast events occur. The sudden abundance of food leads to huge population irruptions of mice, rats and (crucially) stoats, which feed on the mice and rats (see Figure 2.3). Hole-nesting birds such as mōhua, kākāriki and kākā are particularly at risk in these situations, since predators not only eat eggs and chicks, but also nesting females who cannot escape.

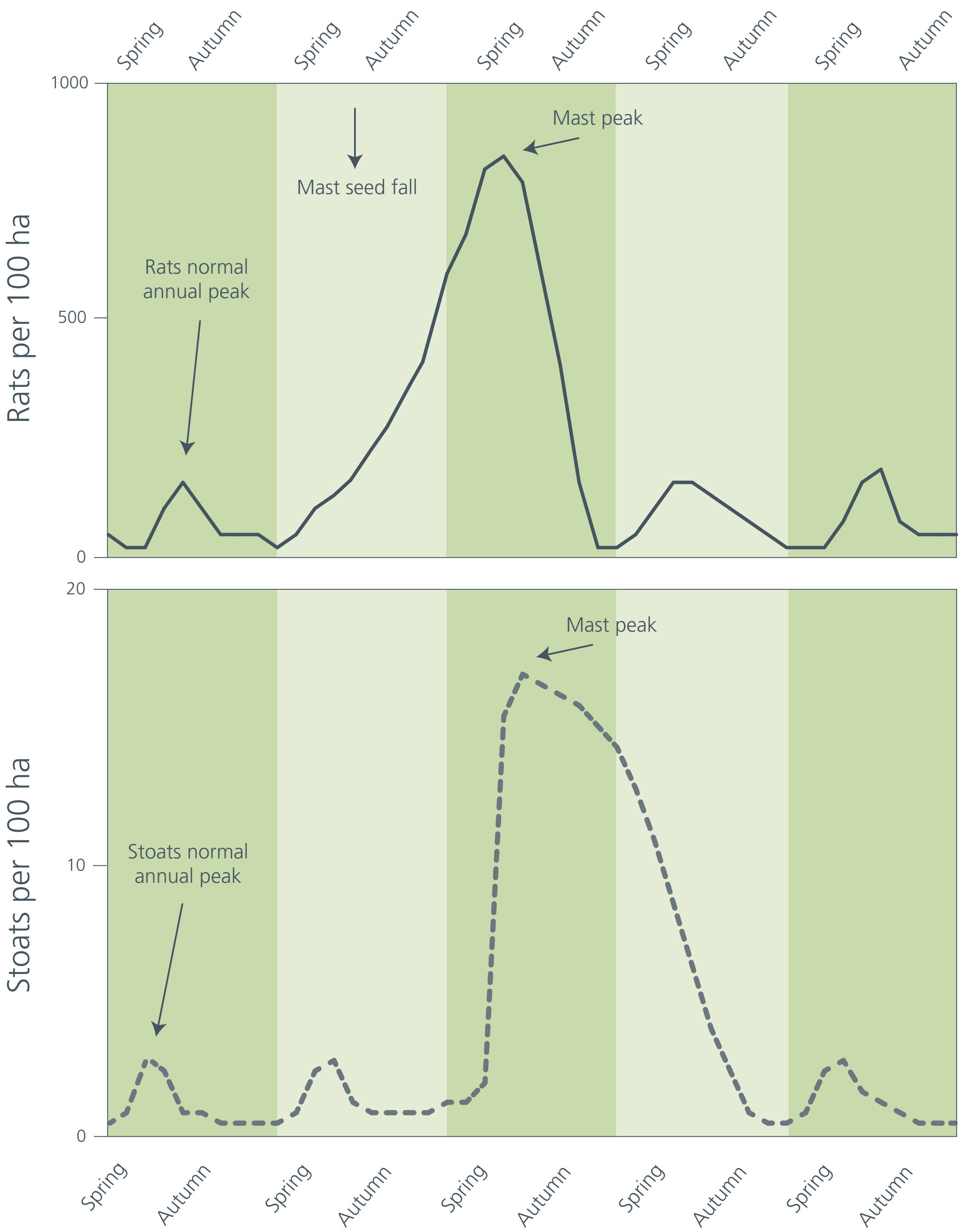


Figure 2.3: A schematic diagram of a mast event showing the effect on populations of rats and stoats.[47]

2.5 We do not have the luxury of time

The damage done to our native species and forests by possums, rats and stoats is a huge and accelerating problem. The situation with our iconic national bird shows that all is far from well. In areas with no pest control, kiwi populations are declining at between 2 and 6 percent per year.[48] This may not sound serious, but a population declining at 6 percent will be virtually gone within a generation.

The situation is just as bad for many other native animals and plants. The extremely high numbers of rats and stoats that follow a mast seeding is a critical and dangerous time for many forest birds. Kiwi, kākā, kōkako, kākāriki, mōhua and whio will almost certainly disappear from forests without effective pest control.

Other native birds (e.g. kererū, korimako, tūī) are also vulnerable to predation and competition for food from introduced mammals and will decline further without effective pest control. The loss or decline of such species, which are important seed dispersers and pollinators of native plants, will lead to other cascading ecological changes in native forests. Some of the bird-dependent native plants, such as mistletoes, are also very vulnerable to browsing damage by possums. Several other native plants and many animals, including insects, frogs, lizards and at least one bat, also face further decline and potential extinction on the New Zealand mainland as a result of the relentless impact of introduced mammals.

Extermination of these mammalian pests from the New Zealand mainland is currently not – and may never be – a realistic possibility. The largest island cleared of mammalian predators so far is uninhabited Campbell Island in the sub-Antarctic, which is only one fifteenth of the size of Stewart Island. For the foreseeable future we are faced with ongoing control of these pests if we wish to protect our native animals, plants and unique ecosystems.

Kiwi on the mainland may be gone within a generation

Yet there remains room for hope. Many government and non-government agencies, as well as private groups and individuals are engaged in tackling this task. For some, conservation of our native species is the primary aim, while for others it is the threat to pastoral agriculture. There is, however, a common enemy. One example of these different sectors working in conjunction with one another is illustrated by the Pest Control Education Trust – a joint initiative between the Royal Forest and Bird Protection Society and Federated Farmers. The aim of the Trust is "*to help educate the public about the importance of controlling introduced mammalian pests in New Zealand*".[49]

As discussed in the next chapter, there are many different techniques used to manage pests, and many different agencies involved. And all are controlled under a detailed framework of legislation and regulation.

3 Controlling possums, rats and stoats

It is ironic that two of the 'big three' pests – possums and stoats – were deliberately introduced into New Zealand by those seeking an economic benefit. In contrast, rats are expansionists extraordinaire and there are very few places on the planet that they have not invaded.

Having arrived in this small country of islands populated with native species unable to fight back, these pests have run rampant. Attitudes towards them and methods for controlling them have undergone considerable changes over time.

This chapter describes the methods currently used to kill possums, rats and stoats, the agencies involved, and the laws that govern their activities.

3.1 How are possums, rats and stoats controlled?

There are various methods used for controlling pests. Each method is discussed below with a particular focus on possums, (ship) rats and stoats, although they will also often be used for other pest species as well.

Trapping

There are three main types of traps used to kill possums, rats and stoats. Kill traps are designed to kill the target animal rapidly when the trap is triggered. Leg-hold traps are designed to capture the animal by the leg but not kill it directly. Cage traps are designed to capture the animal alive and unharmed. Both leg-hold traps and cage traps must be checked regularly and trapped animals then killed humanely.[50]

The design and use of traps has changed markedly over time. Steel-jawed leg-hold traps for possums must now comply with standards designed to limit injury to the captured animals. Larger leg-hold traps are required to have padded jaws.[51] On the conservation estate trappers must not set traps on the ground in areas with flightless birds such as kiwi and weka or where domestic or companion animals may be at risk.

A number of new traps that more effectively kill specific pests have been designed. DOC has developed traps designed specifically for rats and stoats. And recently a private group has developed self-resetting traps for possums, rats, and stoats that can kill as many as 12 animals before needing to be recharged.[52]

Poisons

Fifteen poisons are registered and approved for use against mammal pests in New Zealand.[53] 1080 is one of the eleven used by the Department of Conservation (DOC) to control possums, rats and stoats. These poisons are not used in their 'raw form' but are incorporated into different baits. Poison baits can be placed in bait stations, stapled to trees in biodegradable 'bait bags' or dropped aerially from aircraft. Having a range of poisons available to use in ground operations is important for avoiding bait shyness or the build-up of resistance. The following are the main poisons used.

1080 (sodium fluoroacetate) is approved for controlling possums and rats, and can also be used for controlling other pests such as rabbits and wallabies. 1080 is not used in its raw chemical form, but is incorporated into a range of different baits, including cereal baits, carrot baits, and less commonly, paste and gel baits.

Because stoats are carnivores they do not eat cereal and carrot 1080 baits, but can be killed if they eat possums or rats that have eaten the poison. This process is known as 'secondary poisoning'.

Most 1080 is used in ground operations to control possums to prevent the spread of bovine TB. The baits may be placed in bait stations (that allow the target pest in but are designed to exclude other animals), or applied directly to the ground.[54]

1080 is also used aerially to control possums, rats and stoats. 1080 is the only poison that is used aerially to control these species on public conservation land on the mainland, with the exception of brodifacoum in a very small number of cases. Almost all aerial 1080 operations use cereal baits, dropping about two kilograms of bait per hectare.

Source: Department of Conservation

Figure 3.1: Bait stations keep the baits dry and prevent non-target animals from eating them.

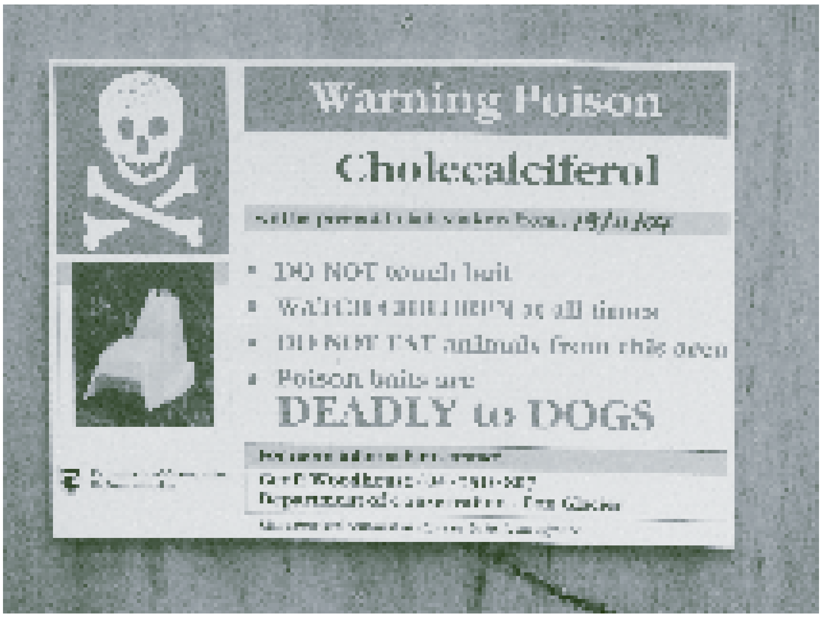
Brodifacoum is used to control possums and rats, although it will kill predators such as stoats through secondary poisoning. It is mixed into cereal or wax-based baits for use in the field and is generally used in bait stations.[55] Brodifacoum is one of the three poisons that can be used aerially, although it is rarely used in this way. DOC will use brodifacoum aerially on offshore islands where the total eradication of rats or mice is possible. On the mainland DOC only uses brodifacoum aerially in reserves with predator-proof fences, where total eradication of rats and possums is possible and where there is little or no risk of by-kill. Some regional councils use brodifacoum aerially to control rats, although they also restrict its use to areas with predator-proof fences.[56]

Pindone is broadly similar to brodifacoum, and is used to control rats although DOC rarely uses pindone because it is less effective. Pindone can be used aerially to control rabbits (the greatest users are private landowners), but this is in open habitats such as tussock grasslands, not in forests.

Diphacinone, coumatetralyl and *bromadiolone* are three other poisons used by DOC to control rats. All three work in a similar way to pindone and brodifacoum.[57]

Cyanide is used mainly to control possums and is used on both private land and public conservation land.[58] It is incorporated into a range of baits, including gel-coated capsules and pastes. Cyanide is only approved for use with ground methods, and is placed in bait stations, in bait bags, or laid by hand as a paste. DOC places restrictions on the way cyanide paste can be used, such as requiring it to be placed up off the ground in areas where flightless birds such as kiwi and weka live.

Cholecalciferol is used by DOC to control rats and possums. It is incorporated into a range of baits, including cereal baits, gel blocks and pastes. It is only approved for ground applications and is used in bait stations or bait bags.



Source: Department of Conservation

Figure 3.2: All operations that use a poison for pest control must place warning signs on their boundaries that inform people what poison is being used, what risks it poses, and when the area will be safe to enter.

Shooting

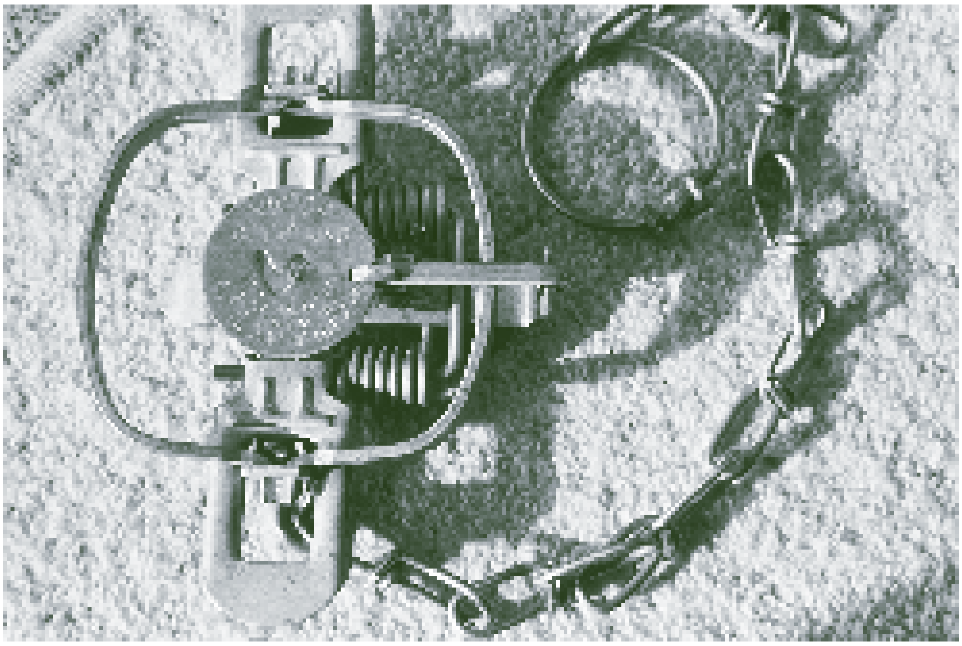
Rifles and shotguns are also used to kill some pests – although these tend to be larger animal such as deer and goats. Shooting possums at night on farmland or on the bush edge is a popular activity, although it is not used as a control method for possums, rats or stoats in forests. Therefore, it is not discussed further in this report.

Biodynamic 'peppering'

Biodynamic 'peppering' is advocated by some as a control method for possums. It involves preparing ash from burnt possum skins, and applying homeopathic solutions made from the ash to the soil under specific astrological conditions. Scientific trials have shown no evidence of effectiveness.[59] Moreover, there is no mechanism known to science whereby biodynamic 'peppering' could work. Therefore, it is not discussed further in this report.

Predator-proof fencing

Another approach to pest control on the mainland is the exclusion of pest mammals by fencing, creating fenced 'sanctuaries' such as Zealandia in Wellington and Maungatautari in the Waikato. These fences can be very effective at protecting native species, although they are expensive to build and require the removal of pests from within the fenced area by poisoning or trapping. They also require ongoing monitoring to ensure pests have not re-invaded the reserve, and maintenance of the fence. The ability of predator-proof fences to protect large areas is limited, and they are not discussed further in this report.



Source: Department of Conservation

Figure 3.3: Leg-hold traps must now be set in a way that does not endanger birds and they must be checked regularly to minimise the suffering of captured animals.

3.2 Who controls pests?

The big players in controlling possums, rats and stoats are the Department of Conservation (DOC), the Animal Health Board (AHB) and local government. Private land owners also use 1080 and other pest control methods to protect the productivity of farms and forests.

Department of Conservation

DOC has identified over 2,700 native species that are at risk of extinction, but actively manages only about 10 percent of these.[60] Management techniques include habitat protection, captive breeding programmes, relocation of threatened species and predator-proof fences. For many native species however, DOC's management is focused on direct control of possums, rats, stoats and other pest mammals.

Over 2,700 native species that are at risk of extinction

DOC targets a wide range of pests, in rugged and remote areas, as well as in small accessible reserves. DOC's use of aerial 1080 varies each year, depending on the management goals for the year. In 2009, DOC applied aerial 1080 to 174,000 hectares to control possums and rats. In that same year, DOC managed possums, rats and stoats on about 1.3 million hectares – just over one eighth of the public conservation estate.[61] About $22 million was spent killing possums, rats and stoats in 2009/10. This is about 8 percent of DOC's total budget under Vote Conservation.[62]

DOC provides a great deal of information about pest control on the conservation estate. This includes public consultation, printed material, and web-based communication including videos and maps of operations, although style and details on maps do vary in quality across conservancies. Summaries of pest control operations for each region are provided, along with information on location, method and poisons used, and which agency is undertaking the operation.[63] The pesticide summaries are technical in nature and use scientific terminology.

Animal Health Board

The AHB is an incorporated society, made up of representatives from the farming sector and local government and has responsibilities to the Minister of Agriculture. Its goal is to eradicate bovine TB from New Zealand, and most of its work is focused on controlling TB spread from possums and other wild animal hosts. The AHB does not target rats since they are not carriers of TB, nor stoats as few live where the AHB is engaged in active eradication.[64]

Much of the AHB's pest control is done using ground techniques on private farmland or on forest edges. Work is also done within forests to knock possum numbers down and slow the rate of re-invasion back on to farmland, or to achieve the eradication of TB from wildlife. Aerial application of 1080 is sometimes used in these situations.[65]

In 2009 the AHB controlled possums and other carriers of TB over 3.4 million hectares. Of this, about 3 million hectares was controlled using trapping and ground poisoning, with the remainder controlled using aerial 1080.[66]

The AHB has a total budget of around $80 million – about $30 million from the Crown, $6 million from local government, and the remainder from industry levies.[67]

At the time of writing, a legislative amendment was before Parliament which would apply to the AHB. Under the proposed Biosecurity Law Reform Bill the AHB would, in relation to its role under pest management plans, be subject to the Ombudsmen Act 1975, which it currently is not.[68]

Local Government

Regional councils and territorial authorities control a number of pest mammals, mainly targeting possums and rabbits.[69] Under the Resource Management Act 1991, regional councils are responsible for maintaining native biological diversity and councils are specifically required to manage pests under the Biosecurity Act 1993. Around 2 million hectares are managed for these pests by councils, although only a proportion of this area will receive pest control in any one year. While councils use a combination of ground control methods and aerial application of 1080, the latter was used on only a small proportion (1.4%) of the total area covered in 2009.[70]

Other pest controllers

Private landowners use 1080 and other pest control methods to protect the productivity of farms and forests. The possum fur industry also kills approximately 1.8 million possums per year using traps and cyanide.

The recently announced Game Animal Council is to be responsible for the management of deer and other game species for hunting over much of the conservation estate.[71] It will not be responsible for the management of possums, rats and stoats, although some of their responsibilities around the management of game may impact on the control of possums, rats and stoats by other agencies.

In particular, it is proposed that the Game Animal Council will be responsible for the management of deer, pigs, chamois and tahr over the entire conservation estate, except for specific areas where DOC identifies that these species are having major conservation impacts. DOC will continue to be responsible for the management of possums, rats, stoats and other pests in the conservation estate. It is not clear what happens if, for instance, DOC wanted to carry out an aerial 1080 operation to kill possums, stoats and rats in an area where there would be a risk of killing deer.

Application of aerial 1080

Figures 3.4 and 3.5 show the areas where aerial 1080 was applied in the 2008/2009 financial year.[72] Operations by DOC were carried out as part of its pest control activities to protect native species. AHB operations were carried out to knock down possum numbers in order to control bovine TB. Data available for mapping aerial 1080 operations in this way has only been available since the ERMA reassessment in 2007.

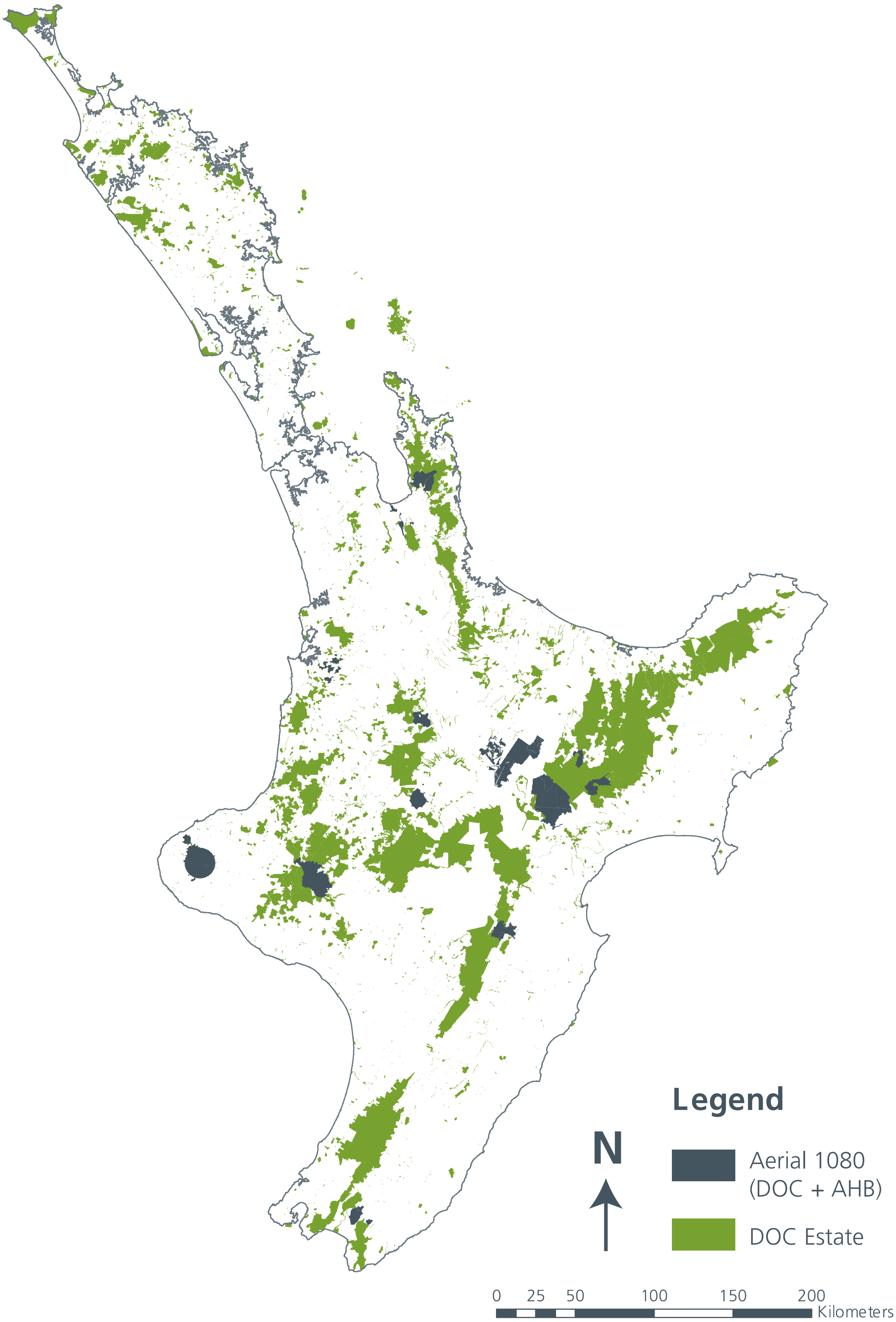


Figure 3.4: Areas over which 1080 was dropped aerially from July 2008 to June 2009 in the North Island by the Department of Conservation and the Animal Health Board.

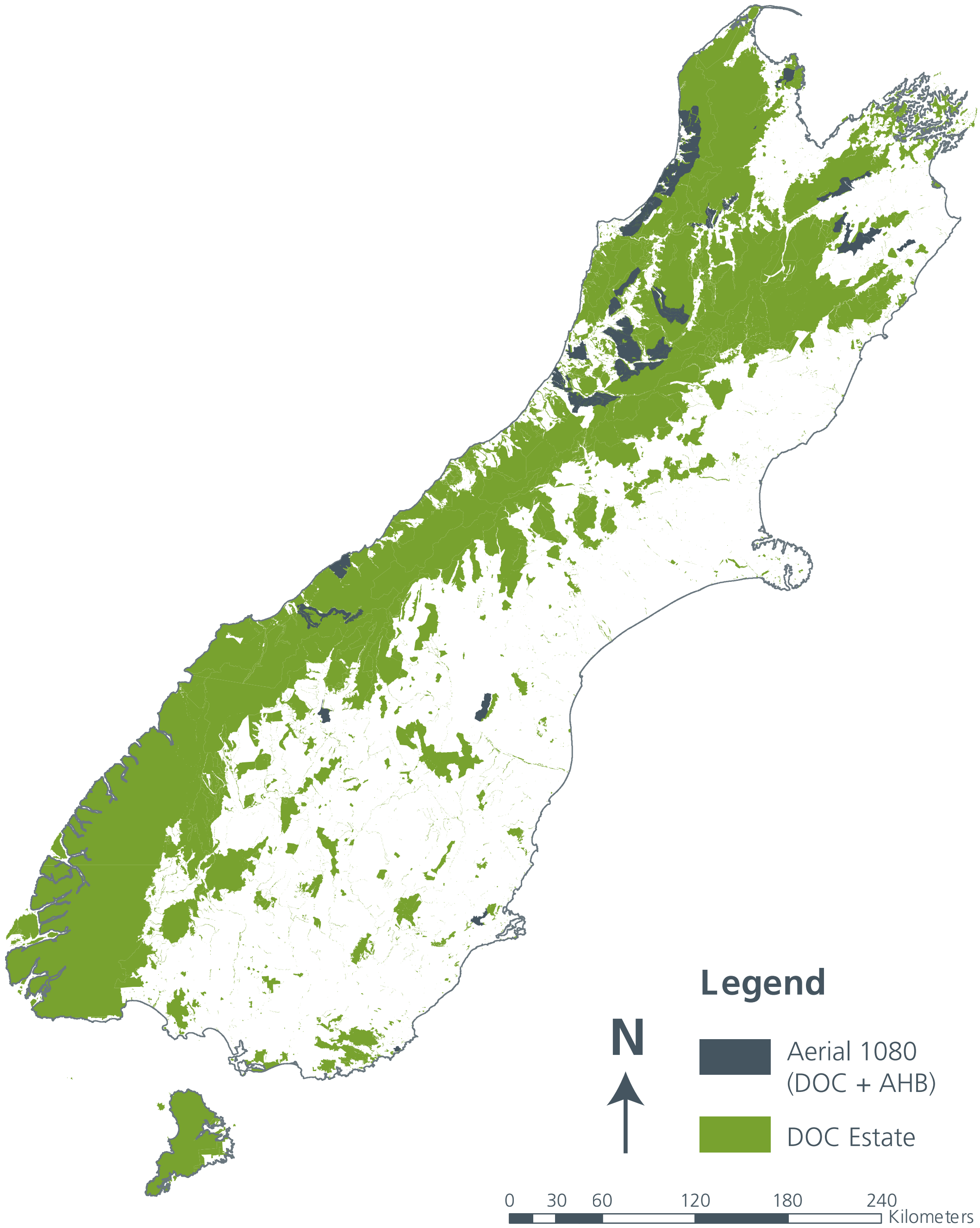


Figure 3.5: Areas over which 1080 was dropped aerially from July 2008 to June 2009 in the South Island by the Department of Conservation and the Animal Health Board.

3.3 Controlling the pest controllers

A labyrinth of legislation governs pest control. Some legislation is common to all operations – health and safety, fire safety and trespass legislation. Additional legislation applies to different pest control methods. For example, shooting of pests is covered by the Arms Act 1983, while the use of traps is covered by the Animal Welfare Act 1999. The controversy over 1080 has led to confusing doubling-up of regulations governing its use. For example, essentially identical requirements for protective clothing and equipment when using 1080 are set under the Hazardous Substances and New Organisms Act, the Agricultural Compounds and Veterinary Medicines Act and the Resource Management Act.

The use of 1080 and other poisons in New Zealand is mainly administered under four laws discussed below. At the absolute minimum, a poison must be registered under the Agricultural Compounds and Veterinary Medicines Act and be approved for use under the Hazardous Substances and New Organisms Act. Depending on the poison and the way it is to be used, other legislation may also apply. The aerial use of 1080 is controlled under 15 different laws.

Aerial 1080 is controlled under 15 different laws

The Agricultural Compounds and Veterinary Medicines Act 1997

Under this Act, poisons for the control of pests are defined as 'agricultural compounds'. The New Zealand Food Safety Authority administers the Act, and can register poisons, setting conditions on their use that must be followed by all operators.

The Hazardous Substances and New Organisms Act 1996

Under this Act, poisons need to be approved for use as hazardous substances. The Environmental Risk Management Authority (ERMA) administers the Act, and can set conditions and restrictions on the use of poisons to protect public health and the environment.

ERMA can also reassess the conditions placed on any poison. In 2007, the registration and use of 1080 was reassessed by ERMA.[73] The Authority approved the continued use of 1080 but strengthened the suite of controls on its use including the requirement that the details of all aerial 1080 operations be reported. Three recommendations were made for improved practice and communication, including consultation with all potentially affected parties before the operation takes place. This includes local iwi, hunting groups, commercial operators, and adjoining landholders.

Increased protections were placed around drinking water supplies. Any pest control operation that uses 1080 must obtain permission from the Medical Officer of Health, who can set restrictions on the operation to protect drinking water and public safety. The applicant must also consult with other regulators and demonstrate that they have complied with all other public health requirements.

Applicants must also get permission from DOC if the 1080 operation will occur on the DOC estate, in order to ensure biodiversity and conservation values are protected.

Anyone carrying out a 1080 operation is also required to notify all landowners and neighbours about an operation before it occurs. ERMA also publishes an annual report on the aerial use of 1080.

The Resource Management Act 1991

Pest control operations that use 1080 and other poisons must comply with the Resource Management Act (RMA) and council plans. Territorial local authorities are responsible for the management of any adverse effects from the use of hazardous substances, and the protection of the surfaces of lakes and rivers.

Regional councils treat poisons as contaminants under the RMA.[74] Use of 1080 and other poisons used in ground operations is generally classed by regional councils as a permitted activity, meaning resource consents are not required, as long as the operations comply with RMA requirements and plans. Seven councils also class aerial 1080 operations as permitted activities.[75]

Six regional councils class aerial use of 1080 as a controlled activity, meaning that the Council can impose additional conditions on operations provided they are in the Council's plan. Provided these conditions are met, the consent will be granted automatically.[76] Another five regional councils class aerial use of 1080 as a discretionary activity, meaning the councils may or may not grant the consent and can impose any conditions.[77] Councils generally apply the same activity status to the aerial discharge of poisons other than 1080.[78]

One of the conditions put on DOC's resource consent for the use of aerial 1080 by the West Coast Regional Council is a specified number of operations during the five-year time frame of the consent. Any additional 1080 operations above this number require a dispensation from the Council.

ERMA publishes an annual report on the aerial use of 1080

Under the pre-2007 Operative Regional Plan, the Manawatu-Wanganui Regional Council classed the aerial use of 1080 as a permitted activity. The plan explains that a simple rule, with few conditions, "*has been adopted to reduce unnecessary regulation of an activity that is adequately and properly controlled by other agencies.*"

The only opportunity for public input into the conditions for permitted and controlled activities is during the public consultation phase of the plan development. For a discretionary activity, public notification of an application for a consent may be required, although recent changes to the RMA have altered the conditions under which public consultation may be required.[79]

The Health Act 1956

Restrictions on the use of poisons to protect public health can be set under the Health Act.[80] These restrictions can be set by local authorities, and generally include measures to protect public drinking water supplies, such as establishing buffer zones around poisoning operations. They can also set requirements for the removal of any carcasses that may contain poison residues.

3.4 Are we losing the battle?

The AHB aims to eradicate bovine TB from New Zealand, through control of vector populations. It is achieving this by greatly reducing possum numbers in key areas, mostly through ground baiting and trapping on farms and forest margins.

DOC faces a much greater challenge. It must try to kill rats and stoats as well as possums, along with other pests such as cats. It must deal with a much greater range of terrain from small reserves near where people live to remote rugged back country.

Thirty percent of New Zealand lies within the conservation estate and only one eighth of it has any pest control at all. For example, almost no pest control is done within the spectacular Kahurangi National Park, yet much of it is beech forest and vulnerable to the destruction of mast events. There are some great biodiversity success stories on small intensively managed reserves, on remote offshore islands and behind predator-proof fences. But on the vast bulk of our conservation land, the battle is not being won.

This does not need to remain the case however. In the next chapter, a set of criteria are developed that can be used to judge how well different methods can control possums, rats, and stoats, particularly in our great native forests.

Source: Department of Conservation

Figure 3.6: Possums have not yet invaded the Copland Valley on the West Coast of the South Island, and southern rātā are still healthy and flower profusely. In comparison, possums have been present for 30 years in the nearby Karangarua Valley and most of the rātā trees are dead or dying.

4 Evaluating 1080 and its alternatives

In this chapter, a framework for evaluating 1080 and its alternatives is presented. This framework consists of nine criteria for judging how well a pest control method (or combination of methods) can deal with the enormous problem of controlling possums, rats and stoats on conservation land.

The nine criteria are presented in the form of questions about the effectiveness of, and concerns about, pest control methods. These questions are then used to evaluate 1080 and its alternatives in the following three chapters.

4.1 Assessing effectiveness

Five questions for assessing the effectiveness of a pest control method (by itself or used in combination with other methods) are presented in this section.

1. Can the method decrease populations of possums, rats and stoats?

The problem of pests on conservation land is not just a possum problem. Lowering a possum population often means more food for rats and stoats. In order to arrest the rapid decline of our special birds and other unique species, possums, rats and stoats all need to be controlled. An effective pest control method would decrease populations of all three predators.

2. Can the method increase populations of native species?

Killing predators does not necessarily lead to increases in populations of native species. A pest control method may accidentally kill individual members of species it is intended to protect. And a population of predators might rebound at a time when native species are particularly vulnerable – when fledglings are still in the nest, for instance. An effective pest control method will deliver a clear net increase in the populations of birds and other animals it is intended to protect.

3. Can the method rapidly knock down irrupting populations of pests?

A huge amount of damage is done to native birds and other animals in mast years when populations of rats and stoats irrupt. The problem is especially acute in beech forests. An effective pest method would ideally be able to be used fast and tactically to deal with these sudden increases in predators.

4. Can the method be used on a large scale in remote areas?

Possums, rats and stoats are damaging our natural heritage almost everywhere, from the coast to above the treeline and from small reserves to vast areas of remote rugged backcountry. The big challenge is the vast areas of remote rugged backcountry, where very little pest control is done now. A pest control method that is effective at meeting this challenge is needed if we are to win the battle on the mainland.

5: Is the method sufficiently cost-effective?

The effectiveness of a method cannot be considered without thinking about its cost-effectiveness. A pest control method might be 100% effective and safe but be so expensive that it could only be used on a few hectares. Only one eighth of the conservation estate has any form of possum, rat or stoat control on it. Greater protection of our native species must be viable in terms of costs.

4.2 Assessing safety and other concerns

Four questions for assessing concerns about pest control methods are presented in this section.

1. Does the method leave residues in the environment?

A pest control method should not leave any long-lived damage behind in the ecosystems it is aimed at protecting. It should leave no significant residues in water, in soil, in plants and in animals.

2. Can by-kill from the method be minimised?

As well as sometimes killing individual members of native species, a pest control method may kill individual members of non-target species such as dogs. A safe pest control method would be able to be managed so as to prevent such by-kill, or at least reduce it to very low levels.

3. Does the method endanger people?

People need to be protected as well as animals. A safe pest control method would be able to be managed to protect the health of those who apply the method, those who live near treated areas, and those who use treated areas for water, food or recreation.

4. Does the method kill humanely?

Although the aim of pest control methods generally is to cause death, the death should not be lingering and painful. A pest control method should kill possums, rats and stoats humanely. And while by-kill should be avoided or minimised, any by-kill should also be killed humanely.

4.3 Applying the framework

While a variety of methods are used to protect conservation land from pests, DOC sees the use of 1080 as an essential option for controlling possums, rats and stoats on much of the conservation estate.

The nine questions presented in this chapter are used in Chapters 5 and 6 to assess the effectiveness and safety of 1080. Alternatives – current and prospective – are assessed in Chapter 7.

5

Effectiveness of 1080

On much of the conservation estate, possums, rats and stoats are completely uncontrolled and are literally chewing the life out of our unique forests. This chapter assesses the effectiveness of 1080 in dealing with this problem by answering the five questions in Section 4.1, namely:

1. Can the method decrease populations of possums, rats and stoats?
2. Can the method increase populations of native species?
3. Can the method knock down rapidly irrupting populations of pests?
4. Can the method be used on a large scale in remote areas?
5. Is the method sufficiently cost-effective?

5.1 Can 1080 decrease populations of possums, rats and stoats?

Possums, rats and stoats are all very susceptible to poisoning by 1080. Possums and rats will eat cereal or carrot baits directly. Rats are more difficult than possums to lure into eating baits because they are wary of anything new, but this can be overcome through pre-feeding with non-toxic baits and other techniques. Stoats can be killed by 1080 if they eat poisoned rats and mice, which are a major part of their diet.

And when populations of rats and mice are knocked down, there is not enough food around for a stoat population to increase, which keeps stoat numbers down for longer. Thus 1080 dropped aerially can be used to decrease populations of all three pests in the same operation.

Kill rates for *possums* using 1080 generally range between 75 and 100 percent of the population, although they are now usually above 90 percent.[81]

Kill rates for rats using 1080 are often close to 100 percent.[82] But because of their high breeding rate, populations of rats can rebound relatively quickly.[83]

There is less information on kill rates for *stoats* using 1080 than for possums or rats. This is because the understanding that 1080 can kill stoats through secondary poisoning has developed relatively recently. Nevertheless, there is evidence that 1080 operations can kill most or all of a stoat population. In three different studies, individual stoats were fitted with radio-transmitters and monitored after 1080 operations. All the stoats monitored through these operations died, with 1080 residues found in all but one.[84]

Since the reassessment in 2007, details of all pest control operations that include the use of aerial 1080 are reported to ERMA. Since 2008, 233 individual applications of aerial 1080 (sometimes several applications make up one operation) have been reported to ERMA.[85] Of the 66 applications of aerial 1080 by DOC, 80 percent were monitored and of these 96 percent met their pest reduction targets.[86]

In most instances the AHB does not monitor the reduction in possum numbers after an aerial 1080 operation. Instead, the AHB monitors TB infection rates in cattle herds as the indicator of success.

Without massive ongoing effort and expense, eradication of pests is only feasible on offshore islands and within fenced sanctuaries. Even in these situations constant vigilance is required in case pests re-invade. The success of any 1080 operation on the mainland is only temporary – populations of pests can only be knocked down for a time.

How frequently aerial 1080 operations are repeated in an area depends on the pest that is being controlled. For possums, control is generally done every 5 to 10 years,[87] while for rats, the intervals are likely to be shorter – generally every 2 to 4 years. Ground control of pests using 1080 is often ongoing, with bait stations refilled with poison several times per year.

Source: Sid Mosdell

Figure 5.1: Kākāriki nest in tree holes, making them very vulnerable to rats and stoats who will eat mother birds, eggs and chicks. The impact is particularly bad in mast years when the huge increase in seed fuels an explosion of rat and stoat numbers. The years that should be boom years for kākāriki are instead the time of the greatest population decline.

A concern with any poison is the development of resistance in the few survivors, so care must be taken not to apply the same poison too often in the same area. To overcome this, different poisons may be alternated in the same operation. For example, in a ground operation 1080 may be used for several years and then a different poison like brodifacoum may be used for a year, before switching back to 1080. Resistance is less likely to be a problem after aerial 1080 operations because the poison is only in the environment for a short period of time and animals cannot be exposed to the repeated doses required to build up resistance.

5.2 Can 1080 increase populations of native species?

1080 operations can decrease populations of possums, rats and stoats, but what matters most is whether populations of native species subsequently increase as a result.

There is a solid and growing body of evidence that, when used well, 1080 leads to increases in a variety of native species. Gathering such evidence out in the field is challenging; a controlled experiment in the bush can never reach the gold standard of a double-blind randomised controlled trial. Nevertheless, over the years the evidence for increases in populations of native species and benefits to native ecosystems has steadily grown.

This evidence is based on a variety of different measurement techniques. For instance, to assess whether a particular bird population has increased, several techniques will be used to compare the birds in the area where the 1080 has been used with a nearby area where it has not been used. These techniques usually include monitoring specific nests to see how many chicks survive, tracking tagged adult birds, counting numbers of breeding pairs, and counting the total numbers of birds.

Many native bird populations have been successfully protected by reducing predator numbers through aerial 1080 operations. Whio, kererū, kiwi, tomtits, robins, kākāriki and mōhua have all responded well to pest control programmes using aerial 1080 operations, with increased chick and adult survival, and increases in population size.[88] Recent field trials have shown that aerial 1080 operations are likely to be able to protect kiwi populations from stoats far more effectively than the current labour-intensive methods of trapping and hand rearing of chicks (see Box 5.1).

Data on seedling survival, tree growth rates and foliage cover may all be used to work out if trees are responding to possum control. Studies have shown significantly better growth and survival for kāmahi, māhoe and tawa,[89] and tree fuchsia,[90] lasting for up to five years after an aerial 1080 operation. As possum populations rebound in the years following control, damage to trees will increase again.

Aerial 1080 has been particularly successful in the management of kōkako in the central North Island. Kōkako suffer heavy predation from introduced predators. Possums and rats eat nesting females, eggs and chicks, and very few kōkako pairs will successfully raise young in areas with no predator control. This predation also leads to a critical shortage of females, so that in unmanaged areas many ‘breeding pairs’ actually end up being male-male pairings.[91]

The kōkako 'rescue' took eight years. Populations of possums and rats were controlled using aerial 1080 for the first three years to initially knock down pests, followed by ground baiting with brodifacoum and 1080 to keep them at low levels.

The aerial 1080 operations reduced predators to low enough levels for nearly 50 percent of nests of kōkako to successfully produce young. In comparison, in areas with no predator control, only 14 percent of nests successfully produced young. In turn this meant that in areas with predator control, there were now young female kōkako that could replace the male-male pairs and create viable breeding pairs, increasing the population further.

Predator control reversed the population decline within three years and, by the end of the study, the population in areas with predator control had increased eight-fold. In two other areas in the study without pest control, populations of kōkako did not increase over the course of the study.

Box 5.1: Using 1080 to help kiwi

The greatest threat facing mainland kiwi populations is the killing of kiwi by predators. Kiwi chicks are especially vulnerable to stoat predation during the first six months of their lives. After this time, the chick is too big – at about one kilogram in weight – for a stoat to kill and it has a high chance of survival.[92]

Over the last two decades, this threat has been managed by removing kiwi eggs from the wild, hatching the chicks in captivity and raising them to a size where they will be able to fight off a stoat attack, before releasing them back into the wild. This technique can be very effective, but it is very expensive and labour-intensive and can only protect kiwi over relatively small areas.

However, recent trials by DOC in the Tongariro Forest in the central North Island have shown that aerial 1080 operations can protect kiwi populations, as well as other threatened species such as whio and pīwakawaka (fantails), over large areas. Before the 1080 operation, kiwi chicks in the forest had less than a 25 percent chance of surviving to six months of age. 1080 was dropped in the study site in September 2006 and rat and stoat numbers were reduced to very low levels. For the next two years, kiwi chick survival was more than twice as high as before the operation, and above levels required to keep the population stable. After two years, stoat numbers had increased again and chick survival dropped back to pre-control levels. Crucially however, the short-term increase in chick survival the 1080 operation provided was high enough to turn the population decline into an increase.[93]

DOC has another aerial 1080 operation planned for the area later in 2011, and will monitor chick survival again in the seasons following the operation.

Not all 1080 operations have been successful in increasing populations of native species. Some operations may simply have failed to kill enough pests. Others may have been mistimed so that predator populations were not low enough in spring when nesting birds and fledglings are especially vulnerable. In other cases, factors other than predation may limit growth in native bird populations, such as very low numbers of birds, making it hard for birds to find breeding mates.

For instance, low bird numbers affected the outcome of a 1080 operation in spring of 2006 in the Hawdon Valley in Arthur's Pass National Park. The goal of the operation was to protect populations of kākāriki karaka (orange-fronted parakeets). The aerial 1080 operation successfully reduced rat numbers to zero and follow up control with brodifacoum on bait stations kept numbers at that level over the following summer. The rat control was essential in protecting kākāriki karaka in the valley but the bird numbers were so low that no increases in their populations were seen. The researchers concluded that the populations of kākāriki karaka would require continued effective pest control as well as the reintroduction of captive-bred birds back into the study site to help increase numbers and opportunities for breeding.[94]

Source: Lee Thangyin

Figure 5.2: Kōkako have benefitted greatly from the use of aerial 1080. Without predator control, most female kōkako are killed while sitting on the nest.

5.3 Can 1080 rapidly knock down irrupting populations of pests?

A fast, tactical knockdown of possums, rats and stoats is often needed in the late winter or early spring to protect birds during the nesting season. The most difficult challenge occurs in mast years as described in Section 2.4. The sudden abundance of fruit and seeds in a mast year is followed by a sudden abundance of rats and mice which is then followed by a sudden abundance of stoats.

With modern techniques – such as pre-feeding with non-toxic baits, and using helicopters with GPS systems – aerial 1080 can knock down possum, rat and stoat numbers in areas of any size in two to three weeks, even during a population irruption.[95] Although rats breed up again relatively rapidly, the key is to time the use of 1080 so that vulnerable fledglings can leave the nest before rat, mouse and therefore stoat numbers increase again.

An example of the successful use of aerial 1080 in combination with ground baiting was the operation to protect mōhua in beech forest in the Dart and Caples Valleys in Otago.[96] The mast began in autumn of 2006. Brodifacoum was placed in bait stations in winter 2006, but it did not stop the rat population from increasing. To control the rat explosion, aerial 1080 was applied the following spring. As a result, rat numbers were dramatically reduced, and then were able to be kept at low levels by continued application of brodifacoum in bait stations. Mōhua were able to successfully breed and maintain their population size in this area.

Source: Department of Conservation

Figure 5.3: Helicopters are used to drop aerial 1080 in rugged areas that are difficult to access. A single helicopter, using a GPS system and mechanised loading, can cover thousands of hectares in one day and control possums, rats and stoats in the same operation.

In contrast, for the area not treated with poison, rat numbers doubled. In these areas mōhua survival was low and the population continued to decline.[97]

Possum populations do not respond in the same way as rats during a mast seeding because their breeding cycles are much longer – about one year – and generally only one young is produced at a time. This means that possum populations do not increase at the same high rates as rats, mice and stoats following mast seeding.

5.4 Can 1080 be used on a large scale in remote areas?

Much of the conservation estate consists of vast areas of steep hills and mountains that are difficult to access. For many of these areas the only options are to drop a poison from a helicopter, or a biocontrol method which will spread itself through predator populations.

1080 is the only poison currently licensed for aerial operations against both possums and rats on the mainland. The larger the area over which pests can be controlled, the longer it takes for their numbers to build up back to levels that threaten native species. The average size of aerial 1080 operations in 2009 was about 8,000 hectares, with the largest just over 46,000 hectares.[98]

In contrast, ground operations carried out by DOC typically cover areas of at most 4,000 hectares.[99] In larger areas, cost-effectiveness, terrain, and access mean that aerial 1080 is the only realistic option.

5.5 Is 1080 sufficiently cost-effective?

Budgets are always limited and the cost-effectiveness of different pest control options must always be considered.

Costs rise when targeting possums, rats, stoats

The cost per hectare of aerial 1080 operations is relatively constant because it is mainly made up of the cost of the bait and the helicopter. Over recent years the cost has been dropping, and an aerial 1080 operation including pre-feeding can now cost $12 to $16 per hectare.[100] The ability of aerial 1080 to control possums and rats (and therefore stoats) in the same operation gives it a real cost advantage over ground control.

In comparison, ground-baiting operations using 1080 (often in combination with other methods) vary greatly in cost. One important variable is terrain. Ground control of possums alone (not including rats and stoats) in easily accessible farmland can cost as little as $4 per hectare, but be as much as $40 per hectare on the bush-pasture edge. Costs will rise significantly if tracks, bridges and huts are needed for access; in rugged country or in areas with difficult vegetation cover, possum control can cost $80 per hectare or more.[101] Costs will also be much greater if rats and stoats are targeted as well as possums because additional traps or other control methods will be required.

In particularly rugged or difficult terrain, there may be areas that people just cannot get into and so predators in these 'pockets' will not be controlled. Predator populations will then recover more quickly and so ground control may be required more frequently than aerial control – for possums this may mean control every 2 to 3 years rather than every 4 to 7 years – pushing costs up further.[102]

DOC controlled possums over 29,000 hectares using aerial 1080 in the Cascade River region of South Westland in June 2010 to protect mistletoe and native bird populations. The operation used cereal baits and cost just over $12 per hectare to apply pre-feed and toxic baits over the area. Monitoring of possum populations after the operation cost a further $1 per hectare. The quoted cost to achieve the same level of control using ground 1080 was $44 per hectare with a further $4 per hectare to monitor the effectiveness of the operation.[103]

5.6 Conclusions

Over the years there have been many changes to the way in which 1080 is used to protect the conservation estate. A more tactical approach to its use, based on the greater understanding of the devastation played by rats and stoats as well as possums, is proving effective, not just in killing these predators but also in increasing the populations of native birds and other animals.

The case for the use of 1080 is very strong. 1080:

- can kill possums, rats and stoats in one operation
- can knock back predators for a time allowing populations of native species to increase
- can be used quickly to protect birds and other animals at vulnerable times, including during the particularly destructive beech masts
- can be used aerially so it can be applied over large remote rugged areas
- is more cost-effective than ground methods in the majority of the conservation estate.

As a pest control method targeting possums, rats and stoats, 1080 is particularly effective. However, like any pest control method there are downsides to 1080 as well as upsides, and there is considerable public concern about its use, especially when used aerially. In the next chapter the safety of 1080 and other concerns about it are examined.

6 Concerns about 1080

Ideally a pest control method would have no unwanted effects, but the reality is that all current pest control methods may cause problems. This chapter assesses the safety and other concerns about 1080 by answering the four questions in Section 4.2, namely:

1. Does the method leave residues in the environment?
2. Can by-kill from the method be minimised?
3. Does the method endanger people?
4. Does the method kill humanely?

In each section, the concern about 1080 is assessed. Examples of the many controls that have been put in place around the use of this poison are also presented.

6.1 Does 1080 leave residues in the environment?

Some poisons leave residues in water or soil or bioaccumulate[104] in plants or animals. 1080 is not one of these poisons in that it naturally breaks down in the environment and does not leave permanent residues in water, soil, plants or animals.

Water

1080 baits can enter waterways during aerial application. Once in water, 1080 is biodegraded into non-toxic by-products[105] within two to six days,[106] although the breakdown rate is slower in colder conditions.[107] However, under field conditions, dilution will usually reduce 1080 quickly to very low concentrations in water.[108] A field trial looking at leaching rates of 1080 from baits placed in streams found that 50 percent of the 1080 was leached from cereal baits within 2 hours, and 90 percent was leached within 24 hours.[109] Unlike the biological breakdown process, the leaching and dilution rate does not depend on the temperature of the water.

After aerial 1080 operations, water samples from both drinking water supplies and natural waterways are tested by Landcare Research for the presence of 1080. Most sampling takes place within 24 hours of the aerial drops.[110] From September 1990 to February 2011, 2,537 water samples have been tested,[111] with traces of 1080 found in 86 of the samples. None of these 86 samples had been taken from a drinking water supply.

Concentrations of 1080 in the 86 samples ranged from 0.1 to 9 parts per billion, with only six of these at or above the Ministry of Health trigger value of 2 parts per billion. None of the six had been taken from human or stock drinking water supplies, and four were likely to be 'false positives' due to accidental contamination.[112]

Soil

In soil 1080 undergoes the same two processes – biodegradation by micro-organisms and dilution following leaching from baits.

The rate at which 1080 biodegrades in soil depends on the temperature of the soil, the levels of bacteria and other micro-organisms present, and the amount of rain that falls. 1080 will be significantly broken down in one to two weeks under favourable conditions – that is, soil temperature between 11°C and 23°C and soil moisture between 8 and 15 percent.[113] In extremely dry and cold conditions, 1080 may remain in baits for several months.[114]

Rainfall will leach 1080 from baits left lying on soil and then dilute it down to undetectable levels – often faster than bacterial breakdown will.

Concentrations of 1080 in soil and leaf litter following three aerial 1080 operations were measured in a field study. Very low concentrations of 1080 were recorded in 6 out of 118 soil samples, at an average concentration of 0.01 mg/kg of soil.[115] Low concentrations of 1080 were found in leaf litter in two of the three study sites, with the highest level recorded being 0.19 mg/kg of leaf litter.[116] This concentration is between 200 to 500 times lower than that required to kill native insects such as ants and wētā.[117]

Source: Parliamentary Commissioner for the Environment archives

Figure 6.1: The 1080 in any baits dropped in water leaches out of the baits very quickly and is rapidly diluted to extremely low levels.

Plants

Plants can take up 1080 from the soil through their roots, and 1080 has been recorded in very low concentrations in a number of New Zealand plants including kāpuka (New Zealand broadleaf), kāramuramu, pūhā, and watercress.[118] Any 1080 that is taken up does not remain in the plants; rather the compound is broken down by the plants and is undetectable within one to two months.

In one trial 1080 baits were put at the base of kāramuramu plants.[119] The highest level of 1080 measured seven days later was 0.005 mg/kg of plant material. 1080 was undetectable after 28 days.[120]

In a similar field trial, 1080 baits were placed at the base of pūhā plants and nine of the ten plants took up some 1080. The highest level of 1080 recorded was 0.002 mg/kg of plant material, found three days after the 1080 was added. 1080 was undetectable in the pūhā 38 days later.[121]

Animals

Poisons used for pest control can also persist in the environment in the bodies of poisoned animals.

Animals that eat non-lethal doses of 1080 retain it in their body tissues and blood for a period of time. In general, concentrations of 1080 will peak and then drop over a matter of hours or days as it is broken down and excreted from the body. The time this process takes will depend on the species and the dose of 1080.

1080 does not leave permanent residues in the environment

It will take up to a week for all traces of 1080 to be eliminated from the bodies of poisoned possums.[122] There is no data available on how long deer or dogs take to eliminate 1080 following sub-lethal doses, although it is likely to be broadly similar to other mammals studied. Wētā, native ants and kōura excrete 1080 within one to two weeks.[123]

Although 1080 does not leave permanent residues in the environment, it does leave residues for a limited time. A number of the controls on 1080 exist specifically to reduce the risk of environmental contamination, particularly during aerial operations (see Section 6.3).

6.2 Can by-kill from 1080 be minimised?

By-kill is almost inevitable with any pest control method. 1080 is a broad spectrum poison and can kill native animals including birds, reptiles, frogs, fish and insects. It can also kill dogs, deer, pigs and other introduced animals.

By-kill is generally easier to limit for ground use of 1080 than aerial use. Bait stations containing 1080 (and other poisons) are attached to trees and have openings designed so that animals such as dogs and deer are not able to reach the bait inside.

Birds

Birds may be killed by eating baits directly and predatory birds, such as falcons, Australasian harriers, ruru and weka could be killed if they eat an animal that has eaten poisoned bait.[124] Individuals from 19 species of native birds and 13 species of introduced birds have been found dead after aerial 1080 drops. Most of these recorded bird deaths were associated with only four operations 35 years ago that used poor quality carrot baits with many small fragments.[125] Overall, far more bird deaths have been associated with the use of carrot baits rather than cereal baits.[126]

Although it is now infrequent, individual aerial 1080 operations can still sometimes affect local bird populations if not carried out with sufficient care. One relatively recent case is the death of 7 out of 17 monitored kea from 1080 poisoning following an aerial operation by the AHB in May 2008 in South Westland, where the helicopter dropped some of the 1080 above the bushline in kea habitat.[127]

Reptiles, frogs and fish

Reptiles, frogs and fish are all susceptible to 1080, although much less sensitive to it than mammals. A dose of 1080 equivalent to about three fully dissolved baits per litre would be required to kill a trout.[128]

Aquatic life

A field study to investigate the impacts of an aerial 1080 operation on native fish and stream insects was conducted on the West Coast in 2004.[129] Cereal 1080 baits were added to five different streams. Populations of longfin eels, kōura and upland bullies, and stream invertebrates were sampled before and after the 1080 was added. Enough 1080 was added to replicate the highest numbers of baits found previously in small streams following aerial 1080 operations. 1080 was recorded in all five streams at very low concentrations for up to 12 hours after the baits were added. No effect on any of the fish or insects in the study was found.

Insects

Insects are susceptible to 1080 poisoning. Some insects are attracted to baits, especially cereal baits, and will die if they consume them.[130] Some field trials have shown that insect numbers can be temporarily reduced within 20 cm of toxic baits, but numbers return to normal levels within six days of the bait being removed.[131] Other trials have found no evidence that insect communities are negatively affected.[132]

Dogs

Some people are particularly concerned about accidental deaths of dogs from 1080. Being natural scavengers, dogs are generally the most common pet to die after eating a poison.[133] The two most common poisonings in dogs are from anticoagulant rat poison and slug poison from domestic use.[134]

Since its re-assessment of 1080, ERMA's annual reports on the use of aerial 1080 contain lists of all incidents and complaints. Eight dogs have been reported to have died from 1080 poisoning since 2007. Two of those died where the operation was not adequately notified – a breach of standard operating procedures. There may be more incidents that have not been reported.

Considerable research is directed at developing poisons or bait types that will limit the secondary poisoning risks to dogs.[135]

Deer and pigs

Wild deer may eat baits directly, and pigs may eat baits or the carcasses of animals that have eaten baits. The proportion of the deer population that is killed in any operation depends on a number of factors, including the type of bait that is used, whether pre-feeding with non-toxic baits is carried out, and at what time of year the operation occurs.[136]

DOC has established eight designated recreational hunting areas where deer repellent may be added to the bait if 1080 is used.[137] 1080 is not used over the vast majority of the country where deer and other game species live. The way deer, pigs, chamois and tahr are managed on the conservation estate is expected to change with the establishment of the Game Animal Council (see Box 6.1).

Box 6.1: The proposed role of the Game Animal Council

The management of deer and other game animals is proposed to be split between DOC and the Game Animal Council. DOC would continue to manage game animals in areas where they have been identified as having major conservation impacts. The Game Animal Council would be responsible for the management of game animals for the remainder of the conservation estate.

The discussion paper on the Game Animal Council suggested that DOC and the council work together to identify priority areas *'where animals need to be actively controlled for conservation purposes'*. Outside these areas, the paper suggests the Council should be responsible for issuing permits for any activities that may kill or harm game species.

Because of the risk of by-kill that 1080 poses to deer, it is not clear what would happen if an agency wishes to use 1080 to control possums, rats and stoats in areas managed by the Council.

Responding to concerns

Public concerns about the risk of by-kill have been one of the main drivers of improvements in the way aerial 1080 is used.

Average sowing rates of 1080 cereal baits have steadily fallen from over 30 kg of bait per hectare in the 1950s to under 2 kg of bait per hectare today – equivalent to about four baits in an area the size of a tennis court (see Figure 6.2). Baits are now dyed green or blue to make them less attractive to birds, and deer repellent can also be added.[138]

Bait design and delivery has also been improved. Small pieces of carrot bait ('chaff') are easy for a bird to eat. The 2007 ERMA reassessment introduced specific controls on the use of carrot baits to reduce the risk of by-kill, including a minimum size for carrot baits and requirements for the removal of chaff. DOC now rarely uses carrot baits in aerial 1080 operations in native forests, although the AHB may, and carrot baits are still used for the control of rabbits in open country.[139]

The average sowing rate of carrot baits from operations targeting possums in forests is now around 3.5 kg per hectare.[140]

Research is currently underway to develop protocols and methods to reduce the risks of 1080 operations to native species. For example, protocols to protect kea during aerial 1080 operations are being developed by DOC. To date, 23 individual kea have been monitored through aerial 1080 operations since the new protocols have been introduced and no kea have been poisoned.[141]

Figure 6.2: The average amount of bait containing 1080 dropped aerially on forests has fallen steadily over the last four decades.[142]

Landcare Research, along with DOC and the AHB, is also conducting trials looking at reducing sowing rates to just 250 grams of 1080 baits per hectare – an eighth of the current sowing rates.

Many of the controls on the use of 1080 are aimed at limiting by-kill, and serious cases of by-kill such as those that occurred with native birds in the 1970s are now rare. But as with any regulations, human error and non-compliance mean that all 1080 operations will not be carried out exactly as specified in regulations, and so the risk of by-kill as with any poison cannot be completely eliminated.

6.3 Does 1080 endanger people?

1080 will kill people if they consume enough of it, either by eating 1080 baits directly or by consuming contaminated food or water that contains 1080. At the highest concentrations of 1080 in baits, eating about seven baits could kill an adult and one bait could seriously harm a child.[143]

However, in the 60 years of use of 1080 in New Zealand, there are no known records of any deaths from people consuming baits from the field use of 1080.[144] There is one case from New Zealand in the 1960s where it appears a possum hunter died after eating 1080-laced jam bait – a bait that is now banned[145] – that was present in his home.[146]

Risk of death from environmental contamination

There are no records of any deaths associated with drinking water or eating wild food after a 1080 operation.

1080 residues have never been recorded in public drinking water supplies. And the highest recorded concentration in any other water sample following a 1080 operation is 9 parts per billion (see Section 6.2). At this concentration an adult would need to drink thousands of litres of water at one time to risk death.[147]

In one trial, eels were fed possum meat contaminated with 1080 to simulate an eel eating a poisoned possum carcass that had fallen into water. The recorded concentrations of 1080 in the eel tissue mean that an adult would have to eat about five tonnes of eel in one meal to risk death.[148] Similarly, an adult would need to eat at least 100 kg of venison from poisoned deer or 30 kg of kōura tails in one meal to risk death.[149]

1080 residues have never been recorded in public drinking water supplies

For plants at the highest recorded concentrations of 1080, an adult would need to eat 28 tonnes of kāramuramu, or 9 tonnes of pūhā or 2 tonnes of watercress at one meal to risk death.[150]

Risk of illness from environmental contamination

With current management practices, the risk of people becoming sick from drinking water or eating food containing 1080 is very small. For instance, to risk illness from non-lethal doses of 1080, an adult would have to eat about half a kilogram of eel containing the 1080 concentrations in the trial cited above every day for 90 days.[151] However, 1080 eaten by live eels is broken down and excreted in two to three weeks.

Many laboratory trials have been conducted to determine if 1080 can cause non-lethal effects.

Trials with mice and rats have found that non-lethal doses of 1080 do not cause DNA mutations in individuals or their offspring, and do not cause cancer.[152] Trials have also determined that 1080 does not disrupt the hormone systems of fish and mammals, including humans.[153]

Studies of the effect of 1080 on rats, ferrets, ducks, starlings, lizards, and invertebrates have shown that repeated non-lethal doses of 1080 can damage organs such as the heart, muscles and testes.[154] Studies with rats have also shown that prolonged exposure to high doses of 1080 may affect the development of unborn young.

The same types of effects could potentially occur in people if they were exposed to high enough doses of 1080 over a long enough period of time. However, it is important to note that these results all come from laboratory studies where animals were dosed with 1080 over long periods.

Source: Parliamentary Commissioner for the Environment archives

Figure 6.3: A cereal bait containing 1080. After an aerial drop there are about four of these baits on an area the size of a tennis court. They are dyed green to make them less palatable to birds, and a deer repellent can also be added.

Controls on 1080 to protect people

Overall, the presence of 1080 baits in the environment poses very little risk to people. This low risk is due to a combination of the properties of 1080 and the way it is managed. Very small amounts of 1080 are applied in pest control operations. Any residues remain in the environment for a short length of time. The series of controls on the use of 1080 virtually eliminate the chance of the public accidentally coming into contact with 1080 baits or residues.

Nevertheless 1080 is a poison, and there are many controls on its use to protect people during and after aerial 1080 operations. For instance:

- The Health Act specifically prohibits the contamination of any drinking water supply, and regional councils place restrictions over the application of 1080 around water bodies. Aerial operations must avoid water supplies – including restrictions on flights near water supplies by aircraft transporting 1080. Depending on the situation, intakes to drinking water supplies may need to be closed and monitored for the poison during aerial 1080 operations, and an alternative drinking water supply provided. Water cannot be taken from a water supply until monitoring has shown that 1080 is not present.[155]

- There are controls on how long after an aerial 1080 operation that people should not commercially harvest food from an area and this period must be clearly stated on signs and public notices. The withholding period for aerial 1080 is based on a minimum period of six months plus an additional period based on the length of time baits and poisoned possum carcasses take to break down at the site.[156] The agency carrying out the operation must monitor the breakdown of baits and carcasses in the operational area to determine if the withholding period needs to be modified. The warning signs cannot be removed until monitoring has shown no 1080 is still present.[157]

- Under the Hazardous Substances and New Organisms Act 1996 and the Health and Safety Act 1992 there are controls in place to protect those who prepare baits and carry out 1080 operations. Anyone handling 1080 must be properly trained and wear suitable protective clothing. 1080 must be packaged and transported in clearly labelled secure containers. Exposure limits for contact with 1080 have been set,[158] and the health of all workers must be monitored regularly.

6.4 Does 1080 kill humanely?

Determining the humaneness of different pest control techniques is not an absolute science. Humaneness is a relative measure that is based both on the time it takes a poisoned animal to lose consciousness and on the nature and severity of symptoms it experiences. Humaneness is also a somewhat subjective measure, and different people may have different opinions on how humane a particular pest control method is.

A recent report commissioned by the National Animal Welfare Advisory Committee (NAWAC) rated the relative humaneness of 1080 and other pest control techniques used in New Zealand.[159] The results of the NAWAC report form the basis of the humaneness assessments in this report. The NAWAC report rated 1080 as moderately humane.

1080 works by interrupting the body's energy production systems: an animal's cells are starved of energy and subsequently vital functions in the body stop. 1080 acts on different animals in different ways. Herbivores usually die of heart failure, whereas carnivores are more likely to suffer convulsions and respiratory failure.

National Animal Welfare Advisory Committee report rated 1080 as moderately humane

The symptoms poisoned animals display also differ. Possums stop eating within an hour of consuming 1080, become lethargic and die between 5 and 40 hours later, depending on the dose consumed.[160] Rats can show pain-related behaviours such as increased grooming and stomach scratching, altered breathing, un-coordination and convulsions.

Deer have been recorded as becoming lethargic and lying down quietly without convulsions or leg-thrashing. However, researchers have noted that behavioural responses in deer to poisoning must be interpreted cautiously. This is because deer are known to frequently show no symptoms when in pain.[161]

Dogs, stoats, and ferrets have all been observed to go through states of fitting and uncoordinated movement to difficulty in breathing, lethargy, and paralysis. Vomiting can also occur.[162] It is not clear how much carnivores suffer during poisoning, as there is some evidence that they lose consciousness well before death occurs.[163]

The suffering of animals killed by 1080 can be reduced in two ways. First, baits can be designed to contain enough 1080 to ensure that they eat enough to die as quickly as possible. Second, painkillers may be added to baits.[164] Currently baits contain doses at levels that increase the likelihood of a fatal dose, but painkillers are not added to them.

There is no known antidote to 1080 poisoning, although veterinary treatment can reduce suffering in poisoned animals.[165]

6.5 Conclusions

1080 is a poison and like any poison has risks associated with its use. Many people are concerned about its safety and humaneness, although it is the most regulated pest control poison used in New Zealand. 1080:

- leaves residues for very short times in the environment, with one exception – it can linger in carcasses of poisoned animals under very cold and dry conditions for some months
- can still cause by-kill of both native and introduced animals, and although techniques are increasingly being used to reduce this risk, there is no way to protect uncontrolled dogs
- does not endanger people provided it is used as prescribed in regulations
- kills different animals in different ways, but is not the most inhumane pest control poison as will be seen in the next chapter.

7 How do the alternatives stack up?

Many of those concerned about 1080 believe or hope that there are alternatives to its use, and millions of dollars of funding has gone into research on potential alternatives. One common view is that it is the best we have until alternatives become available.

But what is the real prospect of alternatives? The Department of Conservation often refers to 1080 as *"one of the tools in the toolbox"*. This is certainly the case for ground control of pests where 1080 is alternated with other poisons in bait stations. But 1080 is the only poison that is used in aerial operations to control possums, rats and stoats in the bush, so it is not really just *"one of the tools"*.

In this chapter three groups of alternatives to 1080 are assessed – trapping, poisons and biological control. As far as is possible, they are assessed against the effectiveness, safety and humaneness criteria laid out in Chapter 4.

7.1 Trapping

For many people, trapping is associated with the cruel and now banned gin trap. Over two decades, traps have been developed to kill pests more efficiently and humanely, and to reduce the risk of accidental by-kill. However, this means that when different pests are to be controlled, a different type of trap will be needed for each one.

Possums, rats and stoats can all be killed with traps. However, an intensive ground operation will typically involve trapping possums and stoats, but poisoning rats because there are so many more of them.

In a mast event, populations of rodents rapidly increase as much as ten-fold, and traps simply cannot be deployed rapidly enough or in sufficient numbers to knock them down.

Ground operations of which trapping is an important component have been shown to help populations of native birds.

Some terrain is too rugged or dangerous for trapping, and trapping is not practical on a large scale. In one day a single trapper can check traps on tens of hectares, whereas an aerial 1080 drop can cover tens of thousands of hectares.

Once a trap has 'snapped' it will not catch another animal unless it is reset. Traps need to be checked and reset regularly, which makes them labour-intensive.

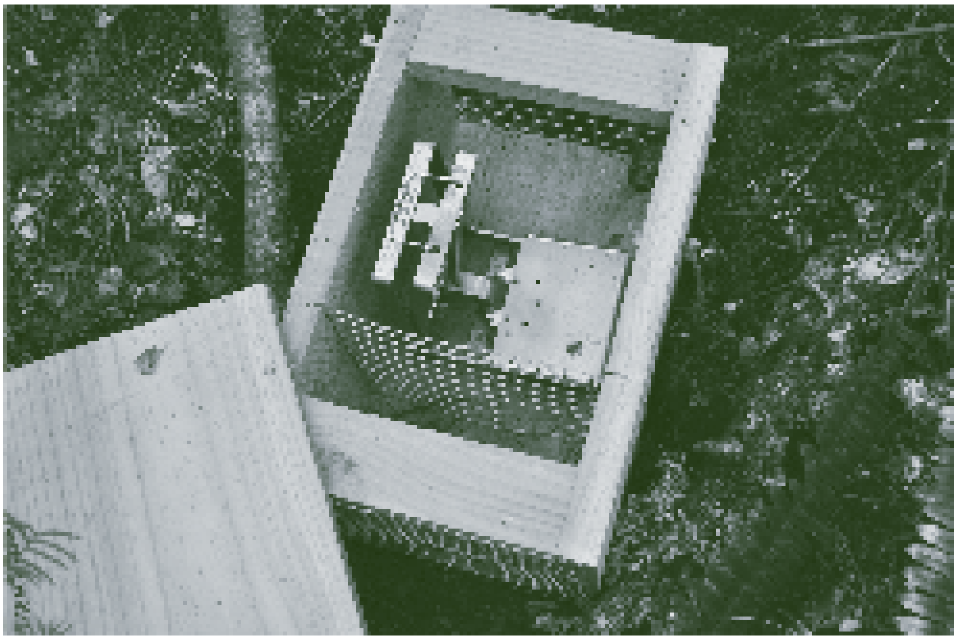
Self-resetting traps are being developed and trialled and could in the future significantly reduce labour costs and increase the cost-effectiveness of ground control operations.[166]

Traps do not leave residues in water or soil, but may be abandoned to rust away.

23 species of native birds have been reported as having been killed by leg-hold traps[167], and many kiwi have suffered leg or beak damage.[168] These traps are now required to be set up off the ground on conservation land where kiwi or weka live, and this has reduced by-kill from these traps to very low levels.[169]

Leg-hold traps capture an animal alive and hold it until it is killed by a trapper, so are considered to be less humane than kill traps. Kill traps are now widely used and should comply with welfare standards.[170] However, a recent assessment of 23 commonly used kill traps found that only 13 met the standard.[171] By-kill from kill traps is low because they have to be set under covers.

Trapping can be a safe and effective method to control possums and stoats in forest edges, along rivers, and in intensively managed patches of forest, but it can only ever play a supplementary role on the great majority of the conservation estate.



Source: Parliamentary Commissioner for the Environment archives

Figure 7.1: Kill traps are designed to quickly kill specific pest species. They are set under covers to stop non-target animals getting killed in the trap.

7.2 Poisons

In this section, poisons other than 1080 that are commonly used are discussed, followed by three poisons that are likely to be in use soon. The ones in current use are pindone (and other first generation anticoagulants), brodifacoum, cyanide, and cholecalciferol. The three that are likely to be in use soon are PAPP, zinc phosphide, and sodium nitrite.

Although there are a number of research projects underway investigating other poisons for pest control, these alternatives are a long way from any potential use and any discussion would be premature.

None of the poisons discussed in this section are used in exactly the same way as 1080. Therefore, it is not possible to judge them against the criteria as fully as 1080 has been assessed in Chapters 5 and 6. It is possible however, to assess many of their fundamental properties and highlight where they do, or can be expected to, perform better or worse than 1080 in controlling possums, rats and stoats.

Pindone (and other first generation anticoagulants)

Pindone is a poison that works by stopping the blood from clotting. These poisons, known as anticoagulants, have been used for a long time to control rats and mice. Pindone is a first generation anticoagulant. First generation anticoagulants require pests to feed on the poisoned bait repeatedly over days in order to accumulate a lethal dose. (In contrast, second generation anticoagulants are powerful enough to kill pests after taking one bait.)

Diphacinone and coumatetralyl, along with pindone, are the other first generation anticoagulants most commonly used for pest control. These poisons are used in bait stations to control rats. Pindone is the only one allowed for aerial use and is sometimes used for large-scale rabbit control by councils and private landowners.

First generation anticoagulants will kill possums[172] and rats (and mice) and because they are slow to break down in carcasses of dead animals, will also kill stoats through secondary poisoning. An advantage of anticoagulants is that rats do not develop bait shyness; because it takes a long time for the poison to work, they do not learn to associate poisoning with the bait.[173]

First generation anticoagulants can't be used tactically to knock down rats and mice during a mast event

Because first generation anticoagulants are generally used in bait stations, they contribute to the increase of native species in forests in intensive ground control operations.

First generation anticoagulants cannot be used tactically to knock down rapidly irrupting rats and mice during a mast event for two reasons - they kill too slowly and multiple feeds would be required.

Pindone is licensed for aerial use and therefore could be used to kill possums, rats and stoats on a large scale in remote rugged backcountry, but it is not used this way because the risks associated with its use are greater than the risks associated with using 1080.

Anticoagulant baits are generally more expensive than 1080 pellets, but the cost of operations using first generation anticoagulants is largely driven by the cost of labour involved in setting and refilling bait stations. For instance, controlling rats in forests during normal bird breeding seasons (not mast years) using first generation anticoagulants in bait stations requires the bait stations to be visited six or seven times to restock the stations with baits.

Anticoagulants break down very slowly in water and soil. They also accumulate in the liver tissue of live animals that have been exposed to the poison (either by eating bait or feeding on an animal that has eaten bait) and in carcasses.

Anticoagulants are considered to be very inhumane because they are slow and painful killers.[174] A rat takes 5 to 8 days to die after a deadly dose of diphacinone, and during that time suffers severe internal bleeding that is likely to cause extreme pain.[175]

By-kill of native species is a significant risk from the use of first generation anticoagulants. Birds that have been found dead after pindone operations in open habitats for rabbits, including plovers, rails, wrybills, Southern black-backed gulls, Australasian harriers, silvereyes and grey warblers. In most cases the actual cause of death is unknown as testing for residues has rarely been done. However, pindone residues have been found in Australasian harriers, Southern black-backed gulls and Moko skinks after pindone operations.[176]

First generation anticoagulants can affect people – indeed warfarin as been used medically for many years as a blood thinner. However, they are generally less toxic to people than 1080.[177] Accidental poisoning with anticoagulants can be treated with Vitamin K1.[178]

Brodifacoum

Brodifacoum is a second generation anticoagulant, so is powerful enough to kill pests after taking one bait. Its effectiveness, however, comes with a cost – long term persistence in the environment and very high risk of by-kill.

Brodifacoum is licensed for killing possums and rats. Like 1080, it will kill stoats that feed on poisoned animals. It has been successfully used in aerial operations to completely eradicate possums and rats and stoats on several offshore islands and fenced 'mainland islands' that are now sanctuaries for endangered animals.[179]

By-kill of native species is a significant risk from the use of anticoagulants

On the islands where it has been used aerially, brodifacoum has clearly increased populations of native species because it has eradicated the pests that prey on them. An example is Ulva Island off Rakiura/Stewart Island. DOC cleared Ulva Island of rats in 1997, and since that time populations of rare birds like tīeke (South Island saddlebacks), toutouwai (Stewart Island robin) and mōhua have been successfully established on the island.[180] Rats reinvaded the island in 2010, and DOC is currently planning an aerial brodifacoum operation to eradicate them again.

Brodifacoum could potentially be used to knock down populations of rapidly irrupting rats and mice (and therefore stoats) during mast events, although it is unlikely to be as effective as 1080.

This is because brodifacoum would not be used aerially to control a mast on the mainland, and because of the behaviour of rats and mice. When using brodifacoum on the mainland, DOC ties it into bait stations to reduce the risks of by-kill from spilled bait. When seeds are abundant during the mast, rats appear to prefer this 'takeaway' food that they can pick up and carry away to a safe place to eat it, rather than eating brodifacoum baits at a bait station.

Like 1080, brodifacoum could be used aerially to control possums, rats and stoats over large remote rugged areas, but the Department of Conservation does not use it in this way on the mainland because of the risks associated with its use.

Brodifacoum is more cost-effective than first generation anticoagulants when used in ground operations because bait stations do not need to be replenished nearly as often. The cost of an aerial brodifacoum operation – in situations where it can be used this way – is broadly similar to an aerial 1080 operation. However, on the mainland brodifacoum is effectively only used in bait stations, meaning an aerial 1080 operation will often be a far cheaper option.

Brodifacoum is considered an extremely inhumane poison

Brodifacoum takes a very long time to break down in soil and water and accumulates in the tissue of exposed animals for years.

Consequently, there is a very high risk of by-kill – at least 21 species of native birds including kiwi, kākā, kākāriki and tūī are known to have been killed by brodifacoum.[181] An area where brodifacoum has been used must be closed for hunting for three years after the operation. In comparison, an area must be closed for four months following an aerial or ground 1080 operation.[182]

Brodifacoum is considered an extremely inhumane poison.[183] It takes up to 21 days for a possum to die after a deadly dose of the poison and it is thought to cause severe pain.[184] Rats can take a week to die after eating a deadly dose of brodifacoum.[185]

As with the first generation anticoagulants, accidental poisoning with brodifacoum can be treated with Vitamin K1.

Cyanide

Cyanide has been used in New Zealand since the 1940s and is licensed for killing possums and wallabies. It is a highly lethal, broad-spectrum poison that depletes cells of energy, quickly resulting in respiratory arrest and death.[186]

Cyanide kills possums and will kill rats (and mice) that eat bait laid for possums. But because it kills so rapidly and breaks down very quickly in carcasses, it is very unlikely to kill stoats through secondary poisoning. Some forms of cyanide bait lose their toxicity quickly; this lowers effectiveness and leads to bait shyness as more animals receive a sub-lethal dose and learn to avoid the bait. Some animals can detect cyanide by its smell.

Encapsulated pellets of compressed cyanide increase its effectiveness because the pellets prevent the animal smelling the cyanide and remain toxic for longer. The results of possum control operations using cyanide are highly variable with kill rates ranging from 28 to 100 percent.[187]

Cyanide is one of the poisons used in bait stations so contributes to the increase in native species that follows ground control operations.

Like other poisons only used in ground operations, cyanide cannot be used tactically to knock down rats and mice during a mast event.

Because it is so lethal, it seems impossible that cyanide would ever be approved for aerial operations, so it could never be used for pest control on a large scale in remote rugged areas.

While cyanide itself is very cheap compared to 1080, the encapsulated bait pellets that give the best delivery results are more expensive.

Cyanide is very volatile and does not leave residues in water and soil or in the carcasses of animals it has killed. Because it is so volatile it can lose its toxicity too rapidly making it ineffective, as discussed above.

High by-kill of native species (including kiwi, kea, weka, and bats) following cyanide operations has been reported in the past, particularly when cyanide paste has been laid by hand. Cyanide will not kill dogs for the same reason it cannot kill stoats – it breaks down so quickly in poisoned animals that secondary poisoning is very unlikely to occur.

Because it's so lethal, it's unlikely that cyanide would ever be approved for aerial operations

Cyanide is more humane than other poisons used for controlling possums because it kills very quickly – within minutes.[188] The short time to death makes it the poison of choice for fur harvesters as animals die close to the bait stations and are easily found.

Cyanide is lethal to humans and while there are antidotes to cyanide poisoning, their effectiveness is controversial and the rapid action of the poison limits the time in which they can be used.[189]

Cholecalciferol

Cholecalciferol naturally occurs as Vitamin D3 in many foods including fish. It was developed as a poison to control rats and mice in the 1980s. It works by leaching calcium from the bones of the poisoned animal into its blood stream leading to organ failure.[190]

Cholecalciferol is licensed for controlling possums and rats and is only used in bait stations. While residues can be found in sub-lethally exposed animals for 3 months, the levels are too low to lead to secondary poisoning of stoats.[191]

Like other poisons used in bait stations, cholecalciferol contributes to the increase in native species following intensive ground operations.

Because it is only used in ground operations and will not kill stoats, and because poisoned rodents take a long time to die, cholecalciferol cannot be used to deal with mast events.

For the same reasons, it cannot be used to control pests on a large scale in remote areas.

Cholecalciferol is more expensive to produce than 1080. Some promising results have been obtained by combining cholecalciferol with other substances such as aspirin to make it more cost-effective and faster acting.[192] Combining the active ingredients in coumatetralyl with cholecalciferol is also being investigated as a potential new poison.

Although cholecalciferol itself is broken down rapidly by sunlight and exposure to moist air, the baits containing it can take a long time to break down and release the poison – up to two years in trials.[193]

The risk of by-kill is considered low, especially as trials have shown that birds are less sensitive to this poison, and that invertebrates do not appear to be affected by it.[194] However, dogs are sensitive to the poison.

Cholecalciferol is considered to be extremely inhumane. It takes a long time for animals to die – possums take up to ten days - and is thought to cause severe suffering.[195]

No specific antidote exists for cholecalciferol; however, intensive treatment including the use of charcoal and saline solution can reverse the effects of poisoning.[196]

Para-aminopropiophenone (PAPP)

Para-aminopropiophenone, known as PAPP for the obvious reason, is a new poison developed to control stoats, weasels, and feral cats.[197] It kills by preventing red blood cells from carrying oxygen, and was approved and registered this year.

PAPP kills stoats directly, but not possums and rats. It is approved for use in paste form or in fresh minced meat, so will only provide effective stoat control as part of intensive ground control.

While PAPP is clearly a useful new weapon in the battle against pests, it cannot substitute for 1080.

While PAPP is a useful new weapon in the battle against pests, it can't substitute for 1080

PAPP does not leave residues in soil or water or bio-accumulate in animals so the risk of by-kill through secondary poisoning is low. It is thought to be relatively humane because poisoned stoats lose consciousness after about 17 minutes and do not appear to suffer painful symptoms.

A research project is underway aimed at developing self-setting delivery systems that could improve the efficiency of this control method, and indeed others, in the future. One possibility is a tunnel through which a stoat would run triggering a device that would spray the poison on to its fur, which the stoat would then lick off.[198]

Zinc phosphide

Zinc phosphide has been widely used overseas for decades, predominantly to control rats and mice on agricultural land. It causes death by heart or respiratory failure.[199]

Zinc phosphide may soon be approved by ERMA for ground control of possums and rats. It could potentially be registered for aerial control of possums and rats. It does not bioaccumulate in the tissue of poisoned animals,[200] so is unlikely to kill stoats through secondary poisoning.

Zinc phosphide is highly toxic and will kill birds and other animals, including fish, but acidity in moist soil or water oxidises and breaks it down over days to weeks.[201]

Zinc phosphide will kill possums and rodents within 24 hours.[202]

Zinc phosphide is considered moderately humane, similar to 1080[203] and there is no antidote.[204]

Sodium nitrite

Sodium nitrite is a naturally occurring substance commonly used as a meat preservative but toxic at higher doses. It kills in a similar way as PAPP, by reducing the ability of red blood cells to carry oxygen.

Research has shown that sodium nitrite could be an effective and affordable poison for the control of possums and feral pigs, and registration is currently sought for ground control of these pests. Sodium nitrite is unlikely to be effective for controlling rats. This is because animals need to eat large amounts of this poison in one feed due to its relatively low toxicity - much more than a rat will eat. It will also not kill stoats through secondary poisoning because it does not bioaccumulate.

Because sodium nitrite is biodegradable and does not bioaccumulate in poisoned animals, the risk of by-kill is low. It is regarded as humane, and an antidote is available should accidental poisoning occur.

Sodium nitrite may become widely used in ground and possibly aerial operations for killing possums, and thus could become particularly useful for the AHB.

7.3 Biological control

Biological control (biocontrol) methods involve controlling pests with biological agents, such as natural predators and parasites, or the use of organisms that cause disease-like viruses, bacteria and fungi. In theory, a successful biocontrol method could decimate or even eliminate pests over large inaccessible areas.

The introduction of stoats and ferrets into New Zealand as a biocontrol method for rabbits clearly did not work and has had a devastating effect on native animals. Bringing in new predators to prey on possums, rats and stoats is not an option.

However, in recent years a number of research projects have been directed at different biocontrol methods for reducing the fertility of possums. No work has been carried out in New Zealand to develop biocontrol methods for rats or stoats.

Two main approaches for the biocontrol of possums have been taken – contraceptive vaccines and hormone toxins.

Contraceptive vaccines

The proposed contraceptive vaccines use genetically modified organisms to trigger a possum's immune system to attack its own reproductive system, thus making the possum infertile.[205] Several ways of delivering such a vaccine have been investigated.

- Genetically engineered empty bacterial cells (called 'bacterial ghosts') or components of viruses (virus-like particles) trick the possum's immune system into attacking its own reproductive function. This makes the possum less fertile or infertile. These biological agents would not be able to reproduce and spread themselves through the possum population. Instead, they would need to be delivered in baits in the same way that poisons are.[206]
- Plants can be genetically engineered to produce molecules that would make possums less fertile.[207] Research has focused on crops such as carrots that would be fed as baits to possums.[208]
- A parasite worm that is specific only to possums has been identified. These worms could be genetically engineered to cause possums' immune systems to attack their own reproductive cells. Such a parasite would remain alive, and therefore transmit through possum populations and persist indefinitely in the environment.[209] It is possible, but unlikely, that a genetically engineered version of the worm could make its way back to Australia where it could also impact their native possum populations.

Hormone toxins

This approach involves using a modified hormone to carry a toxin to cells that produce the possum's fertility hormones.[210] The toxin would kill only those cells and cause the possum to become sterile.[211] The main hormone that was being investigated is not specific to possums, which would make the method suitable for controlling other pests, but may put other animals at risk too. Such a hormone could be put in bait, which would not involve genetic engineering. Alternatively it could be transmitted through the possum population by the parasitic worm mentioned above. In this case, the worm would be genetically engineered to produce the hormone toxin.

Significant research effort and resources were put into these biocontrol options,[212] but all funding ceased in September 2010 after progress was deemed too slow and a research milestone was not met. Other factors were doubtless at play, such as the risks associated with the uncontrollable and irreversible release of biological control agents and the controversy over genetic engineering.[213]

Biological control options cannot be considered as a realistic alternative to 1080 in the foreseeable future.

7.4 Conclusions

The alternative methods currently used for pest control all have their place. Different methods are selected for particular characteristics that suit particular situations.

Trapping can be cost-effective in forested margins and patches, but not over large inaccessible areas. Current advances with self-resetting traps will reduce costs because trapping is so labour intensive. While possums and stoats may be successfully controlled with traps in these relatively small areas, high influxes of rats are impossible to keep at bay with traps.

Alternative poisons are currently only able to be used in ground operations, apart from the occasional use of brodifacoum under very specific conditions for exterminating rodents, and the use of pindone to control rabbits. This means that, like trapping, these poisons can only be used in relatively small accessible areas. Moreover, if they can be used in ground control over larger areas, they will inevitably be less cost-effective than 1080 because of the labour costs. Having a suite of poisons that can be used in ground operations is important for avoiding bait shyness and the build-up of resistance.

- Anticoagulants are generally very effective at controlling rats to keep their numbers low but cannot effectively deal with sudden population surges. Anticoagulants are also the most inhumane of the poisons currently used. Different types of anticoagulants need to be rotated to avoid populations becoming bait-shy or building up resistance.
- Brodifacoum will kill stoats as well as possums and rats because it bioaccumulates in the tissue of poisoned animals. It is very slow to break down in the environment, so while it is very effective, the risk of by-kill is very high.
- Cyanide is used to kill possums and does so quickly and humanely. But its effectiveness varies because of bait shyness. Cyanide breaks down quickly and does not leave residues in the environment, but this means it does not kill stoats through secondary poisoning. Ground-laid cyanide has killed native species and other animals in the past and it takes only a tiny amount of cyanide to kill a human.
- Cholecalciferol will reduce populations of possums and rats, but not stoats since it does not bioaccumulate in animals. It breaks down readily in the environment and the risk of by-kill is considered to be low. Cholecalciferol is very inhumane.
- PAPP is a new poison designed to kill stoats humanely. Its mode of operation means that it will not kill possums and rodents. The risk of by-kill is likely to be low since it does not leave residues in the environment.
- Zinc phosphide may be approved for ground control of possums and rats in New Zealand, but will not kill stoats because it breaks down quickly in the environment and in poisoned animals. By-kill would be expected to be low.
- Sodium nitrite is expected to be used for killing possums, but not rats. It will not control stoats because it will not knock down rat populations or bioaccumulate in poisoned animals. It does not leave residues in the environment and the risk of by-kill is expected to be low. It is much more humane than 1080.

Biological control methods for killing possums, rats and stoats do not currently exist. Research projects aimed at developing such methods made very slow progress and have now ceased. Most of these methods involved some form of genetic engineering, and if developed further would attract a great deal of public opposition.

Although there are other methods that are effective in particular situations, the only practical and cost-effective option that is available for controlling possums, rats and stoats in large and inaccessible areas is an aerially delivered poison. And there is no alternative poison available now or in the near future that could be used aerially and would be preferable to 1080.

8

Conclusions and recommendations

8.1 No moratorium on 1080

The native plants and animals in New Zealand are unique because they have evolved in almost total isolation from the rest of the world. This makes them particularly vulnerable to predators because they have not developed defences against them. In particular, because there were virtually no native land mammals, the invasion of small mammals that followed the arrival of Europeans requires constant vigilance and effort. Possums, rats and stoats are increasingly damaging our national parks and other conservation land, and possums, rabbits and hares lower the productivity of our agriculture and forestry.

Traps and bait stations play a crucial role. But it is a limited role. In our great forests on the conservation estate, possums, rats and stoats breed virtually unhindered, and ground control methods, no matter how sophisticated, simply cannot cover large areas of rugged terrain or prevent the devastation of mast years. The only option for controlling possums, rats and stoats on almost all of the conservation estate is to drop poison from aircraft. And 1080 is the only poison currently available for aerial pest control on the mainland that can do this job.

Dropping a poison from the sky will always be contentious and understandably so, even if a poison were to be developed that was perfectly effective, safe and humane. In this report, 1080 has been systematically assessed for its effectiveness, safety and humaneness. While it is not perfect, it scores surprisingly well, due in large part to the increase in scientific understanding, the establishment of a strong body of evidence, and the addition of many controls over the years.

Research to develop better poisons (and possibly biocontrol options) should absolutely continue. Alternatives, whether currently available or on the horizon, can complement the use of 1080, but cannot replace it. The huge effort, expenditure and achievements to date in bringing back many species and ecosystems from the brink would be wasted if the ability to carry out aerial applications of 1080 was lost.

I recommend that:

1. **Parliament does not support a moratorium on 1080.**

8.2 Simplify regulations

The labyrinth of laws, rules and regulations that govern 1080 and the other poisons used to control introduced pests creates unnecessary complexity and confusion.

Under the RMA, the use of poisons for controlling pest mammals is treated differently by different councils. Some councils treat the use of poisons as a permitted activity with only a few conditions, while other councils treat exactly the same use as a discretionary activity requiring a resource consent. In one case the number of aerial 1080 operations that can take place under the consent is specified, making it very difficult to respond to mast events. Many of the rules also replicate controls already in place under other legislation.

There is considerable scope to simplify and standardise the management of these poisons. There is a strong case for the use of 1080 and other poisons to be permitted activities under the RMA, with local control reserved to those activities that are not covered by already existing controls under other legislation. One way to achieve this standardisation and simplification could be with a National Environmental Standard.

There may also be other opportunities for simplifying various practices associated with the use of 1080, some required under regulations and some not. For instance, over 2,500 water samples have been taken for more than 20 years from drinking water supplies, streams and lakes after aerial 1080 operations. In all this time 1080 residues have never been detected in drinking water supplies, and only found in vanishingly small and harmless levels in 3 percent of the remaining samples. We do not need more water samples to tell us that the way 1080 is used poses no real risk to water.

I recommend that:

2. **The Minister for the Environment investigate ways to simplify and standardise the way 1080 and other poisons for pest mammal control are managed under the Resource Management Act and other relevant legislation.**

8.3 The Game Animal Council

The Government has committed to establishing a Game Animal Council to advise on and manage hunting interests on the conservation estate. The Council will report to the Minister of Conservation and work with her department.

While greater collaboration between different interest groups on the conservation estate should be encouraged, the proposal has the potential to conflict with the Department of Conservation's ability to carry out pest control.

The discussion paper on the Game Animal Council suggested that DOC and the Council work together to identify priority areas '*where animals need to be actively controlled for conservation purposes*'. Outside these areas the paper suggests the Council should have responsibility managing game animals.

While the Council would not be tasked with responsibility for managing possums, rats and stoats, it could under the suggested management structure effectively halt 1080 operations for these pests if it thought game animals may be at risk. This would place an unacceptable constraint on DOC's ability to carry out pest control effectively and efficiently.

I recommend that:

3. **The Minister of Conservation establishes the Game Animal Council as an advisory body that works collaboratively with the Department of Conservation, but ensures that responsibility for all pest control remains with the department.**

8.4 The Animal Health Board & the Official Information Act

The goal of the Animal Health Board (AHB) is to eliminate bovine TB from New Zealand. Most of its effort goes into killing possums and other carriers of the disease. The AHB is a major user of 1080, mostly in ground control operations along with trapping and other poisons such as cyanide.

The Department of Conservation and regional councils are subject to the Official Information Act and the Ombudsmen Act, but the AHB is not. Moreover, New Zealand's principal manufacturer of 1080 baits, Animal Control Products Ltd, is subject to both Acts.

The AHB receives about $30 million of central government funding and about $6 million of regional council funding every year. As a recipient of government funding, it would be consistent with sound public policy to increase the transparency and accountability of the AHB by making it subject to the Official Information Act and the Ombudsmen Act.

Currently the Biosecurity Law Reform Bill 256-1 (2010) before Parliament would see this occur at least in part. The relevant proposed amendment (clause 79) is not specific to the AHB, but rather is directed to any agency "*if they are corporate bodies, in their role under pest management plans or pathway management plans*".

However the question arises as to whether the coverage proposed in the amendment is as comprehensive as is desirable. If the intent is to ensure the AHB is fully transparent in a manner consistent with other public agencies, then AHB should be specifically named in the Ombudsmen Act.

Including the AHB in the Ombudsmen Act would also automatically subject the AHB to the Official Information Act. The Official Information Act provides for requests to be made for information and sets time limits for responses. If the AHB were made subject to the Official Information Act, then an individual or group would have much greater access to information. For instance, someone concerned about whether buffer zones were actually adhered to in an aerial 1080 drop might request a copy of a map of the actual flight tracks recorded on the GPS system in the helicopter.

I recommend that:

4. **The Minister of Justice introduces an amendment to the Ombudsmen Act 1975 to add the Animal Health Board to Part 2 of Schedule 1 of the Act, and thereby make the Animal Health Board also subject to the Official Information Act 1982.**

8.5 Economic value from pests without undermining conservation

During this investigation the economic potential of the possum fur industry has been raised. Some have argued that large scale possum fur harvesting would be an effective pest control method. Others have suggested that reducing possum numbers could actually make things worse, by leading to higher populations of rodents because there would be more food for them, and then stoats would multiply because there would be more rodents for them to eat.

While "a good possum is a dead possum", commercial fur harvesting is unlikely to benefit the conservation estate. Unless possum fur becomes much more valuable than it is now, commercial harvesters would probably stop catching possums long before their numbers have been reduced to levels that are low enough to benefit native animals and plants. Nevertheless there is every reason to encourage possum fur harvesting on the conservation estate, provided it does no damage.

Currently agreements between pest control agencies and fur harvesters appear to be *ad hoc*. Where possums are being controlled entirely by ground methods commercial trappers are sometimes allowed in to have "first crack". But there could be considerable potential in large areas of back country where there is no pest control at all taking place.

It is not cost-effective to control pests using ground operations in large areas of back country. However, well-organised large scale fur harvesting, like the wild venison hunting of the seventies, may be economically viable.

A working group involving the Department of Conservation, the Animal Health Board, regional councils, and industry representatives has been established to consider developing policies and procedures for testing the economic potential of fur harvesting, but it is not at all clear that it is a priority.

I recommend that:

5. **The Minister of Conservation asks the Department of Conservation to prioritise the development of national policy and operational procedures on possum fur harvesting.**

8.6 Department of Conservation: improve transparency

In the course of this investigation it has become clear that the quality of communication about 1080 operations and the relationships between pest control agencies and communities varies across agencies and regions.

A key communication tool is the Department of Conservation website. Currently it contains four-monthly updates on pest control operations and conservancy plans for pest control, including maps. The provision of such information makes an extremely valuable contribution and should be encouraged. However, the information given in conservancy plans is not consistent; for example, only some conservancies state the size of the area that is to be treated. And no conservancies provide information on why a particular operation is being carried out, such as the need to knock down rodents to protect kōkako nestlings.

Providing relevant information on 1080 operations on the website in a consistent, readily accessible format is essential.

Reports on completed operations should also contain the results to demonstrate what worked, what did not work and why. Open communication of success and failures is critical for building good relationships between pest control agencies and the public.

I recommend that:

6. **The Minister of Conservation improve information about pest control on the conservation estate by providing consistent and accessible information on the Department of Conservation website, including the purposes and results of different pest control operations.**

Endnotes

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14 Two species of seal (the New Zealand fur seal and the New Zealand sea lion) breed at sites on the coasts of the North and South islands, while a further five species breed in our territorial waters in the Antarctic or sub-Antarctic (King, C.M. (ed.). 2005. *The handbook of New Zealand mammals*. Oxford University Press, Auckland).

15 Developing and maintaining predator defences is energetically costly. The ability to fly, for example, requires very large amounts of food for energy. If flight is not required because there are no mammalian predators, then much less food is required, or that food can be put into other things such as breeding.

16 King, C.M. (ed.). 2005. *The handbook of New Zealand mammals*. Oxford University Press, Auckland.

17 Clark, G. 2005. Kuri. *In:* C.M. King (ed.). *The handbook of New Zealand mammals*. Oxford University Press, Auckland.

18 http://www.teara.govt.nz/en/kiore-pacific-rats/3

19 Dama wallabies (*Macropus eugenii egenii*) are established in the Rotorua region where they can have major impacts on native forests (Waburton, B. 2005. Dama wallaby. *In:* C.M. King (ed.). *The handbook of New Zealand mammals*. Oxford University Press, Auckland). Bennett's wallabies (*M. rufogriseus rufogriseus*) are established around Waimate in South Canterbury, where they can cause economic damage to pasture and pine forest (Waburton, B. 2005. Bennett's wallaby. *In:* C.M. King (ed.). *The handbook of New Zealand mammals*. Oxford University Press, Auckland.

20 Kākāpō, hihi, tīeke are all threatened by introduced predators. For example, being flightless makes kākāpō easy prey for stoats, while hihi and tīeke are very vulnerable to possums, rats, and stoats when they are on their nests. They have been assessed as being unable to coexist with these species, and are now only found on predator-free islands or in fenced sanctuaries (Innes, J., Kelly, D., Overton, J.M. and Gillies, C. 2010. Predation and other factors currently limiting New Zealand forest birds. *New Zealand Journal of Ecology* 34: 86-114).

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27 The study by Landcare Research also estimated that without the current possum control efforts of DOC, the AHB and other pest controllers, there would be around 48 million possums in the country (Warburton, B., Cowan, P. and Shepherd, J. 2009. *How many possums are now in New Zealand following control and how many would there be without it?* Report prepared for Northland Regional Council, Landcare Research, Palmerston North).

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49 Supporters of the project include the Animal Health Board, the Department of Conservation, Dairy NZ, Solid Energy, the Isaac Wildlife Foundation, Meat & Wool New Zealand, PGG Wrightson, Deer Industry New Zealand, and Bush and Beyond. Press release, 8 April 2010, www.1080facts.co.nz/1080_newsroom [Accessed 18 May 2011].

50 S 36(1), Animal Welfare Act 1999.

51 As of 1 January 2011, under the Animal Welfare (Leg-hold traps) Order (see http://www.biosecurity.govt.nz/regs/animal-welfare/stds/traps#leg-hold [Accessed 9 February 2011]).

52 http://goodnature.co.nz.s52206.gridserver.com/news/?cat=10 [Accessed 29 April 2011].

53 All poisons must be registered as vertebrate toxic agents under the Agricultural Compounds and Veterinary Medicines Act 1997, and must be approved for use under the Hazardous Substances and New Organisms Act 1996.

54 Morgan, D. and Hickling, G. 2000. Techniques used for poisoning possums. *In:* T.L. Montague (ed.). *The brushtail possum: biology, impact and management of an introduced marsupial*. Manaaki Whenua Press, Lincoln. Paste bait for cats or goats is usually applied to earth ‘spits’ or up-turned turf that is turned back over after the poisoning operation.

55 Some regional councils use brodifacoum in bait stations to control possums in urban parks and reserves. For example, Greater Wellington Regional Council uses brodifacoum in bait stations to control possums and rats in its regional parks around Wellington city (http://www.gw.govt.nz/Possums-targeted-on-Tinakori-Hill; http://www.gw.govt.nz/Possum-control-operation-to-start-in-Whiteman-s-Valley [Accessed 11 May 2011]).

56 Auckland Council used aerial brodifacoum to eradicate possums, rats and stoats from a predator-fenced area of Tawharanui Regional Park in 2003 (http://www.arc.govt.nz/albany/index.cfm?A6FA346B-14C2-3D2D-B961-557E260B50CB [Accessed 20 May 2011]) and has an aerial drop of brodifacoum planned for fenced area in Shakespear Regional Park in 2011 (Press Release, Auckland Council, 2 March 2011).

57 DOC has used phosphorus in the past for rabbit and possum control. Magnesium phosphide is sometimes used as a rabbit burrow fumigant in habitats where rabbits can reach high numbers, like tussock grasslands.

58 It is also used to control wallabies in some places.

59 Eason, C.T. and Hickling, G.J. 1992. Evaluation of a biodynamic technique for possum pest control. *New Zealand Journal of Ecology* 16: 141-144. Supporters of biodynamic methods of pest control claim the research trials carried out by Landcare Research were not conducted under the correct conditions (Blake, G. and Bacchus, P. 2000. Possum peppering trial on the Thames Coast. *Harvests* 53: 22-25).

60 DOC. 2007. *Department of Conservation annual report ended 30 June 2007*. Department of Conservation, Wellington.

61 ERMA. 2010. *Annual report on the aerial use of 1080 for the year ended 31 December 2009*. Environmental Risk Management Authority, Wellington.

62 This is 15% of DOC's budget for the management of natural heritage. A further $7 million was spent on controlling deer and goats, and $39 million were spent on other actions to protect threatened species, such as captive breeding programmes or management of populations on predator-free islands. DOC. 2010. *Annual report for the year ended 30 June 2010*. Department of Conservation, Wellington: 110.

63 See http://www.doc.govt.nz/conservation/threats-and-impacts/animal-pests/pesticide-summaries/ [Accessed 17 May 2011].

64 Stoats can carry TB. However, they prefer forest habitats and are rare in farmland, and so are unlikely to come into contact with cattle. In comparison ferrets, which also carry TB, are more common in farmland and forest edges, and are therefore much more likely to come into contact with cattle. In a small number of areas with no ferrets and large areas of forest, the AHB does do some monitoring of TB infection rates in wild stoat populations (Animal Health Board, 2010. Annual report for the year ending 30 June 2010. Animal Health Board, Wellington).

65 The AHB uses ground techniques on about 90% of the land it controls pests on and aerial 1080 for the rest (ERMA. 2010. *Annual report on the aerial use of 1080 for the year ended 31 December 2009*. Environmental Risk Management Authority, Wellington).

66 ERMA. 2010. *Annual report on the aerial use of 1080 for the year ended 31 December 2009*. Environmental Risk Management Authority, Wellington.

67 AHB. 2010. *Annual report for the year ending 30 June 2010*. Animal Health Board, Wellington.

68 The proposed changes relate to the AHB and other management agencies as defined under the Biosecurity Act.

69 Marlborough District Council, Environment Canterbury, the Otago Regional Council, and Environment Southland list rabbits as pest animals in their pest management strategies.

70 ERMA (2010), Annual report on the Aerial Use of 1080 for the year ended 31 December 2009. Environmental Risk Management Authority, Wellington.

71 New Zealand Government. 6 April 2011. *Game Animal Council to be established.* Press release. http://www.beehive.govt.nz/release/game-animal-council-be-established [Accessed 18 May 2011].

72 Data obtained from DOC and AHB.

73 ERMA. 2007. *Environmental Risk Management Authority Decision. Application for the reassessment of a hazardous substance under section 63 of the Hazardous Substances and New Organisms Act 1996: sodium fluoroacetate (1080) and formulated substances containing 1080.* Environmental Risk Management Authority, Wellington.

74 Most councils include vertebrate pest control agents in rules relating to 'agrichemicals'. Three councils have separate rules relating to 'pesticides', and one council has rules specific to 'vertebrate toxic agents'.

75 These councils are Auckland, Waikato, Bay of Plenty, Gisborne, Hawke's Bay, Horizons, Marlborough (private land in the Wairau/Awatere region), and Chatham Islands.

76 Northland, Greater Wellington, Tasman, West Coast, Southland, and Canterbury (if not discharging in or near water supplies).

77 Taranaki, Nelson, Marlborough (on public land), Canterbury (in or near water supplies), and Otago.

78 Aerial discharge of toxins other than 1080 is currently discretionary (rather than permitted) in the Manawatu-Wanganui region, and restricted discretionary (rather than controlled) in Southland.

79 S 95A, RMA 1991.

80 S 69ZZO, Health Act 1956.

81 Using cereal baits with a 1080 concentration of 0.15% and a drop of non-toxic baits before the poison operation. This 'pre-feeding' overcomes any wariness that pest animals may have to the bait itself, to help prevent bait-shyness (Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton). The effectiveness of 1080 operations can be improved by up to 15% by the practice of pre-feeding. (Morgan, D.R. 2004. *Maximising the effectiveness of aerial 1080 control of possums (Trichosurus vulpecula).* Thesis (PhD). Lincoln University, Lincoln.)

82 Using cereal baits with a 1080 concentration of 0.15% and a non-toxic pre-feed. Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton.

83 For ship rats, see Innes, J.G. 2005. Ship rat. *In:* C.M. King (ed.). *The handbook of New Zealand mammals*. Oxford University Press, Auckland. For mice, see Ruscoe, W.A. and Murphy, E.C. 2000. House Mouse. *In:* C.M. King (ed.). *The handbook of New Zealand mammals*. Oxford University Press, Auckland.

84 Gillies, C.A.; Pierce, R.J. 1999. Secondary poisoning of introduced mammalian carnivores during possum and rodent control operations at Trounson Kauri Park, Northland, New Zealand. *New Zealand Journal of Ecology* 23: 183-192; Murphy, E.C., Robbins, L., Young, J.B. and Dowding, J.E. 1999. Secondary poisoning of stoats after an aerial 1080 poison operation in Pureora Forest, New Zealand. *New Zealand Journal of Ecology* 23: 175-182; Alterio, N. 2000. Controlling small mammal predators using sodium monofluoroacetate (1080) in bait stations along forestry roads in a New Zealand beech forest. *New Zealand Journal of Ecology* 24: 3-9.

85 Data spans 1 January 2008 – 1 October 2010. Monitoring of pest populations before and after an aerial operation is not legally required.

86 Data from the Pestlink reporting database (ERMA, unpublished data).

87 Nugent, G., Whitford, J., Sweetapple, P., Duncan, R. and Holland, P. 2010. Effect of one-hit control on the density of possums (*Trichosurus vulpecula*) and their impacts on native forest. Department of Conservation, Wellington.

88 For examples, see ***Whio*:** Beath, A. 2010. *Securing Whio (blue duck) in Tongariro Forest*. Technical Report No. 6, Ruapehu Area Office, Department of Conservation. ***Kereru*:** Innes, J., Nugent, G., Prime, K. and Spurr, E.B. 2004. Responses of kukupa (*Hemiphaga novaeseelandiae*) and other birds to mammal pest control at Motatau, Northland. *New Zealand Journal of Ecology* 28: 73–81. ***Kiwi*:** The survival of brown kiwi chicks following an aerial 1080 drop in Tongariro Forest in the central North Island was twice as high as before the operation. This effect lasted for two years before stoat numbers increased again and chick survival dropped back to pre-control levels (DOC, unpublished data). ***Tomtits*:** Powlesland, R.G., Knegtmans, J.W. and Styche, A. 2000. Mortality of North Island tomtits (*Petroica macrocephala toitoi*) caused by aerial 1080 possum control operations, 1997–98, Pureora Forest Park. *New Zealand Journal of Ecology* 24: 161-168. ***Robins*:** Powlesland, R.G., Knegtmans, J.W. and Marshall, I.S.J. 1999. Cost and benefits of aerial 1080 possum control operations using carrot baits to North Island robins (*Petroica australis longipes*), Pureora Forest Park. *New Zealand Journal of Ecology* 23: 149-159. ***Kākāriki and mōhua*:** Elliott, G. and Suggate, R. 2007. *Operation Ark: Three year progress report*. Department of Conservation, Christchurch.

89 Nugent, G., Whitford, J., Sweetapple, P., Duncan, R. and Holland, P. 2010. *Effect of one-hit control on the density of possums (Trichosurus vulpecula) and their impacts on native forest.* Department of Conservation, Wellington.

90 Urlich, S. and Brady, P.L. 2005. Benefits of aerial 1080 possum control to tree fuchsia in the Tararua Range, Wellington. *New Zealand Journal of Ecology 29*: 299-309; Pekelharing, C.J., Parkes, J.P. and Barker, R.J. 1998. Possum (*Trichosurus vulpecula*) densities and impacts on Fuchsia (*Fuchsia excorticata*) in South Westland, New Zealand. *New Zealand Journal of Ecology 22*: 197-203.

91 Innes, J., Hay, R., Flux, I., Bradfield, H. and Jansen, P. 1999. Successful recovery of North Island kokako *Callaeas cinerea wilsoni* populations, by adaptive management. *Biological Conservation* 87: 201–221.

92 Adult kiwi do remain vulnerable to attacks from ferrets and dogs however.

93 Source data: DOC Powerpoint presentation *'Survival of brown kiwi (Apteryx mantelli) in Tongariro Forest New Zealand'*. DOC Tongariro/Taupo Conservancy.

94 Elliott, G. and Suggate, R. 2007. *Operation Ark: Three year progress report*. Department of Conservation, Christchurch.

95 Due to its properties, 1080 can knock down populations of possums and rats very quickly – in one to two days, independent of whether it is used in a bait station or aerially. However, a 1080 operation will take longer in total due to the need to pre-feed first with non-toxic baits. The pre-feeding is required to get the target pest used to the bait, not the poison.

96 The pest control was carried out as part of a Department of Conservation project known as Operation Ark. This project, commenced in June 2004, aims to preserve 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 the project is to protect these 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.

97 Elliott, G. and Suggate, R. 2007. *Operation Ark: Three year progress report*. Department of Conservation, Christchurch.

98 ERMA. 2009. *Annual report on the aerial use of 1080*. Environmental Risk Management Authority, Wellington.

99 DOC, pers. comm.

100 DOC, unpublished data.

101 Rosevear, M. and Urlich, D. 2010. *Bovine TB strategy: review of costs.* Report produced for MAF Biosecurity by Outcome Management Services, Wellington.

102 Rosevear, M. 2003. *Scientific research and aerial possum control: a cost/benefit study*. Evaluation report prepared for the Foundation for Research, Science and Technology by Outcome Management Services, Wellington.

103 The cost of monitoring the effectiveness of the ground operation was higher than for aerial control because the ground operation would need to be done in smaller blocks that could be feasibly controlled by a field team. Each block would then require monitoring to check if possums had been satisfactorily controlled. DOC, unpublished data.

104 Bioaccumulation occurs when a substance is added to an environment more quickly than it can be broken down or removed. Some substances can be concentrated up the food chain; mercury is an example.

105 One of the breakdown products is fluoride. The addition of fluoride to urban water supplies in order to reduce tooth decay remains somewhat controversial, and some are concerned that 1080 is 'fluoridating' water. A study that looked at the levels of fluoride in water after 1080 operations in Taranaki found the concentrations of fluoride in waterways in treated areas were completely within the range of natural levels of fluoride in New Zealand waterways. The levels of fluoride recorded in both treated and untreated areas in the study were 10 times lower than the Ministry of Health's standard for fluoride in drinking water of 1.5 grams per cubic metre (Fowles, C.R. and Williams, J.R. 1997. Water quality monitoring in relation to a possum control operation on Mount Taranaki/Egmont. *New Zealand Natural Sciences* 23: 93-99).

106 Parfitt, R.L., Eason, C.T., Morgan, A.J., Wright, G.R. and Burke, C.M. 1994. The fate of sodium monofluoroacetate (1080) in soil and water. *In:* A.A. Seawright and C.T. Eason (eds). *Proceedings of the Science Workshop in 1080*. Miscellaneous Series 28. The Royal Society of New Zealand, Wellington. More than 70% of 1080 in water is broken down within one day.

107 Eason, C.T., Gooneratne, R., Wright, G.R., Pierce, R. and Frampton, C.M. 1993. The fate of sodium monofluoroacetate (1080) in water, mammals and invertebrates. *Proceedings of the New Zealand Plant Protection Conference* 46: 297-301.

108 Eason, C., Miller, A., Ogilvie, S. and Fairweather, A. 2011. An updated review of the toxicology and ecotoxicology of sodium fluoroacetate (1080) in relation to its use as a pest control tool in New Zealand. *New Zealand Journal of Ecology* 35: 1-20.

109 Suren, A.M. 2006. Quantifying contamination of streams by 1080 baits, and their fate in water. *New Zealand Journal of Marine and Freshwater Research* 40: 159-167.

110 In some instances water samples were taken within 48 hours (Landcare Research, pers. comm.). The current protocol recommends taking water samples within 8 hours of the 1080 drop (see Booth, L.H. and Wright, G.R.G. 2008. *Guideline for sampling and testing of water associated with monitoring of aerial 1080 baiting operations.* 2nd ed. Landcare Research New Zealand Ltd).

111 The first water samples were taken in 1990 following aerial 1080 operations at Waipoua Forest in Northland (September) and Rangitoto Island in the Hauraki Gulf (November) (Eason, C.T., Wright, G.R. and Fitzgerald, H. 1992. Sodium monofluoroacetate (1080) water-residue analysis after large-scale possum control. *New Zealand Journal of Ecology* 16: 47-49).

112 Landcare Research, unpublished data.

113 King, D.R., Kirkpatrick, W.E., Wong, D.H. and Kinnear, J.E. 1994. Degradation of 1080 in Australian Soils. *In:* A.A. Seawright and C.T. Eason (eds). *Proceedings of the Science Workshop in 1080*. Miscellaneous Series 28. The Royal Society of New Zealand, Wellington.

114 Fisher, P. and Northcott, G. 2011. *Aerobic transformation of 1080 in soil.* Animal Health Board Project No. R-10695, Wellington.

115 0.01 mg/kg is one part in 100 million by weight.

116 Wright, G.R.G., Booth, L.H., Morriss, G.A., Potts, M.D., Brown, L. and Eason, C.T. 2002. Assessing potential environmental contamination from compound 1080 (sodium monofluoroacetate) in bait dust during possum control operations. *New Zealand Journal of Agricultural Research* 45: 57-65.

117 1080 concentrations of 90mg/kg have been recorded as reducing cocoon production. The maximum recorded concentration in New Zealand of 1080 in soil is 0.19 mg/kg – about 500 times lower than this level (O'Halloran, K., Jones, D., Booth, L. and Fisher, P. 2005. Ecotoxicity of sodium monofluoroacetate (compound 1080) to soil organisms. *Environmental Toxicology and Chemistry* 24: 1211-1218.

118 Ogilvie, S.C., Booth, L.H. and Eason, C.T. 1998. Uptake and persistence of sodium monofluoroacetate (1080) in plants. *Bulletin of Environmental Contamination and Toxicology* 60: 745-749.

119 Kāramuramu (*Coprosma robusta*) was used by Māori as part of many traditional medicine and cultural customs. For example, Tūhoe priests would use kāramuramu branches in cleansing rituals (Gouldie, W.H. 1904. Article 1: Maori medical lore: notes on the causes of disease and treatment of the sick among the Maori People of New Zealand, as believed and practiced in former times, together with some account of various ancient rites connected with the same. *Transactions of the New Zealand Institute* 37: 1-120), or would wear girdles made from kāramuramu (Best, E. 1907. Art. XV.—Maori forest lore: being some account of native forest lore and woodcraft, as also of many myths, rites, customs, and superstitions connected with the flora and fauna of the Tuhoe or Ure-wera District.—Part I. *Transactions of the New Zealand Institute* 40: 185-254).

120 Ogilvie, S., Ataria, J., Waiwai, J., Doherty, J., Lambert, M., Lambert, N. and King, D. 2006. Uptake and persistence of the vertebrate pesticide, sodium monofluoroacetate (compound 1080), in plants of cultural importance. *Ecotoxicology* 15: 1-7.

121 Miller, A., Ogilvie, S.C., Ataria, J.M., Waiwai, J. and Doherty, J.E. 2009. *Sodium fluoroacetate (compound 1080) uptake by puha, a culturally-important food plant.* Lincoln University Wildlife Management Report No. 48. Lincoln University, Lincoln.

122 Eason, C. and Gooneratne, R. 1993. An evaluation of the risk to man of secondary poisoning with sodium monofluoroacetate (1080). *New Zealand Medical Journal* 106(949): 41.

123 Tree wētā dosed with 15 µg 1080/g eliminated > 90% of the 1080 within 4–6 days (Eason, C.T., Gooneratne, R., Wright, G.R., Pierce, R. and Frampton, C.M. 1993. The fate of sodium monofluoroacetate (1080) in water, mammals, and invertebrates. *Proceedings of the forty-sixth New Zealand Plant Protection Conference*: 297-301). Ants dosed with 0.3 g 1080/kg still had detectable levels of 1080 (0.27 mg/kg) seven days after dosing (Booth, L.H. and Wickstrom, M.L. 1999. The toxicity of sodium monofluoroacetate (1080) to *Huberia striata*, a New Zealand native ant. *New Zealand Journal of Ecology* 23: 161-165). 1080 residues in sub-lethally poisoned kōura decrease by a factor of five after eight days, which the study authors attributed to the animals metabolising or excreting the compound (Suren, A.M. and Bonnett, M.L. 2006. Consumption of baits containing sodium fluoroacetate (1080) by the New Zealand freshwater crayfish (*Paranephrops planifrons*). *New Zealand Journal of Marine and Freshwater Research* 40: 169-178).

124 There is one recorded instance of a morepork dying following an aerial 1080 operation using carrots (Powlesland, R.G., Knegtmans, J.W. and Styche, A. 1999. Impacts of aerial 1080 possum control operations on North Island robins and moreporks at Pureora in 1997 and 1998. *Science for Conservation* 133. Department of Conservation, Wellington). There have been no mortalities of harriers or falcons recorded following 1080 operations (Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton).

125 After these operations, 748 birds were found dead, of which 508 were introduced species such as blackbirds and chaffinches. There were 240 individual native birds killed, including tomtits, robins, whiteheads, grey warblers, riflemen, fantails and silvereyes (Spurr, E. 2000. Impacts of possum control on non-target species. *In:* T.L. Montague (ed.). *The brushtail possum: biology, impact and management of an introduced marsupial*. Manaaki Whenua Press, Lincoln).

126 Veltman, C.J. and Westbrooke, I.A. 2011. Forest bird mortality and baiting practices in New Zealand aerial 1080 operations from 1986 to 2009. *New Zealand Journal of Ecology* 35: 21-29.

127 DOC, unpublished data.

128 The concentration of 1080 required to have a 50% chance of killing trout has been estimated as 54 mg 1080 per litre (Fagerstone, K.A., Savarie, P.J., Elias, D.J. and Schafer Jr, E.W. 2000. Recent regulatory requirements for pesticide registration and the status of compound 1080 studies conducted to meet EPA requirements. *In:* A.A. Seawright and C.T.Eason (eds). *Proceedings of the Science Workshop in 1080*. Miscellaneous Series 28. The Royal Society of New Zealand, Wellington).

129 Suren, A.M. and Lambert, P. 2006. Do toxic baits containing sodium fluoroacetate (1080) affect fish and invertebrate communities when they fall into streams? *New Zealand Journal of Marine and Freshwater Research* 40: 531-546.

130 Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton.

131 Sherley, G., Wakelin, M. and McCartney, J. 1999. Forest invertebrates found on baits used in pest mammal control and the impact of sodium monofluoroacetate ('1080') on their numbers at Ohakune, North Island, New Zealand. *New Zealand Journal of Zoology* 26: 279-302.

132 Booth, L.H. and Wickstrom, M.L. 1999. The toxicity of sodium monofluoroacetate (1080) to *Huberia striata*, a New Zealand native ant. *New Zealand Journal of Ecology* 23: 161-165; Powlesland, R.G., Stringer, I.A.N. and Hedderley, D.I. 2005. Effects of an aerial 1080 possum poison operation using carrot baits on invertebrates in artificial refuges at Whirinaki Forest Park, 1999–2002. *New Zealand Journal of Ecology* 29: 193-205.

133 http://poisons.co.nz/fact.php?f=24 [Accessed 16 May 2011].

134 According to a recent survey of veterinary practices the two most commonly reported poisonings in dogs were rat poison and slug baits; most would have been domestic incidents (Massey University, unpublished data). Between 2007 and 2009 the National Poison Centre received over 4000 calls from the public about exposure of dogs to poisons, of which the majority related to anticoagulant rat poison, and slug and ant baits (National Poisons Centre, unpublished data).

135 For a summary see ERMA. 2010. *Annual report on the aerial use of 1080, for the year ended 31 December, 2009*. Environmental Risk Management Authority, Wellington.

136 A 1080 operation in the Blue Mountains in Otago in 2001 is estimated to have killed between 67% and 75% of a fallow deer population. (Nugent, G. and Yockney, I. 2004. Fallow deer deaths during aerial 1080 poisoning of possums in the Blue Mountains, Otago, New Zealand. *New Zealand Journal of Zoology* 31: 185-192.) In three aerial operations carried out between 1988 and 1999, between 5% and 54% of red deer were killed. Aerial 1080 operations in Pureora Forest in the 1990s using carrots killed between 30% and 93% of deer (Nugent, G., Fraser, K.W., Asher, G.W. and Tustin, K.G. 2001. Advances in New Zealand mammalogy 1990–2000: Deer. *Journal of the Royal Society of New Zealand* 31: 263-298).

137 Minister of Conservation. 12 April 2005. Press release. The eight recreational hunting areas are Pureora, Kaimanawa, Aorangi, Lake Sumner, Oxford, Whakatipu, Blue Mountain and Kaweka.

138 The fish-based deer repellent costs around $2 per kilogram of bait (data from ERPO Ltd). For an aerial 1080 operation sowing 1 kg of prefeed and 2 kg of toxic baits, the use of deer repellent adds around $6/ha to the cost of the operation.

139 DOC has not used carrot baits to control possums or rats in forests since 2008, while the AHB has used carrots in forests in 15 different operations (ERMA, unpublished data).

140 ERMA, unpublished data.

141 DOC, unpublished data.

142 Sources: ***1973–1997:*** Operations targeting possums using cereal bait only. Adapted from: T.L. Montague (ed.) 2000. The brushtail possum. Manaaki Whenua Press, Lincoln: 146.

1998–2003: Sowing rates are from operations on conservation land only. Adapted from: Veltman and Westbrooke 2011 New Zealand Journal of Ecology 35: 21-29.

2008–2010: Average sowing rates of all operations targeting possums and/or rodents. ERMA data (operations from 1 January 2008 – 31 October 2010).

Note: Carrot and cereal baits have been combined for the figures years 1998–2010.

143 Based on 14 gram cereal baits with a 1080 concentration of 0.15% (21 mg of 1080), and assuming an adult weight of 70 kg and a child weight of 25 kg. Estimates of lethal doses are based on the LD50 method, that is, a lethal dose is one that has a 50% chance of killing. A range of LD50 values have been published for humans (see Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton.; Eason, C., Miller, A., Ogilvie, S. and Fairweather, A. 2011. An updated review of the toxicology and ecotoxicology of sodium fluoroacetate (1080) in relation to its use as a pest control tool in New Zealand. *New Zealand Journal of Ecology*, 35: 1-20). The value used in all calculations in this report is 2.5 mg/kg body weight.

144 ERMA 2007. *Evaluation and review report: Appendix M. Application for the reassessment of a hazardous substance under section 63 of the Hazardous Substances and New Organisms Act 1996: sodium fluoroacetate (1080) and formulated substances containing 1080*. Environmental Risk Management Authority, Wellington.

145 The 1994 report into possum management by the first Parliamentary Commissioner for the Environment noted that jam-based paste baits posed a major risk to bees. The report recommended that paste baits should be modified or changed to make them less attractive to bees – essentially recommending the banning of jam-based pastes (Parliamentary Commissioner for the Environment. 1994. *Possum management in New Zealand*. Wellington). The 2007 ERMA reassessment noted that pastes that are now approved for use have been modified in light of the Commissioner's 1994 recommendations (ERMA, pers. comm.).

146 The coroner concluded at the time that the man died as a result of 1080 poisoning. No official conclusion was reached as to how or why the man consumed the 1080 (reported in *The Press*, 26 November 2009. See http://www.stuff.co.nz/the-press/news/3097688/Hunters-family-in-1080-battle [Accessed 12 May 2011].

147 ERMA 2007. *Evaluation and review report: Appendix M. Application for the reassessment of a hazardous substance under section 63 of the Hazardous Substances and New Organisms Act 1996: sodium fluoroacetate (1080) and formulated substances containing 1080*. Environmental Risk Management Authority, Wellington.

148 The concentrations of 1080 measured in eels tissue ranged from 0.0174 to 0.0306 mg/kg of eel tissue (Lyver, P. O'B., Ataria, J., Throught, K. and Fisher, P. 2005. Sodium fluoroacetate (1080) residues in longfin eels, *Anguilla dieffenbachii*, following exposure to contaminated water and food. *New Zealand Journal of Marine and Freshwater Research* 39: 1243-1252). Using an LD50 for humans of 2.5 mg 1080/kg body weight (Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton.

149 Calculations for deer are based on the highest recorded concentration of 1080 found in live deer muscle (1.5mg/kg muscle) (McIntosh, I.G. and Staples, E.L.J. 1959. The toxicity of muscles, liver, and heart of deer poisoned with sodium monofluoroacetate. *New Zealand Journal of Science 2*: 371-378; cited in Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton). Calculations for kōura are based on the highest concentrations of 1080 recorded in kōura tail muscle of 5 mg/kg of muscle (Suren, A.M. and Bonnett, M.L. 2006. Consumption of baits containing sodium fluoroacetate (1080) by the New Zealand freshwater crayfish (*Paranephrops planifrons*). *New Zealand Journal of Marine and Freshwater Research* 40: 169-178).

150 See Eason, C., Miller, A., Ogilvie, S. and Fairweather, A. 2011. An updated review of the toxicology and ecotoxicology of sodium fluoroacetate (1080) in relation to its use as a pest control tool in New Zealand. *New Zealand Journal of Ecology* 35: 1-20.

151 This calculation is based on the Acceptable Operator Exposure Limit (AOEL) set by ERMA of 0.2 micrograms of 1080 per kg of body weight per day. At the highest concentration of 1080 recorded in the Lyver et al. 2005 study (0.0306 mg 1080/kg eel muscle), a 70 kg person would need to eat 458 grams of eel every day for a period of months to be at risk of sub-lethal effects.

152 Broome, K.G., Fairweather, A.A.C. and Fisher, P. 2009. *Sodium fluoroacetate*. Version 1.13. Department of Conservation Pesticide Information Reviews series. Department of Conservation, Hamilton.

153 Tremblay, L.A., Fisher, P. and Leusch, F.D.L. 2004. Potential of sodium monofluoroacetate (1080) and fluorocitrate to bind to the estrogen receptor. *Australasian Journal of Ecotoxicology* 10: 77-83; Tremblay, L.A., Fisher, P., Leusch, F.D.L., van den Heuvel, M.R., Nicolas, J-C., Pillon, A. and Balaguer, P. 2005. Potential of sodium fluoroacetate (1080) and fluorocitrate to bind to androgen and oestrogen receptors. *Australasian Journal of Ecotoxicology* 11: 155-162.

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"NRS-6"

January | 15

BUSINESS CASE:

SIMPLIFYING THE REGULATION OF AERIAL 1080 UNDER THE RESOURCE MANAGEMENT ACT

This is the exhibit marked "**NRS-6**" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Miriam Sophie Bookman
Solicitor
WELLINGTON

Solicitor of the High Court of New Zealand

Foreword

The following business case has been prepared in partnership between the Department of Conservation, Ministry for Primary Industries and TBfree New Zealand Limited (the partners). The case has been developed in response to the Parliamentary Commissioner for the Environment's 2011 evaluation of 1080 which supported its continued use as a vital biosecurity tool and recommended that the Minister for the Environment investigate ways to simplify and standardise its management under the Resource Management Act (RMA) and other legislation.

The purpose of the case has been to explore this recommendation further by examining whether there is a need for standardisation and/or simplification and what the benefits and costs of achieving this might be. The assessment has identified a strong case to simplify the current regulatory system for 1080 under the RMA and recommends the future management of the substance be provided for solely under the nationally consistent Hazardous Substances and New Organisms Act (HSNO) and Agricultural Compounds and Veterinary Medicines Act (ACVM) framework.

This recommendation is based on an extensive review of the evidence that has found the adverse effects and risks of aerial 1080 use are being comprehensively managed under the HSNO/ACVM framework and that these requirements are being duplicated under the RMA. This duplication is not improving the management of risks and effects and has been found to impact the timely and cost effective delivery of pest control operations. The analysis has further found that the regulation of aerial 1080 operations varies significantly by region under the RMA and that this inconsistency undermines opportunities to standardise operations to improve efficacy and efficiency.

Based on these findings, the partners consider that if the areas of duplication can be minimised through simplification, and cost savings put into improving operations, the likely benefits will include greater control of bovine tuberculosis (TB) in key vector areas, and biodiversity gains. Achieving consistency is also likely to improve the effectiveness of operations long term as it will provide opportunities to improve the way pest management agencies manage and deliver operations by allowing technical teams to work within nationally consistent standards.

The case has considered the range of policy options and approaches to achieve standardisation and has assessed the costs, benefits and risks of each option. This assessment has concluded that a national policy approach is most likely to achieve greater consistency and generate the largest net benefits to society over the long term. The preferred policy approach is a regulation under section 360(1)(h) of the RMA, which would exempt aerial 1080 operations from section 15 of the RMA and leave their continued management under the HSNO/ACVM framework.

Preparation of this business case has been overseen by the partners and the findings have been developed in consultation with Regional Councils, the Ministry for the Environment and the Environmental Protection Authority. We would like to acknowledge the work of independent external providers in assisting the development of the case including Latitude Planning Services for project management and resource management planning advice, Sapere Group Limited for cost-benefit analysis and Atkins Holm Majurey for legal advice.

It is intended that the findings of this case will be utilised in the generation of the technical policy documents necessary to support the process for implementing a section 360(1)(h) regulation. The partners welcome the opportunities a regulation would provide to deliver enhanced biosecurity and biodiversity outcomes for New Zealand and build on the significant improvements to the delivery and management of aerial 1080 operations made in the last 10 years.

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EXECUTIVE SUMMARY

Agriculture and tourism are key drivers of New Zealand's economy comprising some 16% of the national Gross Domestic Product. The significance of these sectors to the nation's prosperity is reflected in the Government's Business Growth Agenda, which is focussed on growing the value of exports and the efficient stewardship of New Zealand's natural resources to sustain growth.

New Zealand's substantial natural resource base is integral to the value generated from both sectors, and our extensive biosecurity system plays a critical role in protecting and enhancing this base. Its purpose is twofold: to stop invasive pests from entering the country, and to manage established pests within the country. This dual role supports our agricultural and tourism sectors and enhances New Zealand's unique biodiversity and landscapes, which are fundamental to our national identity, international image and branding, and lifestyle.

The vertebrate toxic agent sodium fluoroacetate (1080) is a key component of the biosecurity toolkit. The aerial use of 1080 for animal pest control is critical for controlling the threat of bovine tuberculosis (TB) to the $14 billion per year beef, dairy and deer export industries, and reducing the impacts of animal pests on productive land.

Aerial application of 1080 also provides effective control of vertebrate pests to protect and enhance our unique natural heritage, which is the cornerstone of a $23.9 billion dollar tourism industry. Providing for the safe, efficient and effective use of 1080 is therefore important for maintaining biosecurity and protecting New Zealand's unique biodiversity and landscapes.

Purpose

This business case has been prepared in partnership between the Department of Conservation (DOC) TBfree New Zealand Limited (TBfree NZ) and the Ministry for Primary Industries (MPI) in consultation with Regional Councils, the Ministry for the Environment (MfE) and the Environmental Protection Authority (EPA).

The case is a direct response to the findings of the Parliamentary Commissioner for the Environment's (PCE) review of 1080 in 2011 which supported its continued use and recommended *"The Minister for the Environment investigate ways to simplify and standardise the way 1080 and other poisons for pest mammal control are managed under the Resource Management Act and other relevant legislation."*

The purpose of the case has been to explore this recommendation in detail by examining whether there is a need to simplify the regulation of 1080 under the Resource Management Act (RMA), and, if so, what the benefits, costs and risks of this might be.

Key findings

The business case has involved an extensive review of the regulatory system for 1080, including a detailed examination of the national regulatory framework for 1080 under the Hazardous Substances and New Organisms Act (HSNO), Agricultural Compounds and Veterinary Medicines Act (ACVM) and the Health Act, along with an analysis of compliance requirements under regional plans and resource consents pursuant to the Resource Management Act (RMA).

This analysis has found that the potential adverse effects of 1080 use are being robustly managed at a national level under the HSNO, ACVM and Health Act framework. Independent monitoring completed by the EPA within the last five years confirms that the HSNO system is effective at managing the risks of operations and that the management of operations has improved significantly.

The analysis has also revealed that the further regulation of 1080 at a regional level under the RMA is affording no extra protection to the environment or public health and that there is compelling case to simplify the RMA system due to the following:

- There are high levels of duplication and replication between RMA and HSNO requirements. Duplication and replication occurs between regional plan rules and HSNO controls. The environmental effects and risks that are managed under resource consent conditions are also managed under HSNO requirements. This duplication can be costly and does not improve the management of effects and risks.
- The regional plan rule framework for aerial 1080 is complex and varies by region. There are 13 regions with regional plan standards that require resource consent for aerial 1080 operations. There is significant regional variability in the types of consent conditions and in the way consents are managed. This inconsistency can adversely impact the effectiveness of operations as it acts against development of nationally standardised operating procedures.
- Regional variance and duplication can create operational difficulties for compliance. Variable consent conditions make it more difficult for operators to ensure that best practice is always achieved, which increases the risk of breaching consent conditions. Even if the effects of such breaches are minor, they are treated as adverse incidents in EPA monitoring reports. The recurrence of incident reports could lead to further controls on the use of 1080 being imposed under the HSNO Act, potentially resulting in the loss or reduced availability of 1080 as a pest management tool for biosecurity and biodiversity programmes.
- The current RMA regime imposes needless costs on both the users of 1080 and regional ratepayers. The compliance costs for resource consents in the last ten years have been estimated at $10.7M. Future costs could be reduced significantly through removing the need for resource consent and managing 1080 operations solely under HSNO.

Areas of Duplication

The business case analysis has examined a range of regional plans and resource consents and has revealed high levels of duplication between RMA requirements and HSNO requirements. Key areas of duplication include:

- Direct duplication of HSNO requirements in Regional Plan rules. Many Regional Plan rules specify the need for compliance with HSNO and repeat requirements already set out in HSNO controls and permission conditions.
- Duplication of process, where a single operation can require three separate approvals - resource consent under the RMA, a DOC permission, and MOH permission under HSNO. All three approvals require preparation of the same substantive effects assessment and supporting technical data. All three processes also require input from technical and planning staff or contractors, and often necessitate duplicate reports to meet like conditions.
- Significant duplication and cross over between resource consent conditions, HSNO Act controls, and MOH and DOC permission conditions. For aerial 1080 consents granted from 2003 - 2013, approximately 90% of resource consent conditions imposed simply duplicate or are managed by equivalent controls under the HSNO and ACVM Acts. Those 10% of conditions not covered by HSNO or ACVM are addressed within SOPs which all commercial 1080 contractors are bound to comply with. Resource consent conditions are not managing any potential adverse effects that are not already managed under the HSNO Act.

Regional Inconsistency

The analysis has found that all regional plans regulate the aerial application of 1080 in different ways and there is also significant regional variance in the way resource consents are considered, processed and conditioned.

Notable areas of inconsistency identified include:

- Some Regional Plans treat the aerial application of 1080 as a permitted activity with only a few conditions, while others treat exactly the same activity as controlled, discretionary or non-complying, and thus requiring resource consent. Even in those regions (or parts of regions) where Plans permit aerial 1080 application, formal consent requirements are often still triggered by permitted activity rule conditions, which often relate to proximity to waterways or significant natural areas.
- The Regional Plan framework is further complicated by varying interpretation and administration of Plan rules, and notable variance in technical definitions for vertebrate toxic agents within and between Plans.
- Rules within regional plans and consent conditions can be contrary to the considerable body of technical evidence that supports the comprehensive risk management framework established for aerial 1080 under HSNO.

- Between 2003 and 2013 the RMA planning framework required the issue of some 270 resource consents for aerial 1080 operations. Consents were processed in all regions except for Taranaki, Otago and Manawatu-Wanganui, where more permissive frameworks exist. The complexity and length of these resource consent processes varied significantly during the period. Excluding consents that were withdrawn or not yet issued, approximately 83% of the consents were non-notified and 17% were notified or limited notified, with two of these consent applications reaching the Environment Court. Despite this varying complexity, all of the consents processed were approved subject to conditions.
- The type and number of conditions imposed on operations varied significantly between regions. For example, consents granted by West Coast Regional Council contain an average of 22 conditions, whilst consents in Marlborough District contain an average of 8 conditions.

The above issues create a very complex operating environment for those partners who undertake operations pan-regionally, with a national strategic focus. This inconsistent approach to the management of 1080 under the RMA is in contrast to the nationally consistent management regime under HSNO.

Costs of Duplication and Inconsistency

The regional plan framework generated 270 resource consents for aerial 1080 operations in New Zealand from 2003 to 2013. The cost to applicants in obtaining these consents has been estimated at $10.7M. This includes costs for preparing and managing consent applications and compliance with conditions, and Council fees for processing and compliance monitoring. Third party costs have not been included in the estimated costs, but are a component of all notified or limited notified consents, and most non-notified consents where affected party approvals are required.

The current system of consenting also generates opportunity costs. Because of seasonal or biological factors, timeliness of operations can often be critical. Time delays to operations from lengthy resource consent processes can result in failure to meet operational timeframes, setting pest control programs back with potential adverse pest management outcomes. The risks and uncertainties around consent processes and conditions can also affect the efficiency and effectiveness of operations. Inconsistent consent conditions add further compliance risk where operations may span two or more regions, requiring multiple resource consents which may impose differing conditions. Delays to operations, and reduced efficiency and effectiveness resulting from consenting processes and conditions, can have adverse flow-on impacts for biodiversity and natural heritage protection and can result in increased risk of TB infection.

A recent DOC aerial 1080 operation over the Tennyson Scenic Reserve provides an example of the opportunity costs associated with a complex consent process. This was a notified resource consent process followed by an appeal to the Environment Court, mediation and negotiated settlement. The total cost of the Tennyson operation has been estimated at $149,000 with almost 40% of the cost related to RMA compliance. In addition, the planned operation was delayed by one year due to the appeal process. This in turn set back an associated $500,000 multi-year research programme in the same location.

The partners have also incurred costs in pursuing initiatives to improve the consistency of Regional Plans. Most recently DOC engaged on the Canterbury Land and Water Plan review and sought amendments to the rules for aerial 1080. A team of DOC planners, legal and technical staff prepared evidence that resulted in a change from controlled activity status to a permitted activity for aerial 1080. The costs of DOC involvement in this process have been estimated at $25,000-$30,000, exclusive of any costs associated with Council and third party involvement in the process. TBfree NZ and Federated Farmers of New Zealand also incurred costs in preparing and presenting submissions on this matter. DOC is currently involved in a similar review process on the Auckland Unitary Plan.

Future Pressures

There are currently 110 active resource consents for 1080 use nationally and 98% of these consents are due to expire within the next 10 years. In locations where operations are set to continue, consent renewals will be required. In addition, an indeterminate number of consents are likely to be required for new operational areas over the next 10-year period. Key operations that will drive the need for consents include:

- DOC's commitment to increase its aerial 1080 programme by 50,000 hectares per year for five years contributing to the on-going protection of native species.
- The likely need to repeat DOC's significant response to the 2014 South Island beech mast and predator irruption event - the "Battle for our Birds" operation. In 2014 this required DOC to increase its aerial 1080 protection in the South Island by approximately 500,000 hectares, and required 16 separate resource consents.
- By 2026, TBfree NZ aims to have reduced the extent of the existing TB vector risk area (where TB is present in possums and other wildlife) by at least 2.5 million ha. The key regions targeted for reduction include Waikato, Hawkes Bay, Manawatu, Tasman, West Coast, Canterbury, Otago and Southland, and consents will be required in most regions. Further possum control operations will also be required in these and other regions to prevent disease spread and minimise livestock infection rates.

If a timely solution that achieves national consistency can be delivered, this has the potential to realise significant cost savings for the partners in the short term and potentially allow the further reallocation of resources into operational areas of need.

Case for Change Summary

Given the above findings, the partners consider there is a compelling need to simplify the management of 1080 use under the RMA to reduce duplication, provide greater consistency, reduce compliance costs and minimise operational risks.

This simplification will assist the partners in achieving their strategic objectives and thereby generate significant national benefits through the protection of New Zealand's livestock industries and exports from the effects of bovine TB, and the continued protection and enhancement of our biodiversity for its intrinsic, economic and recreational values.

This change can be made while still providing for the safe use of aerial 1080, as the risks and effects of the substance are already comprehensively managed under the HSNO framework.

Investment Objectives

Based on the findings of the case for change, the partners are seeking to achieve the following key objectives from simplification;

1. Improve the effectiveness of aerial pest control operations by establishing nationally consistent environmental compliance measures within the next two years (ie by December 2016).
2. Improve the efficiency of aerial pest control operations by reducing unnecessary RMA compliance costs by 80% within the next five years (ie by December 2019).

Options Assessment

The partners have explored the full range of potential options to achieve these objectives as summarised below.

National Options	
	• Regulation under the RMA • New National Policy Statement. • National Environmental Standard (NES) • Legislation Change • New Act • Plan change at National Level • National Consent
Regional Options	
	• Regional Approach –comprising a mix of Regional Plan review and comprehensive resource consents • Comprehensive Consents • Private Plan Changes • Council led Plan Changes
Advocacy	
	• Improved systems approach • Best Practice Guidance

The options have been qualitatively assessed against the investment objectives to determine a short list of three options. The final short list includes two national options and a regional option as follows;

1. A new National Environmental Standard (NES) – permitting the use of 1080 nationally subject to HSNO controls.

2. A new Regulation under Section 360 (h) of the RMA - exempting 1080 from the discharge controls set out in Section 15.

3. Regional Approach – comprising a mix of Regional Plan reviews and comprehensive resource consents to permit the use of 1080 subject to HSNO controls.

Cost-Benefit Analysis

The short list has been subjected to an independent cost benefit analysis by Sapere Research Group. The results of this analysis pointed strongly towards the two national options, as opposed to the regional option. The analysis found little differentiation between the benefits and costs of the two national options.

The benefits of the national options – with a benefit-cost ratio of 11 to 1 - were assessed as being significantly higher than the regional options. Other benefits not readily quantifiable in the cost benefit analysis would also accrue from the implementation of a national option, including:

- Enhanced opportunities for the partners to standardise internal processes allowing for more specialised planning and operational functions that enable more efficient use of staff time.
- Reduced uncertainty potentially leading to lower contract pricing, to the extent that contractors currently factor in price premia for consenting risk. There may be scope for national standardisation to allow these premia to be waived and costs of operations to be reduced.
- Standardisation and a single set of rules may reduce cases of consent non-compliance when conducting aerial 1080 operations.
- Improved timeliness of operations with national standardisation meaning that operations could be planned an implemented more quickly than under the current framework, thereby being more responsive to on-the-ground changes.
- Reduction in suboptimal consents; whereby operations are constrained for the sake of meeting consent requirements, resulting in reduced pest control benefits.
- Increases in area covered by aerial 1080 operations if organisations can realise operational savings from a streamlined consent process. Freed-up resources could be reallocated to additional pest management operations. This could lead to an expansion in the area covered by aerial 1080 operations, with consequent gains for biodiversity protection and bovine TB control.
- Improved public confidence where the introduction of a national standard and single set of rules may improve overall public confidence in the conduct of aerial 1080 activities.

Preferred Option

The pros and cons of the two national options were further assessed by the partners and the preferred option has been assessed as a regulation under Section 360 of the RMA, for the following reasons:

- It is a more directly applicable and appropriate policy tool than a NES to address the case for change.
- There is a risk that an NES would create a new set of conditions or standards which would once again needlessly duplicate HSNO standards and controls.
- A regulation is likely to have a higher chance of success overall.

Delivery arrangements

The proposed delivery arrangements for the preferred option have been scoped and will be completed in six key stages including:

1. Preparation stage – including confirming the project plan and resourcing, preparing a public discussion document, regulatory impact statement and legal drafting of the regulation.
2. Securing Ministerial/Cabinet approval to consult with Central and Local Government on the proposed regulation.
3. Consulting with Central and Local Government on the proposal and making revisions.
4. Securing Cabinet approval to release a discussion document for formal consultation.
5. Releasing the discussion document and analysing submissions.
6. Revising the regulation for promulgation.

The option is to be delivered by a project team that includes resources from within the partners with independent project management and communications support. The delivery of the option has been assessed as being affordable within the context of the benefits it is likely to generate. The aim of the partners is to deliver the preferred option by August 2015.

Conclusion

The business case analysis has found a compelling case for aerial application of 1080 to no longer be treated as a discharge to be managed under the RMA. The preferred option is an efficient and cost effective solution that is likely to realise significant economic and environmental benefits for the partners and New Zealand, whilst still enabling robust management of any environmental risks or adverse effects. The potential benefits of the preferred option of a section 360(1)(h) regulation are therefore considered to significantly outweigh any potential disadvantages.

PART 1 – OVERVIEW AND SCOPE

1 OVERVIEW

The following business case has been prepared by TBfree New Zealand Limited (TBfree NZ) in partnership with the Department of Conservation (DOC) and the Ministry for Primary Industries (MPI). The case has been developed in consultation with Regional Councils, the Ministry for the Environment (MfE) and the Environmental Protection Authority (EPA). These organisations have all been involved in the case for change assessment and the options analysis, including the determination of the preferred option.

The case has been prepared in response to the Parliamentary Commissioner for the Environment's (PCE) Report of June 2011 which identified a need to simplify and standardise the management of 1080 under the Resource Management Act 1991 (RMA) and other legislation, stating *"the labyrinth of laws, rules and regulations that govern 1080 and the other poisons used to control introduced pests creates unnecessary complexity and confusion."*.

The purpose of the case has been to explore the PCE's conclusions further by assessing whether a compelling argument exists for greater standardisation and simplification of the regulatory system. This analysis has concluded that the environmental effects and health risks of the aerial discharge of 1080[1] are robustly managed under the Hazardous Substances and New Organisms Act 1996 (HSNO), Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM) and the Health Act 1956 in all aspects.

It has further found that there are very high levels of duplication between the HSNO requirements for 1080 use, and regional plan standards and resource consent conditions under the RMA. It has also found that there are inconsistencies in how aerial 1080 is regulated through regional plans under the RMA.

The evidence reviewed suggests that these issues are impacting the effective and efficient delivery of aerial pest management operations and are imposing needless costs on public good pest management programmes.

Based on this evidence the partners consider there is a compelling case to change the system by simplifying the regulation of aerial 1080 under the RMA. The likely benefits of this change will be a reduction in unnecessary compliance costs (with the potential to reinvest cost savings into pest management operations and research), significant operational benefits and efficiencies, and lower risks of operational non-compliance. These benefits may in turn lead to improved biodiversity outcomes for New Zealand and greater protection from the effects of bovine tuberculosis (TB) for the New Zealand meat and dairy industries.

The changes sought will not adversely impact the safe use of aerial 1080, as the environmental effects and risks of the substance are already comprehensively managed under the HSNO framework.

[1] Full list of 1080 products, refer Appendix F

2 BUSINESS CASE FRAMEWORK

This business case is based on New Zealand Treasury's National Infrastructure Unit Better Business Case framework.[2] The business case analysis has followed the five case model (refer Figure 1) comprising:

- Strategic case - is the proposal supported by a compelling case for change that fits within the strategic context/drivers and meets the business needs?
- Economic case - does the preferred option optimise value?
- Commercial case - is delivery of the preferred option viable?
- Financial case - is the proposed spend affordable and how can it be funded?
- Management case – is the proposal achievable and can it be delivered successfully?

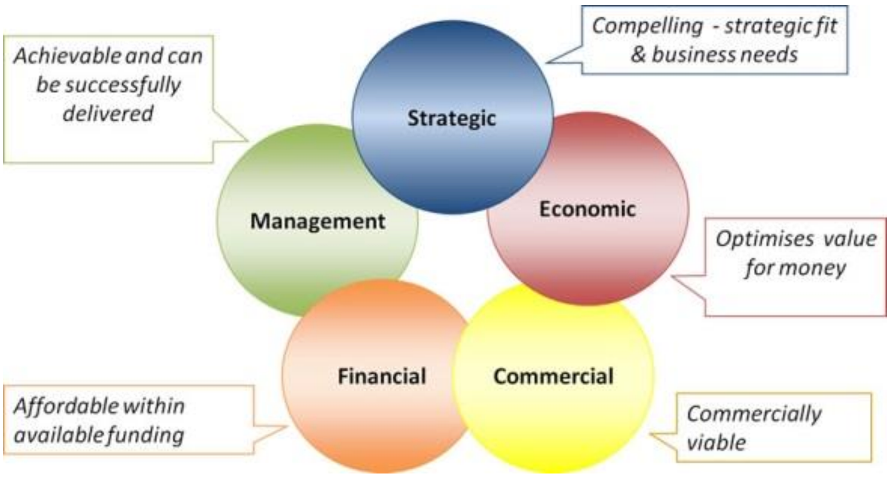

Figure 1: Better Business case five stage model

Within this framework the report is structured as follows:

- Part 1 provides an overview of the case, a summary of analysis framework used and case scope.
- Part 2 contains the strategic case; setting out the strategic drivers and context for the business case, the analysis of the existing regulatory system for aerial 1080, the issues identified with the current system and whether there is a compelling case to change the current system.
- Part 3 contains the economic case detailing the options for change, the options assessment and the preferred way forward.
- Part 4 contains the management, financial and commercial cases setting out the recommended delivery arrangements for the preferred option including its proposed implementation, monitoring and review.

[2] http://www.infrastructure.govt.nz/publications/betterbusinesscases

3 CASE SCOPE

The use of aerial 1080 in New Zealand is regulated primarily under the following legislation:

- Hazardous Substances and New Organisms Act 1996 (HSNO).
- Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM).
- Resource Management Act 1991 (RMA).
- Health Act 1956 (the Health Act).

The analysis undertaken for this business case has focussed on the regulation of aerial 1080 under section 15 of the RMA and the interaction of this regulatory system with the requirements of the HSNO/ACVM/Health Acts. The key area of focus is highlighted in Figure 2 below. Whilst the case analysis has involved an extensive review of the HSNO framework, it has not focussed on the need for any changes to this system as the evidence reviewed has revealed it is operating effectively.

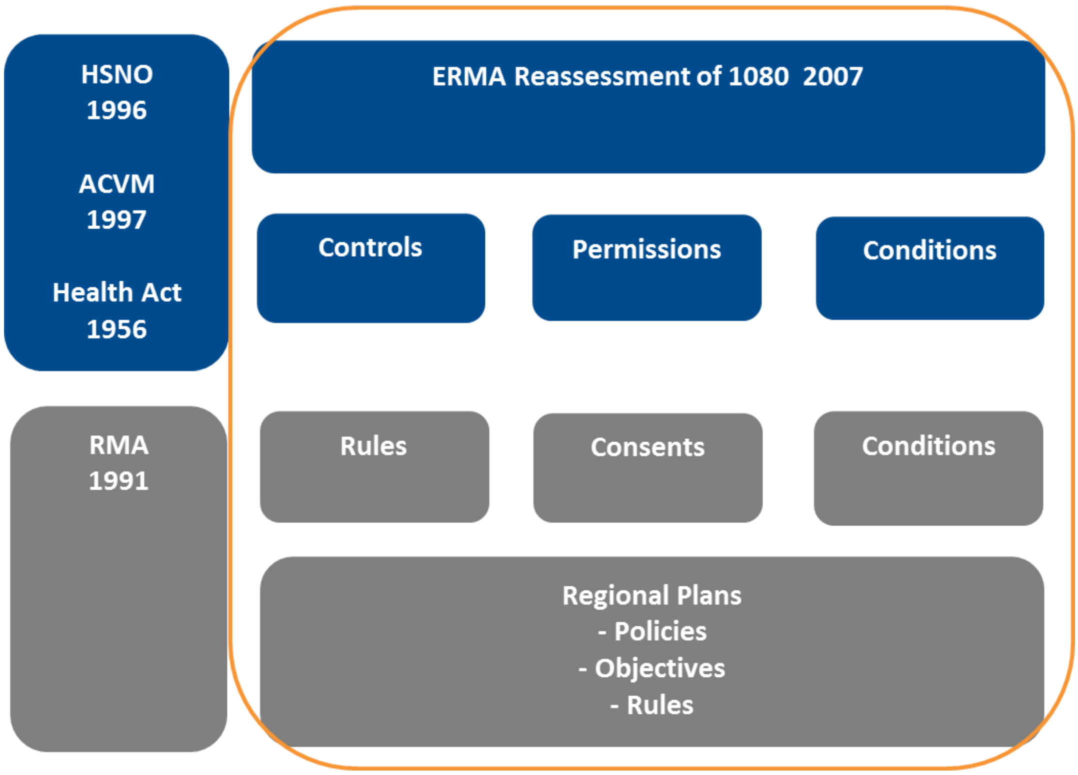

Figure 2: Business Case Focus

This business case relates to all 1080 products that are registered for aerial application in New Zealand under both HSNO and ACVM. A full list of the applicable products is contained within Appendix F.

PART 2 – STRATEGIC CASE

4 STRATEGIC CONTEXT AND DRIVERS

The primary drivers for the development of this business case include:

- The ongoing strategic need for aerial 1080 use in New Zealand.
- The findings of the Parliamentary Commissioner for the Environment (PCE) on the regulation of 1080 under the RMA.
- The strategic objectives of the partners to deliver effective and efficient pest control for biodiversity gains, and to protect agriculture from bovine tuberculosis (TB)
- The immediate and ongoing operational needs of the partners.

4.1 Drivers for aerial 1080 use

4.1.1 Threat of bovine tuberculosis to agriculture

Agriculture is a key driver of New Zealand's economy, and together with the food and forestry sectors, generates 70% of New Zealand's merchandise export earnings and around 12% of Gross Domestic Product.[3] The importance of the agricultural sector to the economy is reflected in the Government's Business Growth Agenda where sustained growth in agricultural exports is a key priority of the plan.[4] The nation's significant natural resource base is integral to the value generated by the sector.

Rising international animal health standards and growing concerns about food safety are major factors that govern and threaten access to overseas export markets for agricultural goods. New Zealand's extensive biosecurity system plays a critical role in protecting and enhancing our natural resource base and our productive agricultural sector. Its purpose is twofold: to stop invasive pests from entering the country, and to manage established pests within the country. This dual role underpins the competitiveness of the agricultural industry in international markets.

1080 is a key component of the biosecurity toolkit and its use is critical for controlling the significant threat of TB to a $14 billion per year deer, beef and dairy export industry[5], and reducing the impacts of vertebrate pests on productive land. Many of New Zealand's trading competitors, including Australia, are classed as being free of TB and an effective TB control programme is essential for New Zealand to maintain the productivity and reputation of our cattle and deer industries.

TB control in New Zealand is fundamentally reliant on effective control of the brush-tailed possum, which acts as a host and vector of the disease, and aerially applied 1080 is the key tool for TB-related possum control over large and inaccessible areas.[6]

[3] http://www.mpi.govt.nz/agriculture
[4] Business Growth Agenda
[5] http://www.tbfree.org.nz/bovine-tuberculosis-information.aspx
[6] http://www.tbfree.org.nz/pest-management-%E2%80%93-how-are-we-doing-it-2.aspx

In the absence of an effective TB control strategy, the number of infected herds and animals would escalate to unacceptable levels and may reach a point where there is a degree of risk to New Zealand's overseas trade in beef, dairy and venison products in some markets. The potential damage to export trade resulting from reduced consumer preference for food products from a country with high TB prevalence rates is a very significant economic factor.

1080 is also a key tool in the ongoing control of rabbits, which are now becoming resistant to rabbit haemorrhagic disease (RHD). Farmers and land managers are returning to aerial 1080 to protect pastoral land from rabbits and preserve the gains made in recent years through the use of RHD.[7]

4.1.2 Conservation, biodiversity and natural heritage

New Zealand is renowned for its high level of biodiversity and endemic species, and it is this uniqueness that underpins our identity as a nation. Many of the New Zealand's national emblems, such as the koru, silver fern and kiwi,[8] are based on our indigenous biological world. The conservation and enhancement of our biodiversity and natural heritage is one of New Zealand's major priorities[9] and is key to our national identity.

Due to New Zealand's long geographic isolation from other land masses, indigenous species have evolved without terrestrial mammalian species (with the exception of bats), meaning that many lack natural defences against introduced destructive mammalian predators and competitors. As a result, many of our indigenous and endemic species have either become extinct or are now threatened. [10]

Endemic New Zealand species are of high conservation importance as they are unique to our country and the survival of natural populations can only be ensured in New Zealand.[11] The uniqueness of much of New Zealand's indigenous biodiversity means that responsibility for its continued existence is entirely ours. It cannot be conserved in nature anywhere else in the world.[12]

Conservation of our biodiversity and natural heritage is also important for the economy. At a fundamental level, all economies and all businesses depend, directly or indirectly, on biodiversity and its component resources.[13] Indigenous biodiversity provides a variety of often unrecognised ecosystem services. These services, which can be provided directly or indirectly, include (among others); [14]

- habitat for native species and taonga,
- protection of soil and water resources (and their quality)
- catchment and coastline protection and mitigation of floods and storm damage
- carbon sequestration
- provision of resources for cultural use,

[7] http://www.landcareresearch.co.nz/publications/newsletters/discovery/discovery-issue-34/rabbits-on-the-rise
[8] http://www.qualityplanning.org.nz/index.php/planning-tools/indigenous-biodiversity/what-is-biodiversity
[9] https://www.biodiversity.govt.nz/pdfs/picture/nzbs-whole.pdf
[10] http://www.qualityplanning.org.nz/index.php/planning-tools/indigenous-biodiversity/what-is-biodiversity
[11] http://www.qualityplanning.org.nz/index.php/planning-tools/indigenous-biodiversity/what-is-biodiversity
[12] http://www.qualityplanning.org.nz/index.php/planning-tools/indigenous-biodiversity/what-is-biodiversity
[13] https://portals.iucn.org/library/efiles/documents/2008-002.pdf
[14] http://www.qualityplanning.org.nz/index.php/planning-tools/indigenous-biodiversity/what-is-biodiversity

- opportunities for recreational activities,
- provision of a backdrop for and essence of much of New Zealand's tourism industry, and
- natural character, aesthetic values and a sense of place.

A 1997 study by Massey University economists suggested that the total annual value provided by New Zealand's native terrestrial biodiversity to the country's economy could be more than half the value of our gross domestic product. They estimated the annual value of native biodiversity on land in 1994 at $46 billion, compared with gross domestic product (GDP) that year of $84 billion.[15]

The protection of New Zealand's biodiversity and natural heritage also plays a key role in supporting our established primary production and tourism industries, and our growing film industry.

To many people biodiversity also has 'intrinsic value' – the idea that biodiversity has value in its own right, and is not something that should simply be viewed for its usefulness to humans. Human responsibility toward other living things, and obligations to future generations, provide strong grounds for conservation, and underlie the International Convention on Biodiversity[16] of which New Zealand is a signatory.[17]

4.1.3 Impacts of pests on biodiversity

A major cause of biodiversity loss is introduced animals which directly affect biodiversity through predation and browsing of indigenous species, and seed consumption. Browsing and seed consumption can have major effects on regeneration of vegetation, and species composition. Predation of pollinators and seed dispersal agents have additional effects on ecosystem functioning.

New Zealand has a very large number of introduced, highly destructive mammalian pests, including possums, rabbits, mice, rats, stoats, ferrets and feral cats.[18] These pests (with the exception of rabbits) all kill adult birds and chicks, and raid nests for eggs. They also compete for, and can wipe out, critical food sources for birds such as supplies of berries, flowers, fruits and invertebrates.[19] Predators are blamed for an estimated 61% of chick and egg losses every year.[20] All of these pests have devastating effects on New Zealand's native plants, animals and ecosystems.

Pests threaten species that are icons of our natural heritage, including:[21]

- Mōhua, southern New Zealand dotterel and kākāriki which are in immediate danger of extinction.
- Rowi (Okarito brown kiwi) kākā and North Island kokako – which are acutely threatened

[15] https://www.biodiversity.govt.nz/pdfs/picture/nzbs-whole.pdf
[16] https://www.biodiversity.govt.nz/
[17] http://www.cbd.int/countries/default.shtml?country=nz
[18] http://www.1080facts.co.nz/
[19] http://www.1080facts.co.nz/conservation.html
[20] http://www.parliament.nz/resource/0000121168
[21] http://www.1080facts.co.nz/conservation.html

- Nationally critical species of giant New Zealand snail, Powelliphanta, and common species such as tui, bellbird, fantail and whitehead.

Introduced pests also devastate forest canopy and strip vast tracts of native bush. Rata, kamahi, pohutukawa, mistletoe and fuchsia are particularly badly affected.[22]

Over the past 50 years, possums have emerged as one of the major threats to the health and wellbeing of forests throughout New Zealand.[23] Many of these impacts are subtle and indirectly affect native birds and insects. [24] Possums cause damage to native forests from the ground level to the canopy where, by concentrating on individual plants of their preferred species, they can kill trees by defoliation over several years.[25] Possums preferentially feed on some of the tall canopy species – such as tawa, northern rata, kohekohe, southern rata, kamahi, pohutukawa and Hall's totara – while ignoring others. They also prefer some of the smaller trees, such as tree fuchsia and wineberry, along with mistletoe, forest herbs, some ferns, and a number of endangered shrubs.[26]

Possum populations have now modified many New Zealand forests. The rate and extent of these changes vary widely between different types of forests. Beech forests are the least affected, but in the vulnerable southern rata-kamahi forests of Westland many valleys have lost between 20% to 50% or more, of their canopy trees. [27] In severe situations, possums have caused the complete collapse of the canopy within 15–20 years of their arrival. Tall forest is then replaced by shrublands.[28]

While the impact of possums is most visible and dramatic when it involves canopy trees, their most pervasive impacts are often less visible. Possums have recently been described as "reluctant folivores". This means that possums prefer to eat other forest foods than the leaves of trees. Flowers, fruit, leaf buds, fungi and insects are all highly favoured. The consumption of these foods has the largest impact on the healthy functioning of forests and the animals that rely on them.[29]

Pest control is now a major focus for most biodiversity management programmes within New Zealand. Conservation of our natural heritage is therefore a major motive for the use of aerial 1080.

1080 is very effective in controlling introduced animal pests (particularly possums) and is well suited to New Zealand conditions. It can be safely applied by air and it is the most cost-effective method of providing landscape scale pest control over difficult terrain.[30] Aerial 1080 operations involving pre-feeding of baits are increasingly reliable in achieving high kills not only of possums but also rats and stoats via secondary poisoning.

[22] http://www.1080facts.co.nz/conservation.html
[23] http://www.doc.govt.nz/conservation/threats-and-impacts/animal-pests/methods-of-control/1080-poison-for-pest-control/the-use-of-1080-for-pest-control/3-why-we-use-1080-for-pest-control/3_3-possum-damage-to-native-forests/
[24] ibid
[25] ibid
[26] ibid
[27] ibid
[28] ibid
[29] ibid
[30] http://doc.govt.nz/conservation/threats-and-impacts/animal-pests/methods-of-control/1080-poison-for-pest-control/

This 'triple hit' of the three major bird predators over a large area provides a breeding 'window' that is crucial to increasing female and chick survival.[31]

4.2 Parliamentary Commissioner for the Environment

The Parliamentary Commissioner for the Environment's Report on 1080 is a key driver for the development of this business case and the key conclusions and recommendations from the report relevant to the case are set out below.

4.2.1 Parliamentary Commissioner for the Environment Report - 1080

In June 2011, the Parliamentary Commissioner for the Environment (PCE) released a report titled *"Evaluating the use of 1080: Predators, poisons and silent forests"* (refer Appendix A). The report represents a comprehensive review and analysis of 1080 use in New Zealand and draws on some 200 individual references to reach its conclusions.

The primary conclusion of the report is:

"It is my view based on careful analysis of the evidence that not only should the use of 1080 continue (including in aerial operations) to protect our forests, but that we should use more of it."

The report also noted issues with the regulation of 1080 stating *"a labyrinth of laws and regulations govern the use of vertebrate toxic agents, resulting in unnecessary complexity, confusion, and potential duplication of costs."*[32]

In reference to RMA regulation specifically, the report noted the differences in the way Councils control aerial 1080 use, with the status of the activity differing between regional plans. Concerns were also noted that as a result, operations may be restricted and it may be potentially difficult to respond to urgent events such as beech mast seasons, which may require pest population control at short notice or within narrow timeframes.[33]

In light of these findings, the report recommended:

"The Minister for the Environment investigate ways to simplify and standardise the way 1080 and other poisons for pest mammal control are managed under the Resource Management Act and other relevant legislation."

4.2.2 Update on PCE Report

In June 2013, the PCE issued an update report summarising progress on its 2011 recommendations and noted;

"although there are other methods that are effective in particular situations, the only practical and cost-effective option that is available for controlling possums, rats and stoats in large and inaccessible areas is an aerially delivered poison. And there is no

[31] http://www.1080facts.co.nz/the-science-of-how-1080-works.html
[32] Parliamentary Commissioner for the Environment Report – Evaluating the use of 1080: Predators, Poisons, and Silent Forests. June 2011, Appendix A
[33] Ibid

alternative poison available now or in the near future that could be used aerially and would be preferable to 1080."[34]

In reference to the recommendations on simplifying RMA regulation, the Commissioner noted that the Ministry for the Environment had provided updated guidance to Councils encouraging them to avoid duplication on matters already covered under HSNO.[35] However, the report also noted that this guidance did not mention 1080 or refer to any tangible examples of duplication.[36]

In reference to the development of this business case the update report also noted the following;

"The other aspect of enquiry was whether any work is being done to develop a National Environmental Standard (NES) to make aerial 1080 a permitted activity in all regions. The Commissioner also raised this question with the Minister of Conservation, Hon Nick Smith, after he took up the portfolio. The pros and cons of an NES on aerial 1080 are being explored by the Department of Conservation, Environment Waikato and the Animal Health Board (TBfree NZ), and a meeting with Ministry for the Environment officials is imminent."

4.3 Strategic Objectives – the Partners

4.3.1 TBFree New Zealand Limited

TBfree NZ is a fully owned subsidiary of Operational Solutions for Primary Industries New Zealand Ltd (OSPRI) and has responsibilities to the Minister for Primary Industries.[37] TBfree NZ is the management agency for the National Bovine Tuberculosis Pest Management Plan pursuant to the Biosecurity Act 1993. This plan is funded by Central and Local Government, and through levies on beef, dairy and deer farmers.[38]

TBfree NZ's overall strategic aim is to eradicate TB from New Zealand by testing all cattle and deer, regulating stock movement, and controlling the wild animals that carry and spread the disease.

The primary objectives of the TB Pest Management Plan are to:

- Establish the feasibility of eradicating bovine TB from wildlife populations by:
  - Eradicating the disease from two extensive bush areas.
  - Maintaining freedom from TB in areas already eradicated.
- Eradicate TB from wildlife over at least 2.5 million ha of Vector Risk Areas by June 2026.
- Prevent establishment of TB in possum populations in Vector Free Areas during the strategy period.

[34] Parliamentary Commissioner for the Environment update report on the original investigation – Evaluating the use of 1080: Predators, Poisons, and Silent Forests. June 2013
[35] Ibid
[36] Ibid
[37] http://www.tbfree.org.nz/governance-and-funding.aspx
[38] http://www.ospri.co.nz/Governance.aspx

The secondary objective of the Pest Management Plan is to:

- Maintain national TB infected annual period prevalence at its lowest possible level and at no greater than 0.4% during the strategy.

The use of 1080 as an efficient and effective means of controlling possum populations is fundamental to achieving the overall strategic aims and objectives of TBfree NZ and its Pest Management Plan.

4.3.2 Department of Conservation

The Department of Conservation is the leading Central Government agency responsible for the conservation of New Zealand's natural and historic heritage.[39] Its legislative mandate is the Conservation Act 1987 and other key statutes such as the National Parks Act 1980 and Reserves Act 1977.[40]

DOC's strategic vision is *"New Zealand is the greatest living space on Earth. Kāore he wāhi i tua atu i a Aotearoa, hei wahi noho i te ao."*[41] This vision is further expanded upon below:

"New Zealand's unique wildlife and spectacular landscapes and coastline are critical to our sense of national identity and our lifestyle, as well as our economy. Supporting this natural capital is the area of focus for the Department over the next 4 years. The state of our native species and the health of New Zealand's land and waters is core work for the Department, but the quality and quantity of that natural capital is critical to the country's ability to prosper."

The efficient and effective control of invasive animals is fundamental to achieving this vision and underpins a of number key outcome areas adopted by the Department as follows:

- *Outcome - The diversity of our natural heritage is maintained and restored*

  New Zealand's native species face constant pressure from introduced plant and animal pests; a pressure that will be further exacerbated by the impact of climate change. Managing these pressures, in order to avoid extinctions and maintain ecosystem services, is a major challenge.

- *Outcome – More people participate in recreation*

  International tourism is one of New Zealand's biggest export earners. To help build economic prosperity, the Department has a focus on having more people participating in outdoor recreation, and spending their leisure time and money in these places.

[39] http://www.doc.govt.nz/about-DOC/role/vision-role-overview-and-statutory-mandate/statutory-mandate/
[40] Ibid
[41] http://www.doc.govt.nz/Documents/about-doc/statement-of-intent-2012-2017/statement-of-intent-2013-2017.pdf

4.3.3 Ministry for Primary Industries

The Ministry for Primary Industries (MPI) has the vision of *"Growing and Protecting New Zealand"* and its core business is focussed on three major systems; biosecurity, food safety and primary production.

MPI is responsible for pest management oversight and leadership within New Zealand and administers the Biosecurity Act 1993. MPI works to prevent harmful pests and diseases from entering New Zealand, manages systems to detect and respond to incursions and established pests, facilitates trade and encourages co-operation and participation in the system.[42]

MPI is also responsible for the co-ordination of partnerships needed to successfully contain or eradicate pest species, the development of national pest management plans and priorities, and monitoring the effectiveness of pest management measures across the public and private sectors.[43]

MPI has adopted the Pest Management National Plan of Action (NPA) which commits those involved in pest management to:

- adhere to firm principles of public accountability in decision making;
- align efforts around shared outcomes;
- ongoing development of people, knowledge, tools and systems;
- implementing a co-ordinated improvement programme.

Key changes in the pest management improvement programme under the NPA are to:

- clarify roles and accountabilities;
- improve and simplify processes;
- develop better and more accessible tools;
- improve capacity for collective action.

The NPA has identified the ongoing availability of pest control tools as a major risk to the future of pest management in New Zealand.[44] Streamlining the regulatory barriers that unnecessarily restrict access to critical tools and the development of a national biosecurity toolkit are key strategic objectives for MPI.

4.3.4 Regional Councils

Regional Councils have a key role in animal pest management and use aerial 1080 in a range of biodiversity projects and programmes. Under the Resource Management Act 1991, Regional Councils are also responsible for maintaining native biological diversity and controlling the adverse effects of activities on biodiversity through regional and district plans. Regional Councils also manage native biodiversity values on regionally-managed public land, for example regional parks.

[42] Ministry for Primary Industries, Statement of Intent 2014-2019
[43] http://www.biosecurity.govt.nz/pests/surv-mgmt/mgmt
[44] http://www.biosecurity.govt.nz/files/pests/surv-mgmt/pmp-working-paper-3.pdf

The Biosecurity Act 1993 gives Regional Councils power to undertake monitoring and surveillance to determine whether or not pests are present, as well as the ability to prepare Regional Pest Management Plans and provide for the assessment and eradication or management of pests in accordance with these plans.

Regional Councils produce pest management plans that establish varying levels of control for a range of vertebrate pests. Aerial 1080 is a key part of the control toolkit for some Regional Councils in meeting the objectives of pest management plans and fulfilling their responsibilities to regional/local communities.

4.4 Operational Pressures

The need to respond efficiently and effectively to operational pressures is a key driver for DOC and TBfree NZ in preparing this business case.

4.4.1 Response to Mast Events

Beech mast events are cyclical, occurring every 2 – 6 years, and are seasons when high levels of seed production in forests trigger rodent and stoat population explosions. When seed supplies run out these predators turn on endangered birds such as mōhua, kākā, kea, whio and kiwi along with other at risk species like bats and land snails.[45]

A significant beech mast event occurred in 2014. It has been estimated that with no pest control response, approximately 75% (or more than 3500 birds) of the remaining mōhua population could be lost[46] and other native bird species could also suffer major losses. In 2000, a widespread beech mast and resulting predator plague caused the local mōhua population in the Marlborough Sounds to become extinct.

In response DOC implemented the "Battle for our Birds" pest control programme, which required DOC to increase its aerial 1080 protection in the South Island by approximately 500,000 hectares. This programme involved the acquisition of 16 separate resource consents within the South Island in 2014.[47]

The cyclical nature of mast events means that this will remain an ongoing operational pressure for the Department.

4.4.2 Commitment to increase coverage

To supplement its response to the predicted 2014 mast event, DOC has also committed to increasing its national aerial 1080 programme by approximately 50,000 hectares per year for the next five years (250,000 hectares total).

This means that DOC will be supporting the 2014 beech mast response by routinely treating approximately 400,000 hectares of public conservation land with 1080 by 2019.

[45] http://www.1080facts.co.nz/
[46] Ibid
[47] Per comms August 2014

4.4.3 TBfree NZ operations

TBfree NZ's aim is to reduce the overall extent of the existing TB vector risk area by 25% by 2026.[48] The key regions targeted for reduction include Waikato, Hawkes Bay, Manawatu, Tasman, West Coast, Canterbury, Otago and Southland. Further possum control operations will also be required in these and other regions to prevent disease spread and minimise livestock infection rates.

5 ANALYSIS OF EXISTING ARRANGEMENTS

5.1 Aerial 1080 use in New Zealand

The primary entities responsible for vertebrate pest control operations within New Zealand are TBfree NZ, DOC and Regional Councils.[49] In monetary terms, DOC spends about $22 million annually[50] controlling animal pests. TBfree NZ spends approximately $46 million annually[51] on animal pest control and management, including approximately $10-13 million per annum on aerial 1080 operations, out of a total TB control budget of $80 million per annum. The overall spend on possum control across the 17 Regional and Unitary Authorities in New Zealand is conservatively estimated at $35 million annually.[52]

Key vertebrate pests targeted by these organisations include possums, rats, stoats, rabbits and wallabies. Aerial application of 1080 is undertaken to manage these pests on both small and large scales, ranging from drops on individual farms, to individual operations over tens of thousands of hectares across TB vector control areas and the conservation estate. In large, steep, and inaccessible areas, aerial application of 1080 is vastly more effective in knocking down pests compared with ground-based methods.[53]

5.2 Scale of use

From 2008 to 2012 TBfree NZ, DOC and Regional Councils were responsible for the operations on 97% of the land area treated with aerial 1080 nationally (refer Figure 3). TBfree NZ and DOC were by far the greatest users within this period and aerially applied the substance to 2.3 million hectares of land during this period.

[48] http://www.tbfree.org.nz/strategy-overview.aspx
[49] Five year review of the aerial of 1080, Environmental Protection Authority, Appendix B
[50] Parliamentary Commissioner for the Environment Report – Evaluating the use of 1080: Predators, Poisons, and Silent Forests. June 2011, Appendix A
[51] Ibid
[52] National Pest Management Plan of Action, Ministry for Primary Industries
[53] Parliamentary Commissioner for the Environment Report – Evaluating the use of 1080: Predators, Poisons, and Silent Forests. June 2011, Appendix A

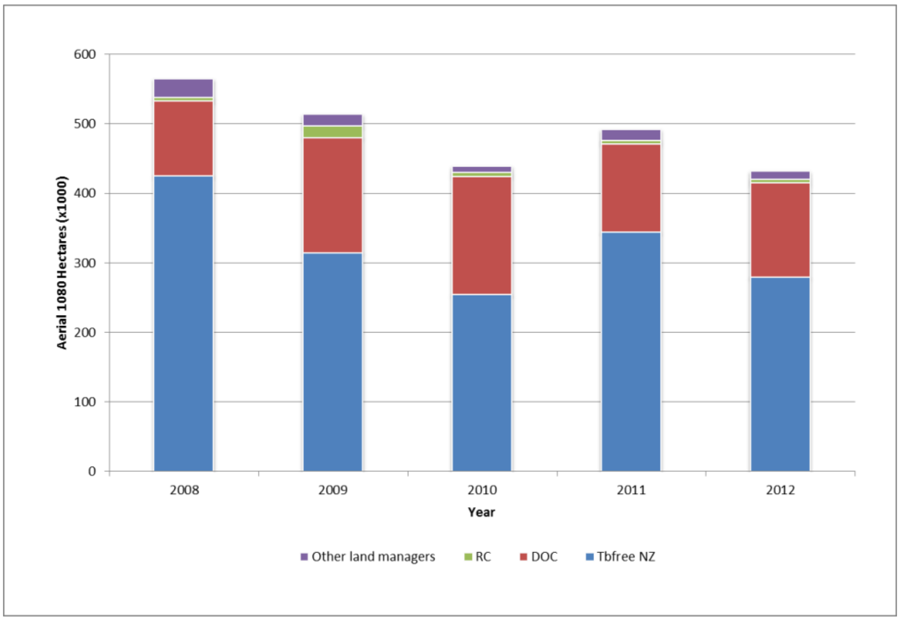

Figure 3: Aerial 1080 operations by land area by operator[54]

Farmers, private land owners and forestry and land managers, such as Land Information New Zealand, use various combinations of aerially applied 1080, shooting and ground-laid poisons to control pests.[55] This is done to meet the requirements of regional pest management plans or for pest control on individual properties to protect crops, pasture or plantations. This group of “other land managers” aerially applies 1080 to approximately 15,000 hectares of land annually.

5.3 Location of operations

Aerial 1080 operations are undertaken in almost all regions in New Zealand. Table 1 shows the locations of all aerial 1080 operations by region from 2008 to 2012. DOC and TBfree NZ undertook operations in all of the regions listed during this five year period. The highest numbers of operations were in the West Coast, Canterbury, Otago and Waikato regions.

[54] Figure5 – EPA Five Year Review of the Aerial Use of 1080, Appendix B
[55] EPA Five Year Review of the Aerial Use of 1080, Appendix B

Region	2008	2009	2010	2011	2012	TOTAL
Bay of Plenty	2	1	1		1	5
Canterbury	11	14	7	7	6	45
Hawkes Bay	5	4	3	3	4	19
Manawatu	8	3	1	4	3	19
Marlborough	3	4	2			9
Northland		1		1		2
Otago	7	9	9	11	7	43
Southland	1		1			2
Taranaki	2		1		2	5
Tasman	6	4		3	2	15
Waikato	9	6	6	8	9	38
Wellington	1	3	1		2	7
West Coast	20	15	13	12	12	72
Grand Total	**75**	**64**	**45**	**49**	**48**	**281**

Table 1: Aerial 1080 operations by Region[56]

Table 2 shows the size of operations by year and region. The West Coast and Waikato regions had the largest area of land treated during the five year period. Otago and Canterbury both had a large number of operations over smaller areas, reflecting a preponderance of rabbit control operations on private land.[57].

Region	2008	2009	2010	2011	2012	TOTAL
Bay of Plenty	47	11	4	0	7	69
Canterbury	25	24	9	10	37	105
Hawkes Bay	52	81	24	17	73	247
Manawatu	48	44	3	119	42	256
Marlborough	49	28	26	0	0	103
Northland	0	2	0	14	0	16
Otago	13	33	4	13	3	66
Southland	7	0	25	0	0	32
Taranaki	2	0	35	0	21	58
Tasman	65	64	0	47	38	214
Waikato	71	27	77	64	75	314
Wellington	3	19	29	0	32	83
West Coast	183	181	203	208	105	880
Grand Total	**565**	**514**	**439**	**492**	**433**	**2443**

Table 2: Aerial 1080 applied to land by Region[58]

[56] EPA Five Year Review of the Aerial Use of 1080, Appendix B
[57] ibid
[58] ibid

5.4 Regulation of aerial 1080

The aerial application of 1080 within New Zealand is managed primarily under the following legislation:

- Hazardous Substances and New Organisms Act 1996 (HSNO)
- Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM)
- Resource Management Act 1991 (RMA).
- The Health Act 1956 (The Health Act).

HSNO provides the basis for approving the importation, manufacture and use of all vertebrate toxic agents (VTAs) in New Zealand, and is administered by the New Zealand Environmental Protection Authority (EPA). The Act sets out the overarching framework for the management of hazardous substances but the details that guide the management of VTAs are all contained in regulations. In addition to regulations, specific approvals for VTAs under HSNO also include a range controls to manage the environmental effects and risks of substance use.

ACVM is administered by the New Zealand Food Safety Authority and Ministry for Primary Industries and VTAs such as 1080 need to be registered for use within the New Zealand under ACVM. Product labels, which include conditions to manage use of the products, are developed under ACVM.

Under the RMA a hazardous substance includes, but is not limited to, any substance defined in section 2 of HSNO. Pest control operations that use 1080 and other poisons must comply with the RMA and relevant council plans. Regional Councils are responsible for managing the effects of discharges to freshwater, land, air and coastal waters and produce a range of regional plans to manage these effects. Territorial local authorities are responsible for the management of any adverse effects from the storage and use of hazardous substances on land, and the protection of the surfaces of lakes and rivers.

The Health Act is used to regulate 1080 to protect public health. Restrictions are set by local health authorities, and generally include measures to protect public drinking water supplies and measures to mitigate human health risks, such as establishing buffer zones around poisoning operations. Health authorities can also set requirements for the removal of any carcasses that may contain poison residues. The Ministry of Health (MOH) operates under this Act when setting conditions on HSNO permissions for 1080 use. In practice, the issue and conditioning of permissions is delegated to the public health units of District Health Boards.

5.5 Regulation under the HSNO Act

HSNO focusses on controlling hazardous substances throughout all aspects of their existence and, for the management of VTAs, the Act is a regulation based regime. The details that guide the management of VTAs are contained within a range of regulations and controls which are essentially rules to prevent and/or manage the adverse effects of hazardous substances.

These controls and regulations are the basis for regulating 1080 use under HSNO.[59] Compliance with HSNO regulations and controls is mandatory for all 1080 operations undertaken within New Zealand.

5.5.1 Reassessment of 1080

In 2006-07 the EPA (formerly the Environmental Risk Management Authority) completed a significant reassessment of 1080.[60] The application was initiated by TBfree NZ (formerly the Animal Health Board) and DOC, driven by the following:

- The need for both agencies to increase the use of 1080 to meet Government targets for reducing the levels of TB in cattle and deer herds and support strategies on sustaining biodiversity.
- The completion of significant research on 1080 since it was first registered in 1964.
- The considerable public concerns about the use of 1080, including concerns about the management of its use and its environmental effects.

The application was five years in the preparation, was assessed over a two year period and involved the consideration of more than 1400 public submissions.[61] The process included an extensive analysis of the costs, benefits and risks of using 1080 in reference to the market economy, the environment, society and communities, the relationship of Maori to the environment and human health and safety[62].

The EPA's assessment of the application concluded that the benefits of 1080 use far outweighed the costs and that there are no practical alternatives to 1080 for the preservation of native bush, biodiversity and the protection of agriculture.[63] The EPA determined to approve the application subject to controls as follows;

Application HRE05002 to import, manufacture and use sodium fluoroacetate (1080) and formulated substances containing 1080 in New Zealand is approved with controls in accordance with the relevant provisions of the Hazardous Substances and New Organisms (HSNO) Act, the relevant regulations made under the Act and the HSNO (Methodology) Order 1998.[64]

5.5.2 HSNO management regime

The reassessment decision established a tighter management regime for 1080 use, and aerial use in particular, based on the identified risks and adverse effects of the substances, the concerns raised by submitters during the reassessment process and issues with the historic management of some aerial 1080 operations.

[59] http://www.epa.govt.nz/hazardous-substances/about/HSNO-controls/Pages/HSNO%20controls.aspx
[60] Summary of reassessment, ERMA NZ, Appendix D
[61] Ibid
[62] Ibid
[63] Ibid
[64] http://www.epa.govt.nz/publications/1080-decision-document-with-amendments.pdf

This regime has been in place since 2007 and comprises four main elements:

1. Strengthened controls to mitigate the range of risks associated with 1080 use and 1080 aerial drops. The controls cover a range of measures to avoid and mitigate potential adverse effects from 1080 use and manage the risks from operations.
2. The establishment of a public watch list that requires annual reporting on all aerial 1080 operations to the EPA. This reporting is publically available.
3. Promotion of best practice amongst all users of 1080 in relation to pre-operation planning, consultation and notification as well as the management of 1080 aerial operations.
4. Recommendations for further research to be undertaken both into alternatives to 1080 for pest control, and areas where there remains a lack of knowledge about the effects of 1080.

A summary of each of these components of the system is provided below, along with the key areas of focus.

5.5.3 HSNO Regulations and Controls

The focus of the reassessment controls and the existing regulations is on the management of the risks and adverse effects associated with the aerial 1080 operations including (but not limited to):

- Impacts on non-target native and introduced species – these are managed through a range of controls specifying maximum application rates, bait types, composition of formulations and restrictions around sensitive areas.
- Water quality impacts – managed through controls requiring buffer zones around waterways, especially drinking water sources. Controls may require pre and post operation water quality monitoring.
- Human health – potential human health impacts are managed locally through permissions conditions which require operators to avoid sensitive areas (ie houses and public accessways) and drinking water supply catchments.
- Cultural values, including iwi values – controls require a range of notification and consultation procedures and include specific requirements to consult with local iwi. Consultation can result in changes to operations to manage any risks and or potential impacts.

Table 3 provides a summary of the key controls for the aerial application 1080 use under HSNO as an example of the range of risks and effects that are managed. A full list of the controls and regulations for 1080 is contained in Appendix E to this business case.

Area of control	Summary of controls (Source ERMA)
Formulations, application rates, bait types and packaging	The use of the pure active ingredient of 1080, sodium fluoroacetate, is restricted to research and the development and manufacture of 1080 products. This means that 1080 can be used only in approved formulations. Maximum application rate for aerially dropped 1080 is 30 grams of 1080 per hectare. Carrot baits (except when used for rabbit control) must be of a specified minimum size. This is because smaller pieces tend to increase the chances of non-target species eating the bait. Some carrot chaff is allowed, but the amount is restricted. Any changes to the composition or proposed use of 1080 formulations must be notified to the Authority in writing. This is because changes in formulations, bait size, colour, etc could change the risk profile of the bait and endanger non-target species. The packaging of 1080 formulations must allow for individual packages to be uniquely labelled in order for it to be able to be traced in the event of an incident.
Controlled substances licences	Anyone selling, supplying or using 1080 must have a controlled substances licence.
Public notification	Public notification requirements for any operation including newspaper notices and signage. Signs marking areas where 1080 is used must contain a statement warning the public, including dog owners, about the danger from possum carcasses. This must be readable from a distance of 10 metres. Signs must remain in place for six months after a 1080 operation or until the earlier of either retrieval of the bait or demonstration that the bait and any poisoned carcasses are no longer toxic.
Permissions	MOH permission is required before using 1080 in a drinking water catchment area or in areas where there may be a risk to the public, for example near dwellings. DOC permission is required before using 1080 on the conservation estate to ensure operations comply with DOC standard operating procedures and risks to the public areas are avoided.
Notification and consultation	Owners and occupiers of land or dwellings within or immediately next to the target site must be given sufficient prior notification of the operation, including details such as location of the operation, approximate date and the

	name and nature of the substance to be used. This notification is to be repeated closer to the time of the operation. The public must also be informed by way of newspaper advertisements. Those using 1080 aerially must consult in good faith with local iwi/hapu. This recognises the principles of the Treaty of Waitangi (Tiriti o Waitangi) and seeks to ensure the role of Maori as kaitiaki is protected. This will be implemented through permissions granted for 1080 use under the Hazardous Substances and New Organisms Act.
Reporting	Reporting of any incident, such as a spill or usage error, to the relevant regional council and the Environment Protection Authority (EPA).
Post operational reports	Post-operation reports are to be submitted to the Authority on all aerial applications of 1080. These are to cover public notification and consultation, complaints received about the operation, any incidents that occurred and the outcome of any post-operation monitoring. These reports will be summarised in an annual report from the Authority.
Requirements for aircraft	Aerial operations require the decontamination of aircraft and loading sites once the drop has been completed. Aircraft involved in aerial 1080 operations must use a navigational guidance system (e.g. differential GPS) to ensure the accuracy of drops.

Table 3: Summary of controls (Source: EPA Summary of Reassessment)

5.5.4 Permissions

The HSNO controls require permissions for operations where 1080 is applied aerially:

- In a catchment area from which water is drawn for human consumption, or in any area where there is a risk to public health, for example in places where the public has access as of right (eg parks).
- On land administered or managed by DOC.

Permissions are assessed, issued and monitored by the Public Health Unit of the local District Health Board and DOC regional offices respectively.

The purpose of MOH permissions is to manage potential for human health impacts from 1080 operations. The purpose of DOC permissions is to ensure that all 1080 operations undertaken on public conservation land are in accordance with DOC's standard operating procedures and that the risks to the public and sensitive sites are appropriately managed.

Applications for both DOC and MOH permissions require the submission of an assessment of potential effects on human health and the environment, alongside information on the location of the treatment (operational) area, proposed control methods and outcomes of any consultation. A risk assessment is also required to be provided for MOH permissions.

Permissions allow agencies to manage localised risks of operations and require specific consultation or monitoring of operations. Permissions can be refused or granted subject to a range of conditions that are imposed to manage the risks of operations. DOC permission conditions are based on standard HSNO controls, but may be augmented to take account of local variations or site specific risks. Examples standard MOH and DOC permission conditions and the effects managed by these conditions are provided in Appendix I.

All aerial 1080 operations undertaken within the last 3 years have required MOH permission[65] and in most cases both a DOC permission and MOH have been required.

It is possible that 1080 operations can be undertaken without the need for permission, and this may apply to operations on private land where there is no risk to human health. As outlined above, such operations are unlikely to pose any risk to human health or sensitive conservation areas. These operations still remain subject to HSNO controls which manage the risks from operations and potential adverse effects on the environment.

5.5.5 Monitoring and review of controls

The EPA monitors the performance of HSNO controls and aerial 1080 operations on an annual basis. Operational reports are provided to the EPA by operators and are made available to the public on the 1080 watchlist[66]. The purpose of the annual monitoring reports is to:

- enable members of the public to register concerns about current and future aerial operations and have those concerns monitored and actioned as appropriate by operators;
- enable the EPA to undertake an audit of aerial operations to monitor best practice and consistency;
- ensure that the EPA has the information it needs for any future reassessment it may wish to undertake.

All operational reporting must include the following detail:

- the reasons for the operation;
- details of the notification and consultation undertaken;
- details of the operation – location, dates etc;
- possum numbers before and after the operation;
- incident reports;
- details of pre- and post-operation monitoring of fauna, including species of particular importance to Māori;

[65] http://www.epa.govt.nz/about-us/monitoring/1080/1080-Watchlist/Pages/default.aspx
[66] http://www.epa.govt.nz/about-us/monitoring/1080/1080-Watchlist/Pages/default.aspx

- details of post operation monitoring of water quality; and
- an overall assessment of the outcome of the operation.

5.5.6 Five yearly review

Annual reporting is used by the EPA for the production of a five yearly review that involves an independent analysis of the efficacy of the management regime for 1080, monitoring of the key changes/improvements to the system since the reassessment and assesses whether there is a need to further reassess the use of 1080.

The latest review covered the period 2008 to 2012 and the EPA concluded the following in reference to the current HSNO management regime;

"Analysis of data from the past five years shows that the tighter management regime is being followed and there have been significant improvements in the use of aerial 1080. Operators show a willingness to continually improve and learn from past mistakes and communications about 1080 operations have improved substantially. Incidents and complaints have dropped and water quality remains unaffected. The tighter management regime is working and at this stage there is no indication that a further reassessment of 1080 is required."

The review noted a trend for fewer complaints about 1080 operations as shown in Figure 4 and noted that improved consultation and communication around operations was the likely cause of this trend.

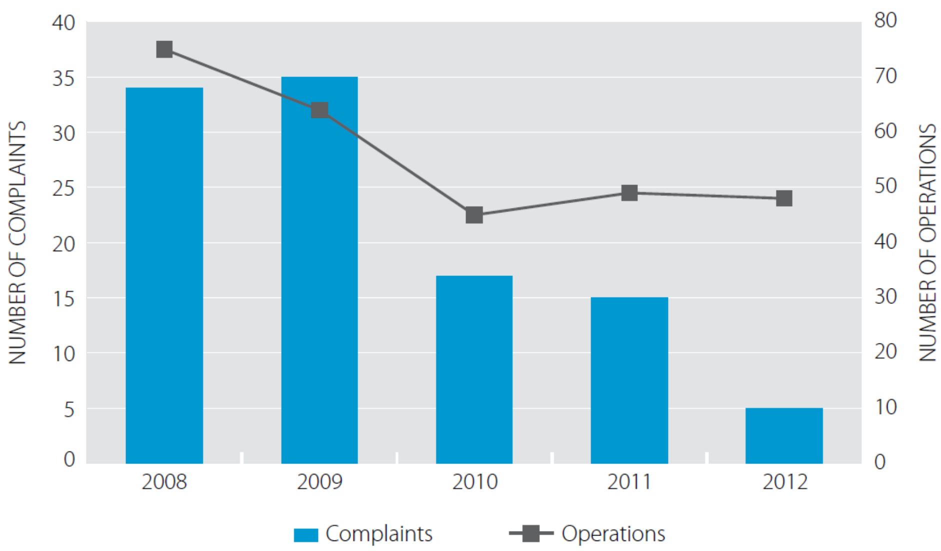

Figure 4: Number of complaints v number of operations[67]

In reference to consultation and communication initiatives, the review further noted;

"The most important improvement in the use of 1080 relates to communications. Operators are using the communication guidelines to engage and inform communities. Local iwi, community groups and regulators are now much better informed about 1080

[67] EPA Five Year Review of the Aerial Use of 1080, Appendix B

operations. Regular notifications, consultation and public meetings are carried out. Today there are fewer complaints about 1080 operations – evidence that improved communication is working well."

Overall, the EPA is currently satisfied that the current management regime comprehensively manages the risks and potential adverse effects of aerial 1080 use and has resulted in improvements to the management of operations over time. The system will be subject to further review in 2017.

5.5.7 Reassessment recommendations

In addition to the controls and monitoring requirements, the 2007 reassessment decision included a number of recommendations aimed at improving the understanding of the impacts of 1080, ensuring greater transparency around operations and improving the understanding of alternatives to 1080.

These recommendations included:

- Undertaking additional research into alternatives to the use of 1080, methods of application and application rates;
- Research to be carried out on the effects of 1080, including:
    - its persistence in soil and water; and
    - effects on taonga species, traditional Maori medicinal plants and valued foods.
- Public consultation processes be further improved;
- Management practices around aerial drops of 1080 be standardised around best practice to ensure consistency; and
- Agencies review their policies and processes relating to the involvement of Maori in the planning and implementation of pest management programmes.

The recommendations have resulted in a range of initiatives by key 1080 users since the decision, including the establishment of the "1080 the facts" website, the provision of information to the public through agency websites, and regular engagement with iwi stakeholders on operations.

Pre operational and post operational monitoring has also been applied to most large scale operations to provide further information about the impacts and effectiveness of 1080 operations. Figure 5 provides a summary of the percentage of total operations that have been subject to species impact monitoring from 2008 to 2012.

The reassessment revealed that many people had concerns around the impact of 1080 on water quality. However, there was no evidence that 1080 adversely affected aquatic species or persisted in water. While there are still some complaints about the possible impact on water quality, monitoring data show that 1080 was detected in only two percent of all samples and has never been detected in drinking water catchments. Where it has been detected, concentrations of 1080 are far below the levels set to protect human health.

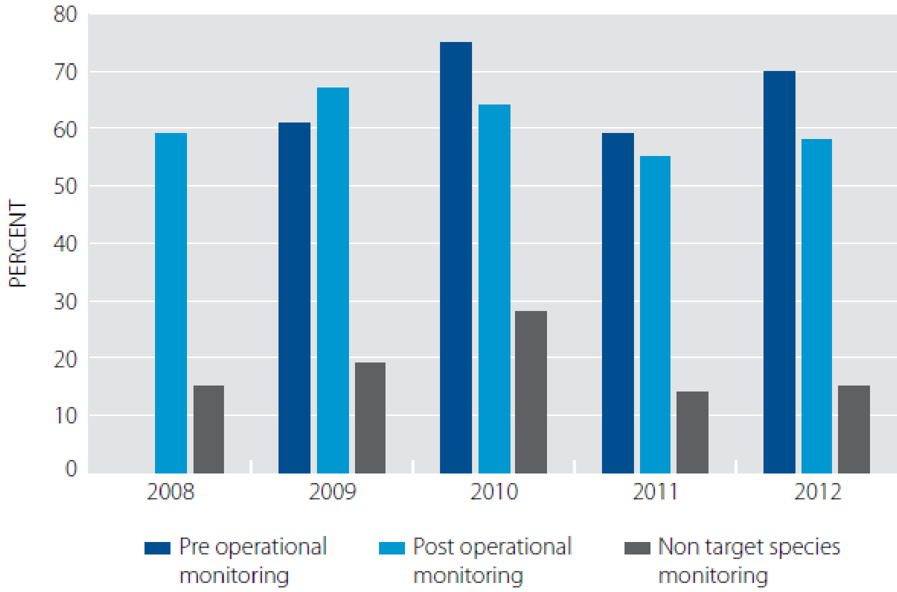

Figure 5: Operations with pre and post operational species monitoring - percentage of total (source: Environmental Protection Agency)

Research projects have been also been initiated by 1080 users since the reassessment, including assessment of alternatives, improvements to operations such as optimum sowing rates and distribution, impacts on non-target and taonga species, impacts on soil, water and animal welfare. Figure 6 provides a summary of the number of research projects undertaken on 1080 from 2008 to 2012.

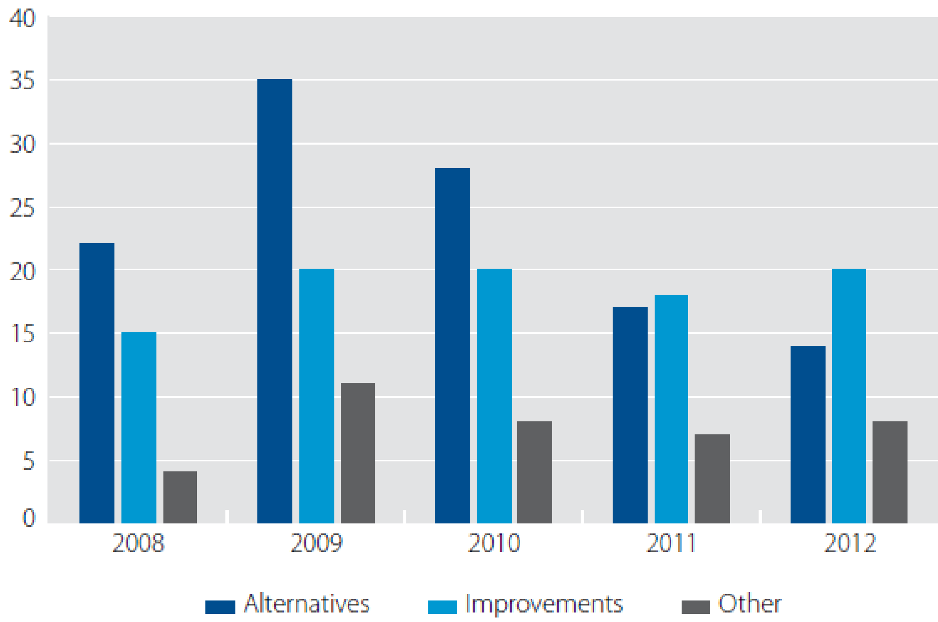

Figure 6: Numbers of new and ongoing research project per year (source: Environmental Protection Agency)

5.6 Regulation under ACVM

The Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM) regulates substances used in the management of plants and animals, including pesticides, fertilisers, stock food, pet food, and veterinary medicines. The Act covers importation, manufacture, sale, and use of agricultural compounds.

Under ACVM, the ACVM Group of the New Zealand Food Safety Authority imposes controls on the use of 1080 products. These controls primarily relate to trade name registration, labelling and signage requirements for all vertebrate toxic agents, including 1080. ACVM controls are supplementary to HSNO controls. The specific ACVM requirements for 1080 include:

- Restrictions on the sale and manufacture of 1080.
- Provision of annual summary reports to MPI on adverse events and advice to MPI on findings from new research into 1080.
- Product labelling controls that:
    - Restrict the sale of 1080 to persons holding a controlled substances licence issued by a test certifier who has been approved by the ACVM Group.
    - Require a register of sales to be kept, recording who the product was sold to and the container(s) serial identity.
    - Require secure storage of 1080.
    - Require public notification of operations when applying 1080 aerially.
    - Set out requirements for signage in prominent places around the perimeter of the treated area.
    - Ensuring the security, identity and application of the product is under the control of a specified person who also holds a controlled substances licence from a test certifier approved by the ACVM Group.

All operations are required to comply with relevant ACVM controls which supplement the extensive regulation of 1080 under HSNO.

5.7 Regulation under the Health Act 1956

The Health Act 1956 (the Health Act) is also used to regulate 1080 and restricts its use to protect and safeguard public health.

The Ministry of Health (MOH) operates under this Act when setting conditions on HSNO permissions for aerial 1080 use. Restrictions are set by local health authorities, and generally include measures to protect public places, households and drinking water supplies.

Restrictions generally include establishing buffer zones around or within poisoning operations, notification requirements, avoidance of times and places of high public use, and in some cases requirements for the removal of any carcasses that may contain poison residues. A list of standard conditions on MOH permissions is contained in Appendix J.

5.8 Standard Operating Procedures and Best Practice Guidance

DOC, TBfree NZ and Regional Councils all have adopted standard operating procedures[68](SOPs) that respond to HSNO, ACVM, RMA and Health Act requirements and controls for 1080. Regional Council SOPs are developed and held by the National Pest Control Agencies (NPCA) as part of the industry best practice.

SOPs include a range of best practice procedures to ensure compliance with relevant legislation, optimal conduct of operations and to manage the risks and effects of 1080, including:

- Specifications for consultation and notification.
- Setting of industry best practice standards.
- Detailed risk management practices.
- Internal and external audit procedures.

DOC also uses SOPs to assess permissions applications and set conditions on all operations undertaken within the Conservation Estate. A summary of the relevant SOPs and standards is provided in Appendix J.

Private contractors who undertake operations for the partners and Regional Councils are contractually obliged to comply with their SOPs.

It is noted that aerial 1080 operations undertaken by private landowners on private land may not be subject to the SOPs developed by the partners, however these operations are subject to general HSNO controls.

5.9 Summary

The national framework of controls and regulations established under the HSNO/ACVM Acts and the Health Act, the monitoring procedures in place, along with a range of best practice guidance and SOPs developed by the partners and Regional Councils together ensure that the risks and potential adverse effects of the discharge of aerial 1080 are comprehensively managed as part of operations.

This framework includes requirements for avoiding and managing off-target impacts, continued stakeholder engagement in operations, public notification of aerial

[68] Refer summary of SOPs, Appendix J

operations, landowner/affected party approvals and consultation with iwi or hapu and other affected parties.

The HSNO framework has further resulted in significant research to advance the understanding of 1080 use, its impacts and improve its efficacy. This has included research into a range of alternative methods. To date this research has not found an effective alternative to the substance.

The EPA monitors the use of aerial 1080 on a national basis and its most recent five yearly review of operations has concluded that the HSNO system of regulation is working well, with complaints and incidents dropping over time. Operators have shown a real willingness to develop and maintain best practice standards.

6 ANALYSIS OF RMA SYSTEM

The following section sets out the key findings of the analysis of the RMA system for the regulation of aerial 1080. The assessment has focussed on two key areas:

- A review of regional plans throughout New Zealand to determine how aerial 1080 operations are regulated on a region by region basis, whether there is inconsistency in the system, and what if any issues this creates.
- A review of all consents for aerial 1080 within the last 10 years (2003 to 2013) to analyse the outcomes of consent processes, explore the way consents are managed from region to region and what if any issues this creates.

The analysis has revealed significant variance in the way regional plans manage aerial 1080 and in the way in which 1080 is managed through resource consent process and conditions of consent. Significant duplication has been identified between regional plan requirements and consents, and HSNO/ACVM requirements.

Section 7 provides an analysis of the impact of these issues in terms of direct and indirect costs.

6.1 Regulation of Aerial 1080 under the RMA

Section 30(f) of the RMA provides Regional Councils with the function to control the discharge of contaminants into or onto land, air, or water and discharges of water into water. Section 15 of the RMA requires Regional Councils to manage the discharge of contaminants to the environment through regional plans. The aerial application of 1080 is regarded as a discharge under Section 15.

Regional plan objectives, policies and rules establish the framework for the control of aerial 1080 operations under the RMA. Rules may require resource consents for operations. Resource consent can be refused or granted and, if granted, potential adverse effects may be managed through conditions on consents. Where no plan rules exist for a particular discharge or where the interpretation of rules is ambiguous, resource consent can be required under Section 15 of the RMA.

6.2 HSNO and RMA interface

The RMA and HSNO Acts have very similar purposes and principles (refer Table 4) and have an interface in the management of hazardous substances. The key difference in relation to hazardous substance management is that HSNO focuses on controlling the specific substance throughout all aspects of its existence (i.e. from cradle to grave) whereas the RMA is primarily concerned with where the substance is in the environment (for example, where it is manufactured, used, transported and disposed of).

HSNO	RMA
Purpose To protect the environment, health and safety of people and communities by preventing or managing adverse effects of hazardous substances and new organisms.	***Purpose*** To promote sustainable management of natural and physical resources.
Principles Safeguarding life supporting capacity of air, water, soil and ecosystems Maintaining and enhancing the capacity of people and communities to provide for their future economic, social and cultural wellbeing.	***Principles*** Sustaining natural and physical resources for future generations Safeguarding the life supporting capacity of air, water, soil and ecosystems Avoiding, remedying or mitigating adverse effects on the environment.

Table 4: Summary of purpose and principles of HSNO and RMA

Under the RMA a hazardous substance includes, but is not limited to, any substance defined by section 2 of HSNO. For hazardous substances that are controlled under HSNO the interface between that regime and RMA is set out in section 142 of HSNO.

When managing the effects of hazardous substances in regional plans, section 142 of HSNO must be read in conjunction with the RMA. This section provides that RMA instruments can only include more stringent requirements than HSNO when they are considered 'necessary' for the purposes of the RMA.

What section 142 means for plan and policy development is that it is permissible for the Council to impose more stringent controls on hazardous substances for RMA purposes. Council's rationale for doing so must be properly considered and justified in terms of section 32 of the RMA.

The provisions of section 142 are relevant to this business case in terms of whether any potential adverse effects from aerial 1080 operations are being regulated under the RMA that are not being regulated under HSNO (or in legislation elsewhere). This is an important test as to whether there is a case to change or simplfy the RMA framework.

The analysis set out below has found that the RMA is not managing any adverse effects that are not already being managed elsewhere under HSNO or other legislation.

6.3 Regional Plan Assessment

Detailed analysis of current regional plans and resource consents has revealed that a complex regulatory environment currently exists for aerial 1080 operations under the RMA. The analysis has further revealed that there is considerable variance in way aerial 1080 operations are managed on a region by region basis under the RMA.

6.3.1 Regional Plan rule framework

All 17 Regional Councils in New Zealand have regional plans that contain objectives, policies and rules that regulate the aerial application of 1080. A summary of relevant regional plan rules, along with an assessment of the activity status of aerial 1080 operations under regional plans is provided in Appendix G.

Each regional plan contains a different rule framework for managing aerial 1080 discharges.[69] Regional plans also contain a range of different terms related to the discharge. In some regional plans, 1080 is included under the wider term “vertebrate toxic agents” and in other plans it is referred to in rules as a poison, contaminant or agrichemical[70]. These terms are often defined differently across region plans and there is scope for ambiguity in the interpretation of plan rules. Where ambiguity exists, consent may be required under Section 15 of the RMA.

6.3.2 Rule framework and consenting requirements

Regional plan rule frameworks result in a range of consent outcomes at three broad levels:

- Plans that require resource consent for aerial 1080 operations as either a controlled, restricted discretionary, discretionary or non-complying activity.
- Plans that require resource consent despite having permitted activity rules for the aerial discharge of 1080.
- Plans that contain permitted activity rules that do not result in the need for resource consent.

The regional plans for Northland, Waikato, Bay of Plenty, Gisborne, Greater-Wellington, Tasman, West Coast and Southland all require resource consents for aerial 1080 operations. With the exception of the Gisborne region, aerial 1080 operations were undertaken in all of these regions between 2008 and 2012[71].

The Auckland, Hawkes Bay, Marlborough, Canterbury and Otago regional plans all permit the aerial discharge of 1080, subject to conditions related to use the substance

[69] Refer summary of Regional Plans, Appendix G
[70] Refer summary of Regional Plans, Appendix G
[71] Refer Table 2, page 5.

around water and within sensitive natural environments such as wetlands and/or the Conservation Estate.

Operations were undertaken in all of these regions between 2008 and 2012, with the exception of Auckland. Between 2003 and 2013, 96 resource consents were required for operations in the Hawkes Bay, Canterbury and Marlborough regions. Consents in these regions were triggered by conditions related to the proximity of operations to watercourses and natural areas.

The Taranaki, Manawatu-Wanganui, Nelson City and Chatham Islands regional plans permit the use of aerial 1080 subject to conditions that do not generally result in resource consents. Aerial 1080 operations occurred in both Taranaki (5) and Manawatu-Wanganui (19) between 2008 and 2012. No consents were recorded in these regions from 2003 to 2013. There were no aerial operations undertaken in the Nelson City or in the Chathams between 2008 and 2012.

6.4 Consenting Overview

From 2003 to 2013, there were 270 consents processed for aerial 1080 operations within New Zealand. A summary of these consents, along with the relevant process pathways is provided in Table 5. The complexity and length of these resource consent processes varied significantly during the period. Approximately 80% of these consents were processed on a non-notified basis. The total number of publicly notified consents during this period was 44, with two of these consents reaching the Environment Court on Appeal. All of the consents processed were approved subject to conditions.

Total Consents	Non-Notified	Limited Notified	Publicly Notified	Withdrawn/ awaiting decision
270	221	15	29	5
100%	81.8%	5.5%	10.7%	1.8%

Table 5: Overview of Consents by type

6.4.1 Consents by Region

Consents were processed in 10 regions in New Zealand during the 10 year period analysed (refer Figure 7). During this same period, 1080 operations occurred in 13 regions. No consents were required in the Taranaki, Otago and Manawatu-Wanganui regions. As discussed above, the plan framework for these regions essentially avoids the need for resource consent. The regions with the largest number of consents processed were Tasman, Canterbury and West Coast.

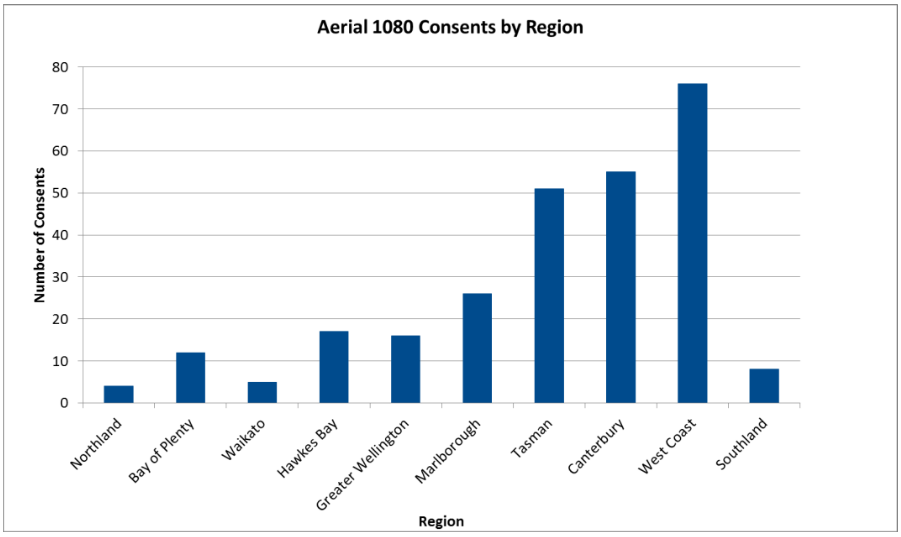

Figure 7: Consents issued in each Region between the years 2003 and 2013 inclusive.

6.4.2 Consent term

Within the 270 consents analysed there is significant variance in the term of consent. Figure 8 shows that most consents are granted for either a longer term (ie 6 to 10 years) or a shorter term (ie less than two years).

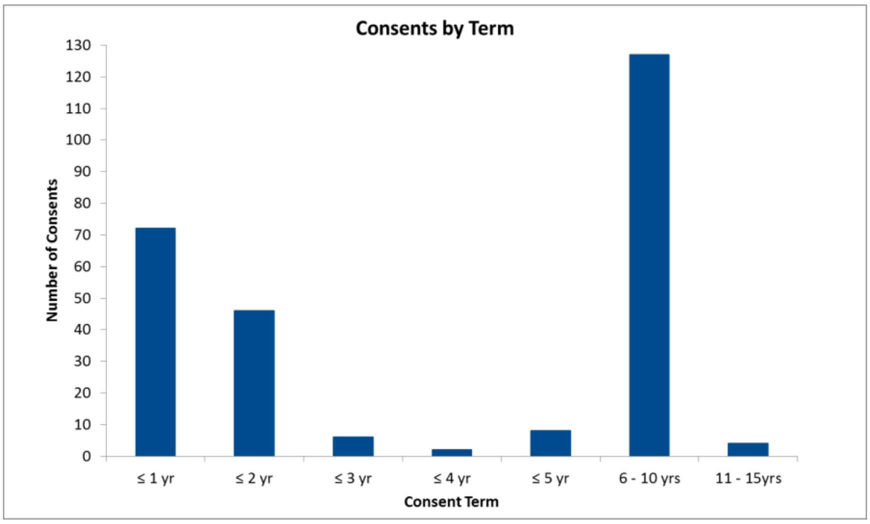

Figure 8: Consents by consent term

The variation in consent term is related to range of factors including;

- the approach taken by applicants when applying for consent (e.g. consent for one operation versus a consent that covers multiple operations);
- the consent term requested by the applicant and/or issued by the Council; and
- Varying consenting practices as Council must publicly notify an application under s95A RMA if the activity is likely to have adverse effects on the environment that are more than minor. This has led to some applicants requesting shorter terms to avoid notification.[72]

[72] Pers comm TBfree New Zealand Limited.

6.4.3 Consent conditions

Analysis of consent conditions has revealed there is a wide variation in the number and complexity of conditions that may be imposed on consents. Some consents contain a relatively small number of conditions (ie less than 10), whilst other consents can contain in excess of 21 conditions. Analysis by region has shown the average number of conditions ranges from 4 conditions (Marlborough) to 38 conditions (Canterbury), with a national average of 18 conditions as summarised in Table 6.

Region	Average number of conditions			
Northland	<10	11-15	16-20	21>
Bay of Plenty		✓		
Waikato				✓
Hawkes Bay		✓		
Greater Wellington		✓		
Marlborough	✓			
Tasman			✓	
Canterbury				✓
West Coast				✓
Southland			✓	

Table 6: Average number of conditions on aerial 1080 resource consents by region.

6.5 Areas of Duplication

The analysis has revealed significant areas of duplication between regional plans and consents conditions and HSNO, ACVM, and Health Act requirements. The key areas of cross over and duplication include:

- Duplication of permitting and consenting processes.
- Duplication of regional plan requirements with HSNO/ACVM requirements.
- Replication between consent conditions and HSNO/ACVM requirements, notaby controls.

6.5.1 Process duplication

There is significant duplication of permitted processes for 1080 operations between the RMA and HSNO. When undertaken on the Conservation Estate, aerial operations can (and often do) require three separate approvals: resource consent, DOC permission and Ministry of Health (MOH) permission under HSNO.

Examples of these applications have been reviewed in the development of this business case and all three approvals necessitate the preparation of the same substantive effects assessment and supporting technical data. All three processes also require input from technical and planning staff/contractors and often necessitate the duplication of reports to meet like conditions.

6.5.2 Regional Plan Rules

A full review of regional plan rules has found that many regional plan rules repeat the requirements of HSNO controls and ACVM legislation unnecessarily. Key examples of rules that duplicate or have equivalent controls under the HSNO Act, ACVM Act, or Ministry of Health (MOH) permission conditions are provided in Table 7.

Regional Plan	Rule	Legislation		Permits/ Permissions
		HSNO	ACVM	MOH
Hawkes Bay Regional Resource Management Plan - Excerpt from Rule 10	*The discharge shall be undertaken in a manner which does not exceed any rate, or contravene any other requirement, specified in the agrichemical manufacturer's instructions.*	✓	✓	
	Every pilot undertaking the aerial application of agrichemicals shall hold a GROWSAFE® Pilot Agrichemical Rating Certificate.	✓		✓
West Coast Proposed Land and Water Plan **Excerpt from Rule 89**	*All residents and occupiers of school buildings within the application area or immediately adjoining the application area are notified at least 48 hours prior to the commencement of the aerial operation.*			✓
	A 100 metre buffer is maintained between the area of application and the boundary of the subject property and between the area of application and any house site.			✓
	Notification of the aerial operation in the local paper occurs at least 14 days prior to the work commencing.	✓	✓	✓
	Signs are posted notifying the public of the application of agrichemicals in public access areas including roads, walking tracks and access along creeks and river.	✓	✓	✓
Greater Wellington Regional Plan for Discharges to Land **Excerpt from**	*There shall be no application of pesticides into open surface water bodies or onto any roof or other structures used as a catchment for water supply.*	✓		✓
	The operator shall ensure that the bucket distributing the bait is covered when flying to	✓		

Regional Plan	Rule	Legislation		Permits/ Permissions
Rule 17	*the extent necessary to minimise the risk of bait spilling from the top due to air currents.*			

Table 7: Examples of Regional Plan rules that duplicate or have equivalent controls under the HSNO Act, ACVM Act, or Ministry of Health Permission Conditions.

6.5.3 Resource consent conditions

A qualitative assessment of 166 consents has revealed significant duplication between conditions of consent and the regulations and controls set under the HSNO and ACVM and conditions contained within Ministry of Health and Department of Conservation Permissions.

For aerial 1080 consents granted from 2003 - 2013, approximately 90% of resource consent conditions are duplicated, or are managed by, equivalent controls under the HSNO and ACVM Acts. The intent of those resource consent conditions and the subsequent duplication is summarised in Table 8. A full assessment of the extent of duplication is contained in Appendix H.

Intent of RMA condition	Other Acts/Processes where controls with equivalent intent are set			
	Legislation		Permits/Permissions	
	HSNO	ACVM	MOH	DOC
Public notification prior to operation commencement	✓	✓	✓	✓
Pilot certification	✓		✓	
GPS of flight lines	✓		✓	
Notification of accidental discharge to authorities	✓	✓	✓	✓
Bait type	✓			✓
Protection of waterways from pesticides	✓	✓	✓	
Warning signage	✓	✓	✓	✓

Intent of RMA condition	Other Acts/Processes where controls with equivalent intent are set			
Complaints and incidents log	✓	✓	✓	
Operation monitoring and sampling	✓		✓	✓

Table 8: Examples of key resource consent condition themes and duplications with other Acts and processes.

6.5.4 Conditions not covered by regulations

The assessment has also found a small number of conditions on consents where there is no direct duplication with any regulations or controls under HSNO or ACVM.

The aspects covered by these conditions are however either addressed elsewhere in the HSNO system (ie through recommendations on the reassessment) or through the SOPs adopted by the partners and Regional Councils. The specific conditions identified, along with a commentary on where they are otherwise addressed are as follows:

- Having a safety officer present on site – this is addressed through SOPs which set out health and safety procedures and security requirements for all operations.
- Requirements for cultural impact monitoring and reporting. HSNO controls address the need for iwi involvement in operations. Cultural impact monitoring may be undertaken in response to consultation with iwi carried out according to the reassessment recommendations.
- Analysis of cause of death of any by-kill. By-kill of indigenous and introduced species has been assessed through research over time and may or may not be monitored or analysed according to DOC permission requirements. By-kill of other valued non-target species (such as game, livestock or domestic animals) is analysed as needed on a case by case basis.

Overall this demonstrates that resource consent conditions are not managing any potential adverse effects that are not already managed elsewhere.

7 DIRECT AND INDIRECT COSTS

The following section details the estimated direct costs of RMA regulation of 1080 within the last 10 years, along with examples of estimated indirect costs. The purpose of the analysis has been to assess the cost impact of duplication and regional inconsistency.

7.1 Analysis of Costs

Costs are analysed in three parts below:

- Resource consent costs – including costs for the preparation, processing and monitoring of all resource consents processed between 2003 and 2013. The detailed methodology for deriving costs is outlined in the independent cost-benefit analysis prepared by Sapere Group and contained in Appendix C.

- Plan review costs – costs for partners for involvement in plan change/plan review processes. A case study of the Canterbury Land and Water plan has been used as indication of the costs of involvement in policy processes.

- Opportunity costs – resulting from time delays to pest control operations, cancellation of operations and changes to operations due to resource consent requirements – for example, reductions in operational areas and restrictions on areas that may be treated. A case study of the Tennyson Inlet has been used to provide an indication of opportunity costs.

7.2 Resource Consent Costs

The current RMA management framework has resulted in the processing and approval of 270 consents for aerial 1080 in New Zealand from 2003 - 2013. The cost to the partners in obtaining these approvals is conservatively estimated to be $10.7M.[73]

Figure 9 summarises these costs by year and full details of the analysis are set out in the independent cost-benefit analysis prepared by Sapere Group Limited (Appendix C). It should be noted that all consent costs exclude third party costs incurred by submitters and other stakeholders involved in consent processes and are therefore considered conservative.

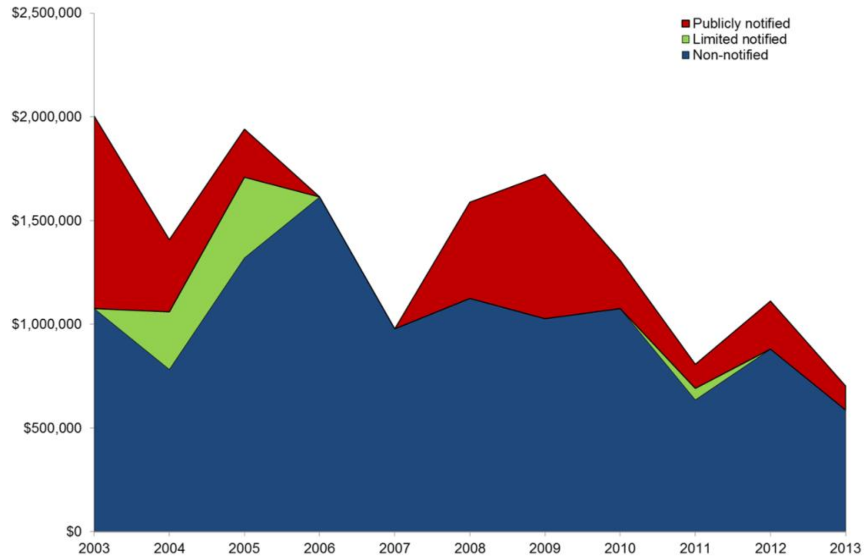

Figure 9: Estimate of compliance costs year 2003 to 2013 - source Sapere Group

[73] Refer Sapere Group cost benefit analysis, Appendix C

Figure 10 provides a summary of the average costs to applicants and Councils by consent type and the key areas of cost, including consent preparation, consultation and monitoring.

	Costs to applicant: Consent preparation	Costs to applicant: Consultation	Costs to applicant: Monitoring	Costs to council: Consent processing	Costs to council: Monitoring
Non-notified:	$29,000 **$6,220** $1,500	$38,892 **$38,056** $19,143	$4,000 **$2,053** $1,000	$7,882 **$1,582** $518	$22,500 **$1,027** $89
Limited notified:	$12,000 **$7,378** $6,993	$38,892 **$38,892** $38,892	$5,000 **$5,000** $5,000	$5,579 **$1,415** $557	$2,797 **$2,797** $2,797
Publicly notified:	$85,500 **$51,222** $6,000	$126,666 **$45,238** $20,923	$5,000 **$5,000** $5,000	$100,000 **$12,440** $2,709	$6,500 **$2,040** $720

Optimistic scenario
Base case
Pessimistic scenario

Figure 10: Average costs to applicant and Councils by consent type source Sapere Group

The average cost of a publically or limited notified consent is significantly higher than the average cost for a non-notified consent, reflecting the greater complexity of these consent processes.

The total cost of compliance noted above provides an indication of the potential direct cost savings that could be achieved by removing RMA consent requirements for aerial 1080 operations. Translated into operations, where the average cost of an aerial 1080 operation is estimated at $17/hectare (refer Figure 11), the reallocation of savings equates to additional 63,000ha of aerial 1080 operations annually.

Figure 11: Average cost per hectare of aerial 1080 application[74]

[74] http://doc.govt.nz/conservation/threats-and-impacts/animal-pests/methods-of-control/1080-poison-for-pest-control/

7.3 Plan Review Costs

In addition to consent costs, DOC and TBfree NZ have been involved in plan reviews to seek amendments to aerial 1080 rules and policy.

The most recent Plan review, undertaken in Canterbury, sought amendments to the rules for aerial VTAs proposed under a new Land and Water Plan. A team of DOC planners, legal and technical staff, prepared evidence that resulted in permitted activity status for aerial 1080, with the Council originally proposing controlled activity status. The estimated costs of DOC involvement in this process are $25,000. TBfree NZ and Federated Farmers of New Zealand also incurred costs in preparing and presenting submissions on this matter. This excludes any costs associated with Council consideration of the changes.

DOC has embarked on a similar process for the proposed Auckland Unitary Plan and is seeking to lift the restriction around the use of aerial 1080. The costs for this process are unknown at this stage.

7.4 Opportunity Costs

Consent processes can result in significant opportunity costs to the partners. Opportunity costs arise when consents – and thus operations - are significantly delayed due to drawn out public notification and/or appeal processes.

A recent aerial 1080 operation over the Tennyson Scenic Reserve is an example of the opportunity costs associated with a consent process. The overall costs of the operation have been estimated at $149,000, with almost 40% of the entire cost of the operation related to resource consent process.[75] The consent for this operation was notified and followed by appeal, mediation and negotiated settlement. The consent process both delayed operations and set back a $500,000 multi-year research program in the area.[76] This does not include the opportunity cost of the biological impact of delayed operations.

7.5 Future Consent Costs

Of the 270 consents issued between 2003 – 2013 inclusive, 149 consents have expired and 78 consents are due to expire in the next 5 years, and the remaining 38 consents will expire post 2018 (refer Figure 12).

[75] Refer Department of Conservation summary of costs and consents, Appendix K
[76] Per comms, Department of Conservation

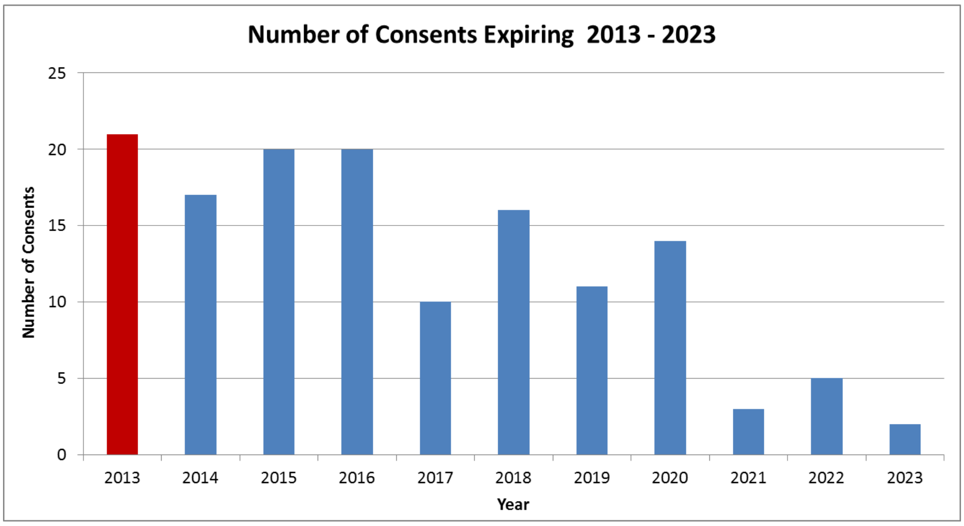

Figure 12: Consent expiry by year. Note that the bar in red indicates consents already expired.

In existing locations where operations are set to continue, consent renewals will be required. In addition, an indeterminate number of consents are likely to be required for new operational areas over the next 10-year period. Key planned operations that will trigger further consents include:

- To increase its ongoing protection for native species DOC is committed to increasing its aerial 1080 programme by about 50,000 hectares per year for five years.
- The likely need to respond to further beech mast events. The 2014 beech mast required DOC to increase its aerial 1080 protection in the South Island by approximately 500,000 hectares, requiring 16 RMA consents.[77]
- TBfree NZ's aim is to reduce the extent of the existing vector risk area by 25% by 2026. The key regions targeted for reduction include Waikato, Hawkes Bay, Manawatu, West Coast, Canterbury, Otago and Southland. Further possum control operations will also be required in these and other regions to prevent disease spread and minimise livestock infection rates.

The potential forward compliance cost of responding to these pressures within the next 5 years is estimated to be $5M which is an indication of the potential cost savings that could be achieved through simplifying RMA requirements for aerial 1080 application.

7.6 Operational Risks and Impacts

Regional inconsistency and duplication also increases the risk of technical breach of consent conditions. Even if the effects of such breaches are minor, they are treated as adverse incidents in EPA reports. Having variable consent conditions reduces the ability of operators to ensure that best practice is always achieved. The recurrence of such incident

[77] Refer Department of Conservation summary of costs and consents, Appendix K

reports could lead to imposition of further controls on the use of 1080 under the HSNO Act, potentially resulting in loss or reduced availability of 1080 as a pest management tool for biosecurity and biodiversity programmes. This would have significant environmental, economic, social and cultural impacts for New Zealand.

Regional inconsistency and duplication has the potential to compromise operations and delay response times, ultimately risking both biodiversity values and TB control outcomes. Furthermore, delays to operations and sub-optimal consents have the potential to compromise the strategic objectives of the partners.

8 CASE FOR CHANGE CONCLUSIONS

It is considered that there is a compelling case to change the existing arrangements and seek to simplify the management of aerial 1080 under the RMA, for the following key reasons:

- The risks and effects of 1080 are robustly and effectively managed under the HSNO, ACVM and Health Act. The regulation of 1080 under the RMA is not affording any extra protection to the environment or public health, nor is it managing risks outside those already managed under HSNO.
- There are high levels of unnecessary duplication between the RMA and HSNO. Significant levels of duplication occur between RMA consent conditions and HSNO controls. There is also duplication between plan rules and HSNO requirements. This duplication is costly and does not improve the management of effects and risks.
- The analysis presented in this business case has found the sustainable management purpose and principles of the RMA are being sufficiently achieved under HSNO. The further management of 1080 under the RMA is not affording additional environmental protection, due to 100% duplication with HSNO permissions and standard operating procedures.
- The management of 1080 through regional plans is inconsistent, and this can adversely impact the effectiveness of operations. There are 13 Regions with varying Regional Plan rules/standards that trigger the need for resource consent for aerial 1080 operations. Over 200 such resource consents have been issued in the last ten years in 10 Regions. There is significant regional variability in consent conditions and in the way consents are managed.
- Inconsistency and duplication increases the risk of compliance failure. Having variable consent conditions reduces the ability of the operators to ensure that best practice is always achieved. Regional inconsistency and duplication also increases the risk of breaching consent conditions. Even if the effects of such breaches are minor, they are treated as adverse incidents in EPA reports. The recurrence of such incident reports could lead to imposition of further controls under the HSNO Act, potentially resulting in the loss or reduced availability of 1080 as a pest management tool for biosecurity and biodiversity programmes.

- There is a need to reduce unnecessary RMA compliance costs to Regional Councils, DOC, TBFree NZ and private contractors/landowners. The compliance costs for resource consents in the last ten years have been estimated at $10.7M. Future costs could be reduced significantly through removing the need for resource consents, and managing 1080 operations under HSNO, ACVM and the Health Act.
- Benefits from greater consistency include the potential direct cost savings for aerial 1080 operations. If estimated compliance costs could be put into operations, where the average cost of an aerial 1080 operation is estimated at $17/hectare, this reallocation would equate to additional 63,000ha of aerial 1080 operations annually. The benefits of this are likely to be significant.

PART 3 – ECONOMIC CASE

9 OPTIONS ANALYSIS

The partners have explored and assessed the full range of regional and national policy and consenting options to address the case for change, including potential advocacy approaches.

The following section summarises the assessment methodology, the options assessed and the short list options assessment process including the rigorous analysis of benefits, risks and costs of the short list of options to determine a preferred option.

The preferred option determined through this analysis process is a regulation under section 360(1)(h) of the RMA which would exempt aerial 1080 operations from section 15 of the RMA and leave their continued management under the HSNO/ACVM framework.

10 ASSESSMENT METHODOLOGY

The better business case model[78] has been used as a framework for the assessment of the options.

The determination of the preferred option was completed through a series of workshops undertaken by two key groups within the project structure (refer Figure 13);

1. The Project Delivery Group – responsible for reviewing and critiquing the case for change, determining the investment objectives and critical success factors, undertaking the qualitative assessment of the long list of options and recommending a short list of options to the Project Steering Group.

   Membership of this group included representatives from Regional Councils, the Environmental Protection Authority, Ministry for the Environment, TBfree New Zealand Limited, Department of Conservation, and the Ministry for Primary Industries.

2. The Project Steering Group - responsible for reviewing the case for change, reviewing the analysis of the short list of options and confirming the short list for cost benefit analysis. This Group then determined a preferred option considering the results of the cost-benefit analysis and relevant risks of each option.

   Membership of this group included representatives from the Department of Conservation, Ministry for the Environment, Ministry for Primary Industries, TBfree New Zealand Limited, and Regional Council.

[78] http://www.infrastructure.govt.nz/publications/betterbusinesscases/files/bbc-prgbus-gd.pdf

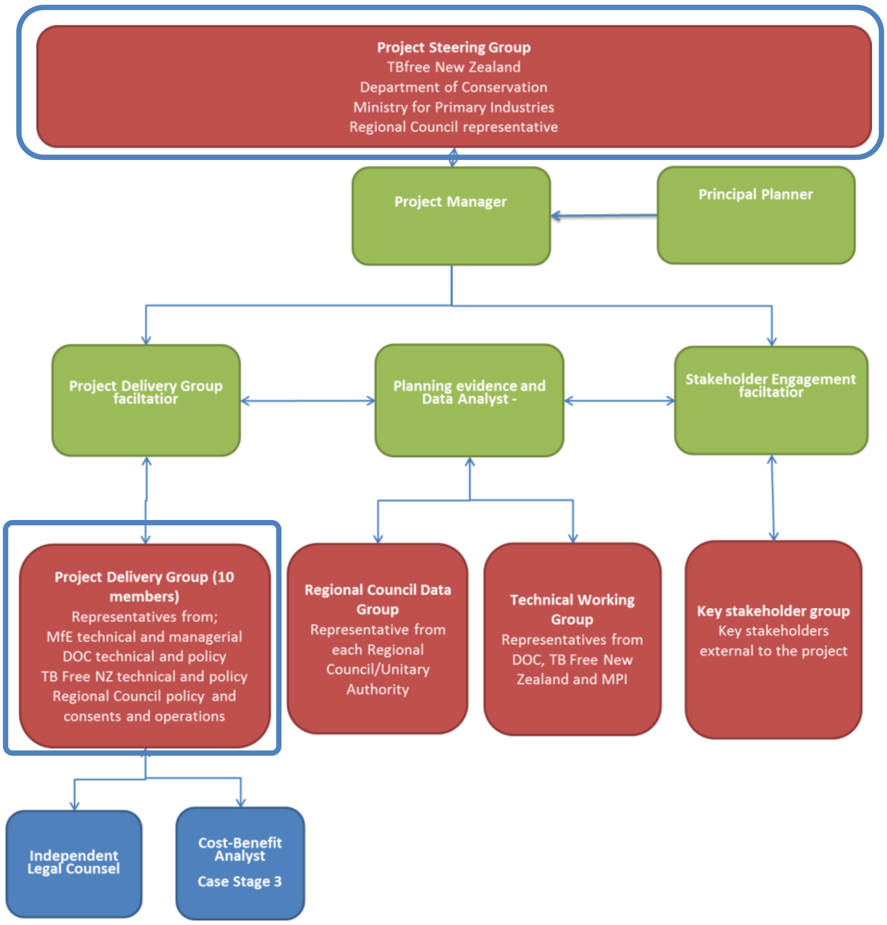

Figure 13: Summary of Project Structure

10.1Analysis Process

The options analysis process involved the following key steps:

1. Assessing and critiquing the case for change and determining the investment objectives and critical success factors.

2. Determining a long list of all possible policy and consenting options to improve consistency in the RMA regulation of aerial 1080 on a national basis.

3. Assessing the long list of options as to how well each option meets the agreed investment objectives and the critical success factors for the project, including an assessment of the risks of each option.

4. Determining a short list of three options based on this qualitative analysis.

5. Assessing the costs, benefits and risks of the three short list options, including an independent cost-benefit analysis.

6. Determining a preferred option based on the findings of the cost-benefit analysis and an assessment of the cost, benefits and risks of implementing the preferred option.

10.2Workshops

The above process was completed through three facilitated workshops with the Project Delivery Group as follows:

- Workshop 1:

  Reviewing the case for change, determining the investment objectives, critical success factors and confirming the long list.
- Workshop 2:

  Qualitatively assessing the long list and determining a short list.
- Workshop 3:

  Reviewing the cost-benefit analysis of the short list options and determining a preferred way forward.

At the conclusion of each workshop the recommendations and findings were reviewed and confirmed by the Project Steering Group before proceeding to the next stage.

11 INVESTMENT OBJECTIVES

Based on the findings of the case for change, the Project Steering Group determined the following investment objectives to inform the options analysis:

1. Improve the effectiveness of aerial pest control operations by establishing nationally consistent environmental compliance measures within the next two years (i.e. by December 2016).

   This objective recognises the importance of achieving national consistency and the implementation of a timely solution given the operational pressures within the next five years.

2. Improve the efficiency of aerial pest control operations by reducing unnecessary RMA compliance costs by 80% within the next five years (i.e. by December 2019).

   This objective recognises that any preferred option should achieve a reduction of unnecessary RMA compliance costs overtime.

Any preferred option must be able to deliver on these investment objectives.

11.1Critical Success Factors

The assessment of options was supplemented by the inclusion of the following critical success factors (CSFs) set out in Table 9 below. The CSFs are key components that are required to successfully achieve the investment objectives.

Critical Success Factors	In a word	Description
Strategic fit and business needs	NEEDS	How well the option meets the operational requirements of the partners in short, medium and long terms. How well the option meets the strategic intent of the partner's business strategies.
Potential value for money	BENEFITS	How well the option generates benefits and optimises potential value for money for the partners and the public good pest management programmes which they deliver.
Capacity and capability	DELIVERY	How well the option can be technically delivered by Central Government and/or Regional Councils.
Potential affordability	COSTS	How well the option can be met within likely available funding.
Potential achievability	RISKS	How well the option can be implemented with due regard to the associated risks and uncertainties.

Table 9: Critical Success Factors

12 LONG LIST OF OPTIONS

Table 10 summarises the long list of options considered in the assessment. The list included policy tools and advocacy approaches at both a national and regional level.

Option	Description
Business As Usual	• Regional Councils set rules on aerial 1080 through Plan Reviews. • Requirements for resource consent vary by region. • Complexity of complying with consent conditions varies by region. • Continued possibility that applications will be notified. • Possibility of further constraints on 1080 use being introduced through Regional Plan reviews
National Options	
New National Policy Statement	• Set objectives and policies for the aerial use of 1080 as a matter of national significance, providing clearer national direction. • Consent authorities must have regard to any relevant national policy statement when considering an application for resource consent.
National Environmental Standard	• Set rules for the adoption of consistent standards at regional level for aerial 1080 as a permitted activity.
Legislation Change	• Amend section 15 of the RMA to state that it does not apply to 1080 products that have approval under HSNO.

Regulation under the under s360(1)(h) of the RMA	• A regulation exempting the use of aerial 1080 from Section 15 of the RMA. • The Governor-General, by Order in Council, makes a regulation under s360(1)(h) of the RMA that; *"Prescribes exemptions from any provision of section 15, either absolutely or subject to any prescribed conditions, and either generally or specifically or in relation to particular descriptions of contaminants or to the discharge of contaminants in particular circumstances or from particular sources, or in relation to any area of land, air, or water specified in the regulations"*
New Act	• Drafting of a new Act that exempts the use of aerial 1080 from the requirements of the RMA.
Plan change at National Level	• Lodge a "plan change" application with the EPA to amend all relevant regional plans simultaneously to permit the aerial use of 1080. • Likely that a Board of Inquiry would process the application as a matter of national significance.
National Consent	• Lodge a multi-region comprehensive consent application with the EPA to secure consent for all 1080 operations over a 35 year term. • Likely that Board of Inquiry would process the application as a matter of national significance.
Regional Options	
Regional Approach	Establishment of a centralised team to manage a rolling multi-year programme comprising: • Submissions on the scheduled Regional Plan reviews within the next two years, with the objective of securing permitted activity status for aerial 1080 operations; and • Preparation of comprehensive resource consents in eight other regions, to secure long-term consents for all operational areas with consistent conditions. Possibility of further constraints on 1080 use being introduced through Regional Plan reviews.
Comprehensive Resource Consents	• Preparation of comprehensive resource consents across 13 Regions to secure long-term consents for all operational areas with consistent conditions.
Private Plan Changes	• Partner led private plan changes with the objective of making the aerial use of 1080 permitted activity subject to HSNO requirements. • Possibility of further constraints on 1080 use being introduced through Regional Plan reviews. •
Council Led Plan Changes	• Council led plan changes with the objective of making the aerial use of 1080 a permitted activity subject to HSNO requirements. • Possibility of further constraints on 1080 use being introduced through Regional Plan reviews.

Advocacy Options	
Improvements to current systems	• Advocacy for improvements in the way consents are processed i.e. establishing standard decision criteria and protocols around affected parties. • An example of this is the Hawkes Bay Regional Council which has dedicated staff to process 1080 consent applications. This has resulted in a more consistent approach to consenting and better relationships between the Council and applicant.
Best Practice Guidance	• Develop guidance in conjunction with Regional Councils to improve consistency in the implementation of VTA regulation. • Voluntary guidance only.

Table 10: Long list options

13 LONG LIST ASSESSMENT

The Project Delivery Group (PDG) assessed the long list of options at a facilitated workshop and the assessment involved a qualitative analysis of each of the long list options against the investment objectives and critical success factors. A summary of the outcome of this assessment is provided in Table 11.

				National Options							Regional Options				Adovcacy Options	
			Status Quo	National Policy Statement	National Environmental Standard	Legislation Change	Regulation under the RMA	New Act	Plan change at National Level	EPA Consent	Regional Approach	Private Plan Changes	Council led Plan Changes	Comprehensive Resource Consents	Advocate for improved systems	Best Practice Guidance
CRITERIA 1	Investment Objectives	QUALITATIVE														
Objective 1:	Improve the **effectiveness** of aerial pest control operations by establishing **nationally consistent** environmental compliance measures **within the next 2 years**.	Unlikely to achieve objective = 1 Potential to achieve objective = 3 Likely to achieve objective = 5	1	2	3	1	3	3	2	2	1	1	1	2	1	1
Objective 2:	Improve the **efficiency** of aerial pest control operations by **reducing** unnecessary RMA compliance costs by 80% **within the next 5 years**.		1	1	4	4	4	4	2	2	3	1	1	2	1	2
IO SCORE			**2**	**3**	**7**	**5**	**7**	**7**	**4**	**4**	**4**	**2**	**2**	**4**	**2**	**3**
CRITERIA 2	Critical Success Factors															
CSF 1:	Strategic Fit and Business Needs	Unlikely to achieve CSF = 1 Potential to achieve CSF = 3 Likely to achieve CSF = 5	1	1	4	4	4	4	2	3	3	2	1	3	2	1
CSF 2:	Benefits		1	1	4	4	4	4	2	2	2	1	2	2	2	2
CSF 3:	Delivery		3	2	3	2	3	3	2	2	3	1	1	1	3	3
CSF 4:	Costs		5	1	4	1	4	2	1	2	3	1	1	2	2	2
CSF 5:	Risks		4	1	3	1	2	2	1	2	3	1	1	1	1	2
IO + CSF SCORE			**16**	**9**	**25**	**17**	**24**	**22**	**12**	**15**	**18**	**8**	**8**	**13**	**12**	**13**
SHORT LIST OPTIONS			**Y**	**N**	**Y**	**N**	**Y**	**not assessed**	**N**	**N**	**Y**	**N**	**N**	**N**	**N**	**N**

Table 11: Summary of long list assessment

14 SHORT LIST SUMMARY

The following short list of options was determined for further analysis;

1. National Environmental Standard.
2. Regulation under section 360 of the Resource Management Act.
3. Drafting of a new Act.

The short list options were recommended to the Project Steering Group and a decision was made to replace the new Act option with a "regional approach" option comprising a mix of;

1. Regional Plan Reviews.
2. Comprehensive resource consents.

The new Act option was replaced as the Project Steering Group considered there was a very high level of risk and uncertainty regarding its potential development and implementation. The potential outcome of the new Act option was also considered to be very similar to both the NES and regulation options. Value was seen in including the regional approach option, which would not require national regulatory or legislative change, to provide a comparison with the national level options.

A detailed description of the final short list of options is contained within Appendix L.

15 COST BENEFIT ANALYSIS FINDINGS

Sapere Research Group (Sapere) were commissioned to undertake an independent cost-benefit analysis of the three short-listed options to inform the final decision on the preferred option. A summary of the key findings of this analysis is set out as follows.

15.1.1 Benefit Cost Ratio

Sapere developed a cost-benefit model to assess the three options against the status quo. The two national options (NES and s360(1)(h)) were treated the same way within the cost-benefit model, as Sapere considered the implementation of both options would result in similar outcomes.

Overall, the analysis concluded that although society would be better off under either approach, the net benefits of the national approach ($10.5million) far outweighed those of the regional approach ($2.6million) with benefit-cost ratios of 11 to 1 and 3.2 to 1 over a twenty year period respectively.

A summary of this analysis is provided in Table 12 and the final model results are set out in Figure 14.

Measure		National approach ($ million)	Regional approach ($ million)
Benefits (present value)	**Total**	**$11.5 m**	**$3.8 m**
	Councils – avoided costs	$0.8 m	$0.3 m
	Applicants – avoided costs	$10.7 m	$3.6 m
Costs (present value)	**Total**	**$1.1 m**	**$1.2 m**
	Development costs	$0.8 m	$0.6 m
	Implementation costs	$0.2 m	$0.6 m
Net benefit (net present value)		**$10.5 m**	**$2.6 m**
Benefit-cost ratio		**11.0**	**3.2**

Table 12: Summary of cost and benefits – source Sapere Group

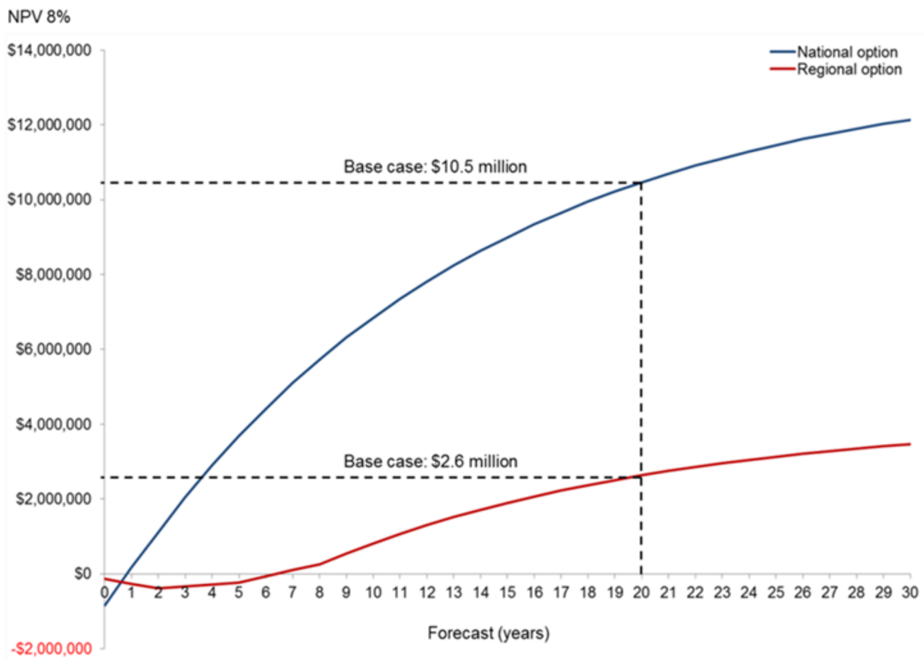

Figure 14: Summary of modelling results – source Sapere Group

15.1.2 National vs Regional

The analysis further identified that the strength of the national approach lies in annual benefits being fully realised upon implementation of national regulatory change, with resource consent costs being avoided. A further strength of this approach is the relatively low cost to develop the regulation and minimal ongoing implementation costs.

In contrast, Sapere noted the benefits accrued under the regional approach are lower with the roll out of a region-by-region work programme supported by staff from partner organisations with the aim of either Regional Councils granting ‘permitted activity’ status (via a regional plan review) or a comprehensive long-term consent.

Of the 12 Regional Councils that do not already permit the aerial use of 1080, the model assumed 6 of these Regional Councils would adopt a streamlined consenting process early on, with a further two Regional Councils adopting this approach every three years. Whilst this gradual uptake occurs, resource consents were modelled as still being required. The benefits under the regional approach were therefore modelled to increase gradually, without reaching the level arising from a nationwide regulatory change under the national approach.

15.1.3 Sensitivity testing

Sensitivity testing of the base case for the national and regional approaches was undertaken. Tests included varying the discount rate, time period, consent cost assumptions, consent volume assumptions, and mix of consents (in terms of notification status). Tables 13 and 14 below summarise the results of this sensitivity testing.

The uncertainty of the regional approach was specifically tested by varying the number of ‘uptake’ councils and the adoption timeframe. The results of these tests showed that the net benefit of the national approach remained substantially higher than the regional approach in all scenarios.

	Net benefit (present value, $ million)		Benefit-cost ratio	
Discount rate	**National approach**	**Regional approach**	**National approach**	**Regional approach**
4%	$15.4 m	$4.6 m	14.5	4.0
6%	$12.6 m	$3.5 m	12.6	3.6
8% (base case)	**$10.5 m**	**$2.6 m**	**11.0**	**3.2**
10%	$8.8 m	$2.0 m	9.6	2.9
12%	$7.5 m	$1.5 m	8.6	2.6

Table 13: Application of discount rate overtime – source Sapere Group

Cost assumption	National approach	Regional approach
Low cost (minimum observed)	$4.1 m	$0.5 m
Base case (average)	**$10.5 m**	**$2.6 m**
High cost (maximum observed)	$24.0 m	$7.1 m

Table 14: Sensitivity testing of compliance cost estimates – source Sapere Group

15.1.4 Operational benefits

The Sapere analysis also explored the potential operational benefits of achieving national consistency. These benefits were not able to be quantified in monetary terms but were considered to be potentially significant. A summary of these benefits as set out in the Sapere report is included in Table 15.

Benefit	Assessment
Applicants standardise internal processes	DOC and TBfree NZ manage aerial 1080 operations from multiple offices, given the differences regional plan requirements and procedures. A nationally consistent approach may allow for more specialised planning and operational functions that enable more efficient use of staff time.
Reduced uncertainty leading to a lower contract price	A national approach to the consent process may provide contractors with greater certainty about what to expect for aerial 1080 operations. To the extent that contractors factor in price premia for consenting risk, there may be scope for national standardisation to allow these premia to be waived and the price of operations to be lower than otherwise would be the case The efficiency gains take the form of time savings and/or reduced costs for aerial 1080 operations. They generally arise from reductions in time and uncertainty as a result of a more streamlined consent process and increased standardisation of operational consents/rules.
Reduced risk of operational non-compliance	Standardisation and a single set of rules may reduce cases of consent non-compliance from contractors conducting aerial 1080 operations. This is because current consent conditions differ across regions, which requires contractors and operational staff to comply with multiple sets of conditions. A reduction in lost time from non-compliance may increase operational efficiency. This gain may be possible under the regional option, albeit to a lesser extent, as some differences between regions would likely remain.
Improved timeliness of operations	The national standardisation of rules for aerial 1080 operations is expected to simplify operational planning and consent processes. Operations could thus be planned an implemented more quickly than under current conditions, thereby being more responsive to on-the-ground changes.

Benefit	Assessment
Reduction in suboptimal consents	The complexity of rules under the current consenting environment can lead to suboptimal operational design in order to ensure consent conditions are met, or to avoid costly and time consuming consent process . This in turn can lead, for example, to the area of coverage being less than optimal for the desired pest management outcome. Under a more standardised approach, it is plausible that these suboptimal consents will be less likely.
Increases in area covered by aerial 1080 operations	If the major applicant organisations can realise operational savings from a streamlined consent process, it is plausible that these freed-up resources could be reallocated into in additional pest management operations. This could lead to an expansion in the area covered by aerial 1080 operations, with commensurate gains in the protection of New Zealand's biodiversity and in the management of bovine tuberculosis.
Improved public confidence	The introduction of a national standard and single set of rules may improve overall public confidence in the conduct of aerial 1080 activities.

Table 15: Summary of benefits of national consistency (source: Sapere Group)

16 ANALYSIS OF SHORT LIST

The cost-benefit analysis results were used to inform the refinement of the short list to a preferred option. The key considerations in process are summarised below.

16.1Regional Option

The Sapere cost-benefit analysis confirmed a benefit cost ratio of 3.2 to 1 for the regional approach, this being significantly lower than both the national options. The regional approach was discounted on the basis of lower potential benefits and the following other factors:

- Whilst regional plans could be changed to permit the use of aerial 1080, such changes may not endure, as plans are subject to review. There is an ongoing risk that standards may change through future plan and/or consent reviews.
- There would be significant costs and risks associated with the regional approach. Changes to plans and/or consents would be required in 13 regions to achieve national consistency and there would be significant time and costs associated with this.
- The regional plan change and consent processes would run separately in each region and therefore is a real risk that consistency may not be achieved and as such there may still be potential for duplication with the HSNO and ACVM Acts.

16.2National Option

The two national options were assessed in the cost-benefit analysis as having the same net benefits to society. The final decision on the preferred option involved a finer level assessment of the national options against the following criteria:

- **Perception -** is there any benefit to be gained in choosing one option over another in terms of how the regulation will be perceived and regarded by the general public;
- **Process** - is there any advantage in process terms around one regulation over another;
- **Timing** - is the timing of one form of regulation better than the other;
- **Cost -** is there any difference in cost to process and implement the option (in terms of monetary cost);
- **Outcome** - is there any difference in outcome.
- **Political** - are there any political risks relating to the choice of regulation (related to the perception risks noted above).

16.2.1 National Environmental Standard – Assessment against Criteria

The NES option was assessed against this range of criteria and was discounted mainly because under Section 43A(3) of the RMA, an NES cannot permit any activity with significant adverse effects on the environment as follows;

43A (3) *If an activity has significant adverse effects on the environment, a national environmental standard must not, under subsections (1)(b) and (4),—*

(a) *allow the activity, unless it states that a resource consent is required for the activity; or*

(b) *state that the activity is a permitted activity*.

The aerial discharge of 1080 can potentially have significant adverse effects on the environment when operations are not managed appropriately. Therefore there is a risk that an NES may not be able to provide for the discharge as a permitted activity, unless the NES itself included sufficiently detailed conditions under which aerial 1080 could be applied without causing adverse effects. Such conditions could ultimately end up duplicating the HSNO regime, creating further complexity within the system. It is also likely that an NES would need to be regularly amended to keep up with any changes to the HSNO conditions, potentially duplicating the regulatory and consultation processes that already exist nationally. This additional complexity and costs would be contrary to the investment objectives of the partners, and would amount to a public disbenefit from such a management regime.

16.2.2 Section 360(1)(h) Regulation – Assessment against Criteria

In contrast to the above, Section 360(1)(h) provides for regulations exempting specified discharges from section 15 of the RMA as follows;

*360(1)(h)*Regulations

(1) The Governor-General may from time to time, by Order in Council, make regulations for all or any of the following purposes:

(h) prescribing exemptions from any provision of section 15 (of the RMA)*, either absolutely or subject to any prescribed conditions, and either generally or specifically or in relation to particular descriptions of contaminants or to the discharge of contaminants in particular circumstances or from particular sources, or in relation to any area of land, air, or water specified in the regulations.*

By its very nature, a Section 360(1)(h) Regulation is unlikely to face the potential complications that may arise from the development and implementation of an NES. Furthermore, the analysis presented in this business case has shown that the aerial discharge of 1080 is well managed under the HSNO framework and that further duplication or regulation is not warranted. The exemption of 1080 as a discharge from Section 15 of the RMA under Section 360(1)(h) is therefore considered appropriate.

16.2.3 Summary of assessment

A summary of this final assessment is provided in Figure 15.

Option		**National Environmental Standard**	**Regulation under s360 of the RMA**	**Regional Approach**
CRITERIA 3 Cost Benefit Analysis				
Present value of monetary benefits		11.5	11.5	3.8
Present value of costs		1.1	1.1	1.2
Net present value		10.4	10.4	2.6
Benefit Cost Ratio		**11**	**11**	**3.2**
		Y	Y	N
CRITERIA 4 Analysis of implementation risks				
Perception		H	M	M-H
Cost	High Risk - H	M	M	H
Process	Medium Risk - M	M	M	H
Timing	Low Risk - L	M	M	H
Outcome		M	M	H
Political		H	M	H
PREFERRED OPTION		N	Y	N

Figure 15: Summary of risk analysis of short list options

This finer analysis concluded that regulation of a **regulation under s360(1)(h) as the preferred option**.

17 DISADVANTAGES OF PREFERRED OPTION

The potential disadvantages of implementing a section 360(1)(h) regulation have been considered by the partners.

A possible objection to a national regulation is the denial of a local democratic process under the RMA by "removing" the need for resource consent and the ability to manage the adverse effects of operations through localised conditions.

In respect of this it may be noted that not all Regional Plans currently require resource consent for the discharge of aerial 1080, so in these regions there would be no change from the status quo. In regions where consent is currently required, the evidence reviewed confirms that 100% of resource consent applications in the last 10 years were granted.

The partners further consider that the public interest is well served on an ongoing basis through HSNO requirements for annual public reporting on all aerial 1080 operations, incidents and outcomes. This public monitoring is further assessed every five years and consideration is given to the need for any further review of HSNO controls and conditions of use.

A further disadvantage of a regulation would be the potential for the regulation to leave gaps in the system that manages the effects and risks of aerial 1080 use. The analysis of the evidence in reference to this has confirmed that the regional plans and/or resource consents are not managing any adverse effects (localised or otherwise) that are not already managed under the HSNO/ACVM framework. Locally specific controls relevant to human health risks would still be able to be applied through permissions from local public health authorities, and from DOC where operations involve public conservation land.

Further analysis of this issue has confirmed that all 1080 operations within the last 3 years were subject to either a DOC or MOH permission. In addition, most private operations are undertaken for rabbit control, predominantly in Canterbury and Otago regions, where resource consent is in any case not required. These operations have not been subject to any significant incident reports and have been undertaken in accordance with the overall HSNO framework. A regulation would not affect the status quo in this context.

Overall of the potential benefits of the preferred option are considered to significantly outweigh the potential disadvantages and resource consents are considered to be an unnecessary further process.

18 PREFERRED OPTION

Based on the qualitative analysis of all options, the findings of the cost-benefit analysis and the assessment of overall benefits, disadvantages and risks of each of the shortlisted options, the Project Steering Group proposes a **regulation under s360(1)(h) as the preferred option**. A full summary of the options analysis is provided in Appendix M.

The key reasons for choosing the regulation option are;

- The cost-benefit analysis confirms that a national policy option is likely to generate four times the benefit of a regional option.
- A national environment standard may result in the further duplication of requirements and there is a risk it could increase the complexity of the current system. This is contrary to findings of the case for change and contrary to the investment objectives of this business case.
- The option will address the current issues of duplication and inconsistency with the current system.
- The option is most likely to achieve the investment objectives and responds best to the critical success factors.
- The potential disadvantages of the preferred option are considered to be significantly outweighed by the benefits.

The following sections of this business case set out the delivery arrangements for the preferred option.

PART 4 – COMMERCIAL, FINANCIAL AND MANAGEMENT CASES

19 DELIVERY ARRANGEMENTS

The following sections set out the recommended delivery arrangements for the preferred option, including the implementation, review and monitoring of the regulation. This section has been reviewed and confirmed by the Project Steering Group as the preferred delivery pathway.

20 REGULATION PROCESS

The process for a 360 regulation will involve the following key decision steps:

1. Ministerial/Cabinet approval to consult with Central and Local Government and develop the regulation.
2. Cabinet approval to issue a public discussion document.
3. Analysis of submissions and a decision by the Minister for the Environment on whether to proceed with a regulation.
4. Drafting, Order in Council processes (i.e. Cabinet agreement to recommend the making of the regulation and then consideration by the Governor-General) and gazettal.
5. Promulgation - The regulation would come into effect 28 days after being promulgated.

21 PROJECT APPROACH

The delivery of the preferred option is proposed in six key stages as follows:

1. Preparation – including confirming the project plan and resourcing, preparing the discussion document and legal drafting for the regulation.

2. Securing Ministerial/Cabinet approval to consult with Central and Local Government on the proposed regulation.

3. Undertaking consultation on the proposal.

4. Securing Cabinet approval to release a discussion document for formal consultation.

5. Releasing the discussion document and analysing submissions on discussion document.

6. Promulgation and gazetting of the regulation.

Each of the key stages is summarised within Figure 16 below along with indicative timings for completion of each stage.

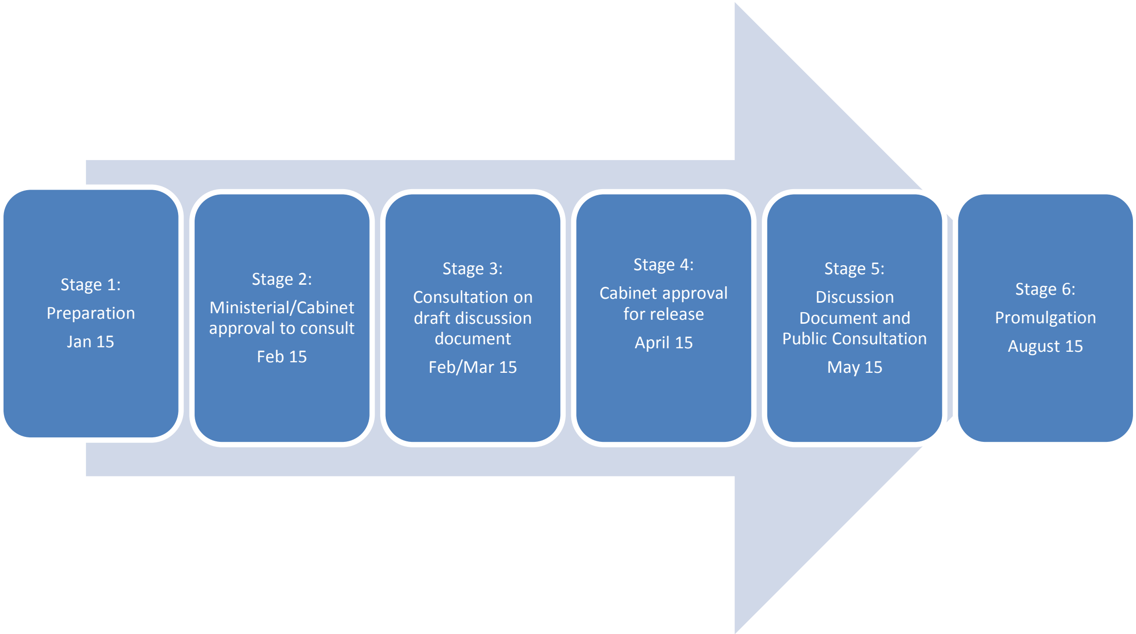

Figure 16: Proposed key project stages

22 PROJECT STRUCTURE AND RESOURCING

The following structure (Figure 17) is proposed to manage the delivery of next project phase.

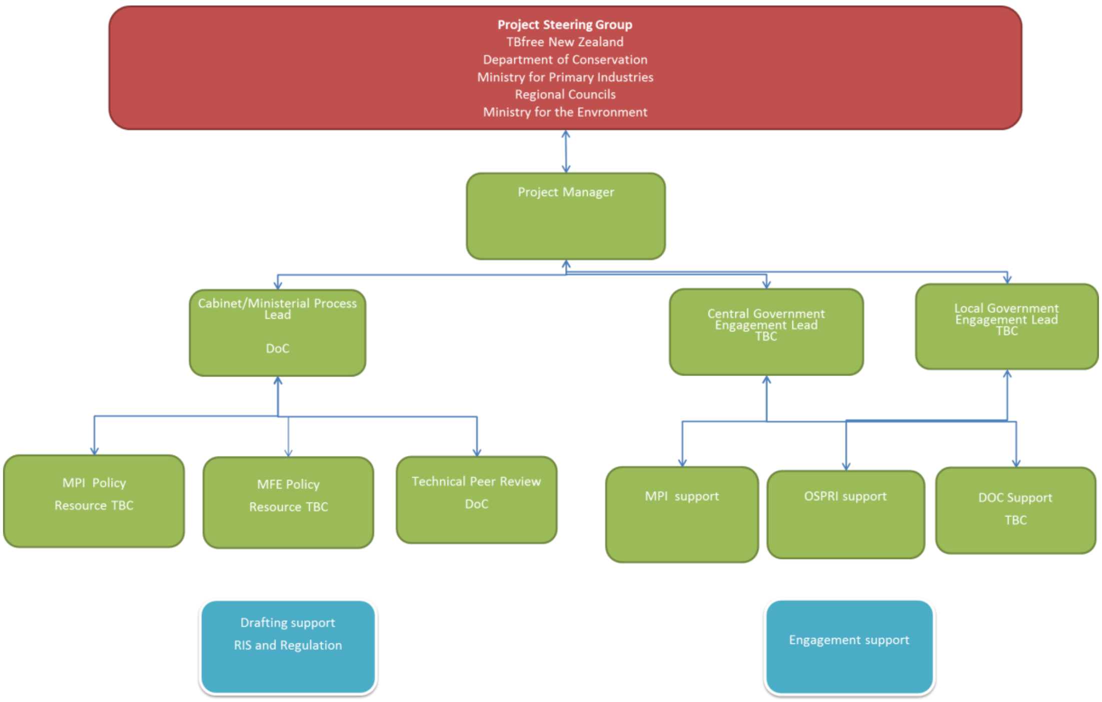

Figure 17: Proposed Project Structure

The key roles within the project structure are:

1 **Project Steering Group (PSG)** – responsible for project oversight and key decisions on project direction, advising and leading key stakeholder engagements and allocating resources to key project tasks.

2 **Project Manager** – responsible for the preparation, confirmation and management of the project plan, day to day co-ordination of the project and reporting to the project steering group.

3 **Regulation process lead** – responsible leading the regulation process, developing the discussion document and regulation including co-ordinating supporting resources.

4 **Central Government engagement lead** – responsible for co-ordinating and leading all engagement with Central Government and reporting to the project manager on progress and risks.

5 **Regional Council engagement lead** – responsible for leading all engagement with Regional Councils and reporting to the project manager.

6 **Support roles –** responsible for providing support and assistance to area leads as required. Likely roles will include drafting of relevant policy papers and co-ordination of key engagements.

23 MILESTONES AND DELIVERABLES

The key deliverables and milestones of each project stage are summarised in Table 16 below.

Project Stage	Objectives	Key Deliverables
STAGE ONE: PREPARATION **January 2015**	Confirm all project resourcing and project plan. Prepare draft Discussion document and Regulatory Impact Statement. Liaise with supporter groups to confirm support for business case.	Confirmed project plan, structure and communications plan. Policy material for briefings to incoming Ministers (BIMs). Draft discussion document and regulatory impact statement.
STAGE TWO: CABINET/MINISTERIAL APPROVAL **February 2015**	Secure approval to consult on draft discussion document.	Briefings to relevant Ministers. Cabinet paper on proposal to consult if required.

Project Stage	Objectives	Key Deliverables
STAGE THREE: CONSULTATION March 2015	Consult with Central Government and key stakeholders on discussion document.	Summary of proposal. Draft discussion document and regulatory impact statement. Summary of consultation and proposed changes.
STAGE FOUR: CABINET APPROVAL FOR RELEASE April 2015	Secure cabinet approval to release discussion document.	Final draft discussion document and regulatory impact statement. Cabinet paper requesting release of discussion document.
STAGE FIVE: DISCUSSION DOCUMENT AND PUBLIC CONSULTATION May 2015	Complete formal submissions stage. Complete analysis and summary of submissions.	Final discussion document, regulatory impact statement and proposed regulation. Independent summary and analysis of submissions. Legal analysis on changes to regulation.
STAGE SIX: PROMULGATION August 2015	Regulation drafted, promulgated and gazetted.	Briefing to Minister for decision on adoption.

Table 16: Key Milestones and Deliverables

24 RISKS

Table 17 outlines the substantive risks to implementing the preferred option, along with proposed mitigation. The risks have been assessed on the basis that the project will proceed as set out above.

Delivery Risks	Probability (H, M, L)	Impact (H, M, L)	Mitigation
Lack of available resources within the project partners.	L	H	Ensure early briefing on expectations. Scope and confirm delivery arrangements early. Regulation itself should be simple to draft.

Cannot secure support of Local Government for project.	H	M	Ensure consistent messaging around business case including CBA findings. Provide regular updates on project progress and key points of engagement. Communication to Local Government on public process and where input is required.
Cannot secure Ministerial support for project.	L-M	H	Early briefing to high level management within MFE, DOC and MPI. Early briefing to Minister of Conservation, Minster for Primary Industries and Minister for Environment to determine appropriate lead Minister. Determine process in conjunction with lead Minister
Cannot secure support in Cabinet for project.	M	H	Scope cabinet process and timings with Minister of Environment, Minister of Primary Industries and Minister of Conservation.
Lack of support from potential support groups.	M	M	Ensure consistent messaging around business case including CBA findings. Early communication to potential supporters on business case and findings of strategic case. Provide regular updates on project progress and key points of engagement. Communication to stakeholders on public process and where input is required.
Significant public opposition to regulation such that political support is lost.	L-M	H	Ensure robust understanding of issues politically. Manage public consultation Ensure key messaging
Personal Risk	**Probability (H, M, L)**	**Impact (H, M, L)**	**Mitigation**
Personal Safety	L	H	Manage external communications in accordance with agreed communications plan. Limit face to face engagement with potential opposition groups. Manage security arrangements if necessary.

Financial Risk	Probability (H, M, L)	Impact (H, M, L)	Mitigation
Underestimate project management tasks.	L	M	Confirm scope and resourcing with project team early.
Underestimate regulation process tasks.	L	M	Confirm scope and resourcing with project team early.

Table 17: Identified project Risks

25 COMMUNICATIONS PLAN

The development of a communications plan will be critical to managing the key project risks and this will be produced as part of the first stage of delivery. The communications plan will include agreed key messaging around the project and protocol to manage information. The contents of the plan will be further scoped in conjunction with the Project Steering Group.

26 DELIVERY COSTS

The costs to deliver the preferred option will be estimated following confirmation of the proposed project structure, staging, timing, and resourcing by the Project Steering Group. The remaining budget from phase 1 could be utilised to initiate the second phase of the project if deemed necessary or appropriate.

27 IMPLEMENTATION AND MONITORING

Once promulgated, the implementation of the regulation under s360 would involve the preparation of guidance for Regional Councils to set out the scope of the regulation, when the regulations would apply and details on the administration of the regulation.

The regulations would apply automatically to all regional plans, consent applications and applications which have not yet been processed within timeframes set under the Act. Exemptions under the regulations would likely be restricted to Central and Local Government agencies, and to agencies with approved Pest Management Plans under the Biosecurity Act 1993. Promulgation of the regulation would not require changes to regional plans. The Ministry for the Environment would need to formally advise Councils of regulations. This could be undertaken through written communications with Councils, and face to face workshops with Councils if necessary.

It is proposed that the effectiveness of the regulation would be monitored through existing statutory reporting to the EPA on aerial 1080 use. These reports are submitted to the EPA by operators for each operation, and include a range of criteria for assessing the impacts of operations. Further questions could be added to existing EPA reporting templates to assess the effectiveness of the regulation over time and whether any changes are needed.

28 SUMMARY AND CONCLUSIONS

This business case has explored the evidence for greater standardisation and simplification of the regulatory system for the aerial application of 1080 and what the costs and benefits of this might be. The business case analysis has established a clear case for change from the status quo. The key reasons for change include:

- The risks and effects of 1080 are robustly and effectively managed under the HSNO and ACVM Acts. The further regulation of 1080 under the RMA is not affording any extra protection to the environment or public health.

- There are high levels of unnecessary duplication between the RMA and HSNO. Significant levels of duplication occur between RMA consent conditions and HSNO controls. There is also duplication between plan rules and HSNO requirements. This duplication is costly and does not improve the management of effects and risks.

- The management of 1080 through regional plans is inconsistent, and this can adversely impact the effectiveness of operations. There are 13 Regions with varying Regional Plan rules/standards that trigger the need for resource consent for aerial 1080 operations. Over 200 such resource consents have been issued in the last ten years in 10 Regions. There is significant regional variability in consent conditions and in the way consents are managed.

- Inconsistency and duplication increases the risk of compliance failure. Having variable consent conditions reduces the ability of the operators to ensure that best practice is always achieved. Regional inconsistency and duplication also increases the risk of breaching consent conditions. Even if the effects of such breaches are minor, they are treated as adverse incidents in Environmental Protection Authority (EPA) reports. The recurrence of such incident reports could lead to imposition of further HSNO Act controls on the use of 1080, potentially resulting in its loss or reduced availability as a pest management tool for biosecurity and biodiversity programmes.

- There is a need to reduce unnecessary RMA compliance costs to Regional Councils, DOC, TBfree NZ and private contractors/landowners. The compliance costs for resource consents in the last ten years have been estimated at $10.7M. Future costs could be reduced significantly through removing the need for resource consent and managing 1080 operations under the HSNO/ACVM and Health Act requirements.

- The potential benefits of greater consistency are likely to be significant. The avoided costs of compliance from the implementation of national consistency generate a benefit-cost ratio of 11 to 1. Benefits may include the potential to divert cost savings into research and operations, leading to improved biodiversity and biosecurity outcomes. There is also potential for technical teams to operate on a national basis within consistent standards.

A rigorous assessment of the options to address the case for change has been undertaken through a series of facilitated workshops involving the partners, Regional Councils and the Ministry for the Environment. The short listed options have been subjected to cost-benefit analysis and an assessment to determine a preferred option.

The preferred option is a regulation under s360(1)(h) of the RMA that will exempt the aerial application of 1080 from being a discharge under section 15 of the RMA.

The delivery pathway for the preferred option has been set out within the business case and has been confirmed by the partners.

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"NRS-7"

New Zealand Government

This is the exhibit marked "NRS-7" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Miriam Sophie Bookman
Solicitor
WELLINGTON

Solicitor of the High Court of New Zealand

Streamlining the regulatory regime for pest control

SUMMARY OF SUBMISSIONS

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Manatū Mō Te Taiao

Contents

Background

The government consulted on a proposal to streamline the regulatory regime for pest control between 14 April and 26 May 2016. The full proposal is outlined in a discussion document.

This proposal arose from the recommendations of a report by the Parliamentary Commissioner for the Environment into the use of one of the main vertebrate toxic agents (VTAs) used in New Zealand – sodium fluoroacetate (1080). This report highlighted the problem of the duplication of existing controls under the Hazardous Substances and New Organisms Act 1996 (HSNO Act) and Resource Management Act 1991 (RMA), including time and cost inefficiencies.

The proposal is to add a regulation under section 360(1)(h) of the RMA that would exempt the requirement of the resource consent or rules in regional plans (under section 15 of the RMA) for discharges of specific VTAs in specific circumstances.

The proposal is designed to:

- reduce duplication within the regulatory regime
- ensure that the regulatory regime does not discriminate the choice of VTA for an individual operation, and the best toxin is used in each case
- enable consistency across the country and ensure that best practice in the use of each VTA can be developed and implemented throughout New Zealand
- remove unnecessary costs of the regulatory regime, and unnecessary delays to pest control work, so New Zealand can control vertebrate pests more effectively.

The consultation document was focused on the management regime for VTAs rather than the use of VTAs; or which VTAs can be used in New Zealand. Importantly, the proposal was designed to ensure the same level of protection would be provided to people and the environment should the changes be implemented. Feedback on whether or not the proposal would achieve its aim, and its impact, was sought from iwi, affected organisations and general public.

A total of 220 submissions were received by the Ministry for the Environment.

Purpose

This document presents a summary of the views expressed in submissions received in response to the consultation document and is grouped by common themes.

This report intends to provide a concise summary of the views expressed, not an analysis of those views or recommendations in response to the submissions. Any recommendations in response to submissions are made through policy advice to Cabinet, delivered later in 2016.

Overview of submissions on streamlining the regulatory regime for pest control

Summary of submitters’ positions

A total of 220 submissions were received.

Of these, 70% of submissions supported the proposal and 23% of submissions opposed the proposal. Only one submission opposed the proposal in part, 10 submissions supported the proposal in part, and 5 submissions were unclear or didn’t state their position.

Table 1: Breakdown of submissions by source

Category	Number of submissions	Supported	Supported in part	Opposed	Opposed in part	Unclear/ not stated
Business/industry	21	21	0	0	0	0
Central Government	3	3	0	0	0	0
Local Government	9	7	2	0	0	0
Iwi	4	1	0	1	1	1
Non-governmental organisations	14	3	2	9	0	0
Unspecified/other*	4	0	2	2	0	0
Individuals	165	118	4	39	0	4
Totals	220	153	10	51	1	5

*This category includes groups such as a political party, and District Health Boards.

55% of the submissions were unique submissions and the remaining were ‘template’ submissions (pro-forma submissions drafted by particular organisations or groups and submitted by individuals or representatives of groups)[1].

36% of the unique submissions were from individuals, with the remaining from: business and industry; local government; NGOs; and iwi.

Key themes from the consultation

To best reflect the tenor of submissions they are grouped into five categories: supported, supported in part, opposed, opposed in part, unclear/not stated.

Due to the nature of many of the submissions, some interpretation was necessary in applying these categories. Submissions that did not clearly state their position were attributed a position, only where it was obvious from the submission’s content and tone.

[1] Many submitters modified a template designed by the Morgan Foundation to include additional comments. The Ministry for the Environment has included all additional comments in its analysis of submissions. Some submitters used the Morgan Foundation template (phrased to agree with the proposal) to show their opposition to the proposal. These submissions have been considered unique submissions and are therefore included in the figures for unique submissions.

Identification of the submission being in 'support' does not necessarily mean the submitter did not offer suggestions for improvement, only that the submission did not suggest that the support was contingent on those suggestions being taken up in the final regulation.

Where the position of a submission was not obvious, submissions were categorised as 'unclear/not stated'.

Some care needs to be taken in the interpretation of these summary findings. The difference in 'supported in part' and 'opposed in part' is open to some debate, but the distinction is intended to reflect the emphasis of the submission.

Overall themes

There were themes common to those supporting the proposal and those opposing the proposal.

Overall, those supporting the proposal said:

- that they had confidence in the Environmental Protection Authority (EPA) review of 1080 in 2007, and/or the investigation into 1080 use by the Parliamentary Commissioner for the Environment (PCE) in 2011
- that 1080 and other VTAs are generally well controlled through legislation such as the HSNO Act
- that the proposal will improve outcomes for pest control operations because of the significant amount of time and money saved by not having to go through RMA resource consent and plan-making processes.

Individual submitters who supported the proposal generally noted their support without further explanation.

Overall, those opposing the proposal said:

- that they don't agree with the use of VTAs, and in particular they don't agree with the use of 1080
- that they don't agree that the science and/or that the figures used by government agencies, local government and/or business and industry are incorrect
- that they had concerns about current and future VTA use.

The removal of local-level consultation was a theme in many submissions.

Overview of submissions from different groups

Business/industry

A total of 21 submissions were received from business and industry groups.

Industry organisations and businesses involved with pest control were strongly supportive of the proposal. Other representative groups such as DairyNZ, Beef+LambNZ, Agcarm, The New Zealand Fur Council, and Federated Farmers of New Zealand were also very supportive.

No submissions were received from business or industry groups opposing the proposal.

Central government

A total of 3 central government agencies made submissions.

Dr Jan Wright, Parliamentary Commissioner for the Environment strongly supported the proposal.

No submissions were received from central government opposing the proposal.

Local government

A total of 9 submissions were received from local government, including a submission from Local Government New Zealand[2].

7 local government submissions supported the proposal outright, with 2 local government submissions supporting the proposal with suggestions for amendments.

No submissions were received from local government opposing the proposal.

Iwi

A total of 4 iwi made submissions.

Submissions were received from:

- Tuwharetoa Maori Trust Board
- Maungaharuru-Tangitu Trust
- Te Runanga O Ngati Whatua
- Ngati Rangi Trust.

All iwi submissions discussed the importance of consultation regarding pest control operations in their rohe.

One submission opposed the proposal; one submission supported the proposal; one submission opposed the proposal in part; and one submission requested further information about the proposal.

Non-governmental organisations

A total of 14 non-government organisations (NGOs) made submissions.

NGOs who submitted included:

- hunting and fishing groups (for example, New Zealand Deerstalkers Association Incorporated and New Zealand Federation of Freshwater Anglers)
- environmental interest groups (for example, Farmers Against Ten Eighty, Friends of Sherwood, New Zealand Wildlands Biodiversity Management Society, Royal Forest and Bird Protection Society of New Zealand Incorporated)
- community groups (for example, Brook Valley Community Group Incorporated)

The majority of NGOs opposed the proposal (approximately 64%).

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[2] LGNZ is the national organisation of local authorities in New Zealand and all 78 councils are members. They represent the national interests of councils and lead best practice in the local government sector.

Most NGOs objected to the use of VTAs at all and most rejected the basis for the proposal (they rejected both the science and data used). Many raised concern about the perceived removal of consultation. Many expressed their disbelief that current legislative controls were enough to manage use of VTA effectively.

Approximately 21% of NGOs supported the proposal. Two NGOs – Environment and Conservation Organisations of New Zealand Incorporated, and Royal Forest and Bird Protection Society of New Zealand Incorporated supported the proposal with amendments.

Political parties

One political party made a submission - the BAN1080 party. Their submission opposed the proposal primarily because of their opposition to the use of VTAs.

Individuals

A total of 163 submissions were made by individuals (i.e. those not submitting on behalf of an organisation). Approximately 72% of these submissions supported the proposal.

The Morgan Foundation provided a tool on its website that enabled people to make submissions on the proposal. A total of 83 submissions were made via this tool by individuals who supported the proposal[3].

Most submissions made via the Morgan Foundation tool indicated support for the proposal without further comment.

About 23% of individual submitters opposed the proposal. Of those who opposed the proposal, the majority objected to VTA use, and in particular, the use of 1080. Some submitters opposed the proposal because they objected to an avenue of consultation being removed, while some opposed the proposal with the concern that personal and environmental protections were being removed.

Key themes analysis

Key themes

The key themes identified during the analysis of submissions are presented in table 2.

Table 2: Key themes from submissions

Key theme	Sub-theme
Opposition to the use of VTAs	Opposition to 1080
Consultation	Local decision-making Ministry for the Environment's consultation process

[3] Many submitters modified a template designed by the Morgan Foundation to include additional comments. The Ministry for the Environment has included all additional comments in its analysis of submissions. Some submitters used the Morgan Foundation template (phrased to agree with the proposal) to show their opposition to the proposal. These submissions have been considered unique submissions and are therefore included in the figures for unique submissions.

Key theme	Sub-theme
Operational issues	Notification of VTA operations Owner/occupier permission for pest control operations Buffers and boundaries, maps and timetables for operations Enforcement/compliance/monitoring and cost recovery

Iwi submissions are included in the overall analysis of submissions and are also separately addressed in the section titled ‘iwi submissions’.

Some components of the proposal specifically affect councils. Council submissions are included in the overall analysis of submissions and are also separately addressed in the section titled ‘council submissions’.

Further information by theme

This section of the report summarises comments on the proposal and categorises them into common themes.

Opposition to the use of VTAs

- Over 90% of submitters opposing the proposal did so because they oppose the use of VTAs. The most commonly opposed VTA was 1080, with the majority of submitters exclusively targeting their feedback at this VTA.
- Less than 20% of individual submitters opposed the proposal; of these, almost all were unsupportive of the proposal because of their strong opposition to the use of VTAs. Opposition to 1080 in particular was very common in this group. Few submitters addressed the proposal specifically, preferring to make more pointed statements such as 'Ban 1080'.
- The majority of NGO submitters opposed the proposal because of their opposition to the use of VTAs.
- One political party 'the BAN1080 Party[4]' opposed the proposal citing their opposition to VTAs.
- Some submitters rejected the proposal outright; they commonly rejected the PCE report and other research/documentation that was used in the development of the proposal. For example, one submitter stated:

  > "I do NOT agree with the proposals because the Parliamentary Commissioner for the Environment's 2011 evaluation of 1080 is fundamentally flawed (e.g. see Pollard, 2014). It is flawed not only in its content, but also in the references which have been used to support the arguments therein. For instance the research undertaken has methodology that is not valid in the wider scientific community, and at times is unethical.[5]"

Submissions opposed to the use of VTAs raised the following views:

- the science used by government agencies, local government, industry groups and/or pest control operators is invalid or incorrect
- that the research carried out by the groups listed above is misinformed, unreliable or purposefully designed to deliberately mislead the public (usually with the goal of financial benefit)
- that there is research missing
- the figures used by the groups listed above are inflated to show more pests and/or more endangered animals than there really are (usually with the goal of financial benefit)
- pest control operators frequently breach the manufacturer's labels on VTAs
- the overall harm from VTAs is far greater than any benefit of pest management.

Concern about 1080 being dropped into water was raised by many of these submitters. Their concern was primarily about ensuring adequate notification about pest control operations so that people could protect themselves around potentially contaminated waterways.

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[4] Individual submitter, Submission reference number 14575

[5] Individual submitter, Submission reference number 14479

The other concern submitters raised regarding water was around pest control operators either ignoring the VTA product labels (which instruct users to minimise baits entering water) or councils allowing pest control operators to drop 1080 into waterways.

One submitter stated that:

> "My principle concern is that there is not proper notification to residents and tourists drawing water from 1080 contaminated water bodies. In fact, the Safety Data Sheet states measures must be taken to "minimise the chance of baits accidentally entering any body of water", but resource consents in the Waikato Region allow indiscriminate dropping of baits directly into water as evidenced by the toxic flightline maps of 1080 drops. Poisoned carcasses are not removed from contaminated water bodies, allowing birds and mammals feeding on these carcasses to become fatally poisoned. There is inconsistency between the warnings on the label and SDS of1080 and how it is actually distributed, with no follow-up removal of dead carcasses. This is not safe or a good look for residents or tourists coming to our country.[6]"

There were some submissions on the issue of bovine tuberculosis (Tb) and possums. Generally, these submitters stated that:

- there is no reliable evidence that possums are responsible for the transmission of Tb to cattle, and therefore the arguments behind the use of 1080 to eliminate possums to prevent bovine Tb is baseless
- there is so little Tb in New Zealand that there is no need to carry out VTA operations to eradicate Tb-infected possums
- Tb-infected possums do not act as a vector between regions (rather, they stay in small, localised areas).

Two submissions stated that seals could be a vector for Tb transmission to other mammals. They suggest that OSPRI and DoC are 'reluctant' to investigate this problem. Other submitters stated that Tb is harboured in soil and that is the main vector for transmission of Tb to cattle.

The majority[7] of individual submitters, who made suggestions for changes to the conditions or for new conditions to be added to the proposal, wanted VTAs, specifically 1080, banned.

These submitters also advocated for increased controls on 1080 such as making aerial application of VTA publically notifiable through the RMA; a 6 month maximum for consents; and adding personal liability conditions for all people involved in VTA operations (including those who make the decision to those carrying out the operations).

Some of these submitters also suggested:

- that valid research be undertaken into VTAs
- that a 'people's panel' be established with the authority to veto "*unacceptably hazardous, unnecessary and inhumane substances in the first place*[8]"
- that "*a whole new pest management strategy is needed*[9]"
- that aerial application be forbidden from areas next to farmland or within urban limits

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[6] Individual submitter, Submission reference number 14605

[7] all except one submitter

[8] Individual submitter, submission reference number 14703

[9] Individual submitter, submission reference number 14626

- that the definition of pest needs to be revised
- that 1080 only be distributed by hand
- that national parks be exempted from VTA use

One NGO opposed the method of application of VTAs - they said that no VTA should be dispersed aerially and they also objected to the use of bait stations.

Some individual submitters were very concerned about unforeseen consequences of the proposal and some of these predicted that hunters, anglers, dogs, endangered animals, other non-pest species, adults and/or children would die if the proposal was approved:

> "You'll kill everything in the wild and poison the land and the water until, one day, you will cause a catastrophic number of human deaths[10]."

A large number of individual submitters were concerned that the proposal would result in damage to the environment and non-targeted pest species. These submitters suggested that unforeseen consequences of the proposal included:

- "The increasingly casual and irresponsible use of toxins, complacency and failure to investigate consequences for the environment and health fully[11]"
- "Killing of all specified and unspecified targets[12]"
- "All these pesticides kill or give sub-lethal doses to, non-target organisms. Randomly spreading them over large areas means consequences are uncontrolled and unpredictable[13]"
- "Public backlash from people who will not tolerate New Zealand's environment being poisoned[14]".

Opposing submissions commonly raised issues regarding consultation. These issues are addressed later in the following section.

[10] Individual submitter, submission reference number 14597

[11] Individual submitter, submission reference number 14634

[12] Individual submitter, submission reference number 14631

[13] Individual submitter, submission reference number 14613

[14] Individual submitter, submission reference number 14603

Consultation issues

Comments concerning consultation issues fell broadly into two categories:

- the effect of the proposal on local decision-making
- the Ministry for the Environment consultation process

Iwi submissions also raised consultation issues. While submissions from iwi were included in the overall analysis of consultation issues here, more detailed information about submissions are covered in the section titled 'Iwi submissions'.

Some councils, iwi and industry groups noted the consultation work they currently do.

Environment Canterbury noted that they work closely with their local authorities and mana whenua:

> "Environment Canterbury works in close collaboration with the ten territorial local authorities (TLAs) in the Canterbury region. Environment Canterbury also works in close partnership with the mana whenua of our region, Ngai Tahu, through our Tuia Relationship Agreement with the ten Papatipu Runanga in Canterbury and the tribal authority, Te Runanga o Ngai Tahu.
>
> … In relation to the proposed conditions … Environment Canterbury recommends that provision be made for adequate time for regional councils and unitary authorities to notify tangata whenua for the area or areas where the VTA is to be used[15]."

The effect of the proposal on local decision-making

Many submitters noted that the proposal would remove the ability for local councils to require resource consents for pest control activity and, as a result, an avenue of local consultation would be removed.

Submitters were generally divided into two groups on this issue:

- business, major industry groups, and local and central government uniformly supported this change
- a majority of NGOs and a minority of individual submitters opposed it.

Submitters supportive of the proposal

Many of these submitters noted the 2007 review of 1080 by the EPA. They expressed their confidence in the process and noted that extensive, nationwide consultation was undertaken as a part of the review.

Most of these submitters noted the report from the PCE on 1080 in June, 2011 and expressed confidence in the findings and recommendations.

Most noted that the RMA process added significant cost (in both time and money) to pest control operations with no discernible improvement neither in public safety nor in the effectiveness of the operation. Some noted that local consultation through the RMA process did not result in any improvements to their operations or increase their knowledge of best practice.

[15] Environment Canterbury Regional Council, submission reference number 14719

All TBFree Committees[16] noted that "interest groups appear to aim for a complete ban on the use of 1080 rather than improve its use in pest control".

OSPRI (also supported by the submissions from the TBFree Committees) stated:

> "It is expected there will some opposition to the proposed regulation, possibly on the basis that it denies opportunities for local decision-making. However in OSPRI's experience, local decision-making and consent processes under the RMA can be subject to strong pressure from interest groups and individuals who appear to be a seeking a complete ban, or at least much more severe curtailment, on the use of 1080 for pest control. Any public policy debate on this matter rightly should be - and has been - carried out through processes for reassessment of national controls on the use of 1080 under HSNO. Attempts to use regional consent processes under the RMA to effectively re-litigate the outcomes of the HSNO reassessment have imposed needless and inappropriate costs on taxpayers, ratepayers and the biosecurity levy-payers, and has resulted in loss of pest control benefits[17]."

Federated Farmers supported the proposal but were concerned that:

> "…there are community groups or individuals that feel aggrieved by what may be perceived to be loss of an avenue to express their concern at a local level. Consequently, this may see more push through the district plan process to make the use of 1080 a prohibited activity. Given the importance of the use of VTA's to the pastoral sector, the Federation seeks assurance that this risk has been recognised and any necessary mitigation measures have been, or will be, taken to prevent such an undesirable outcome from occurring[18]."

Local and central government submissions were generally supportive of the proposal because of the anticipated benefits including eliminating duplication between the RMA and HSNO, and savings in both time and money.

Submitters opposed to the proposal

Submissions addressing the issue of public consultation fell into two camps and felt:

- the removal of the resource consent process silences objectors' voices
- current consultation through the resource consent process is inadequate, non-existent, or corrupt.

Most frequently noted by this group was the proposal's effect of removing the ability of opponents of VTAs to express their opposition at the local level.

One NGO argued for a substitution for the RMA process so that local-level public consultation could be kept, and two NGOs argued for increased public consultation instead:

> "There is an argument to have triplicate provisions where all of these matters can be considered by a 'PEOPLE'S PANEL' who would have a VETO where practices or substances were considered to be beyond the pale of acceptable standards of public decency - such as the prolonged torture of animals with 1080 and brodifacoum in particular[19]."

[16] OSPRI supports 15 TBFree Committees around New Zealand to maintain effective links with the farming community and other stakeholders at a regional level. The TBFree Committees promote the TBFree programme in their regions and are a source of advice and feedback to OSPRI on policy and operational issues.

[17] OSPRI, submission reference number 14632

[18] Federated Farmers of New Zealand, submission reference number 14630

[19] Friends of Sherwood, submission reference number 14692

> "[New Zealand Wildlands Biodiversity Management Society] objects strongly to any reduction of the ability and opportunity for full, timely, and meaningful public consultation right down to a local district or private land area by local district or private land area basis. NZWBM advocates strongly for MORE open and meaningful public consultation in relation to all and any VTA poison applications[20]."

Hunting and fishing NGOs expressed concern that:

- the Human Rights Act was being breached by removing a *"right which has existed*[21]*"*
- that local councils have local knowledge, and should be in charge of decisions that affect their local areas (rather than having a centralised decision process)
- that anglers may be at risk of eating trout that have consumed rodents poisoned with 1080 and the anglers may become unwell as a result (they state that local communities could assess the risk of this happening through the resource consent process).

One individual submitter was concerned that:

> "As long as [DOC] and other agencies continue to fudge the facts and lie about the obscene damage 1080 and brodifacoum are doing to our environment, flora and fauna, any attempt to limit public consultation is a very scary step away from democracy. Too bad if it is slow and expensive, that is how a democracy works[22]."

Some submitters questioned why there is no consultation process now[23].

Some individual submitters were critical of the current consultation process:

> "I have experienced the current consultation process and it is woefully inadequate. Needs more regulation[24]".

MfE Consultation Process

Six submissions provided negative feedback on the process used for the development of the proposal and the consultation process[25].

Four submitters stated that they felt there had been insufficient time for consultation.

The Tuwharetoa Trust Board noted their concern with the period of time allocated for consultation:

> "The Consultation Document was released on 14 April 2016, with submissions due six weeks later. This short consultation period has not, in our view, allowed sufficient time for considered debate and discussions on what the proposed changes to the Resource Management Act 1991 (RMA) could mean for iwi, vis-à-vis the existing regulatory framework. This is particularly concerning given the complexities and controversy surrounding the use of sodium fluoroacetate (1080)[26]."

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[20] New Zealand Wildlands Biodiversity Management Society, submission reference number 14685

[21] New Zealand Deerstalkers' Association, submission reference number 14633

[22] Individual submitter, submission reference number 14414

[23] Note: consultation is currently required under both HSNO and the RMA. There are also consultation processes with iwi.

[24] Individual submitter, submission reference number 14613

[25] Several submitters commented on the length of time submissions were open for in their cover email, but did not raise this issue in the body of their submissions.

[26] Tūwharetoa Māori Trust Board, submission reference number 14727

There was criticism from one NGO about the process of summarising submissions:

> "'The common practice' by government agencies administering and summarising public submissions for presentation to Ministers or decision making bodies ; "-Of applying a numerical weighting scale of adjustment to each submission "point' (and or subject) made by submitters means THE EMPHASIS AND IMPORTANCE OF EACH "POINT" IS COMPLETELY UNDER THE CONTROL OF THE RECEIVING AGENCY AND MAY BEAR NO RELATION AT ALL TO THE IMPORTANCE INTENDED OR MEANT BY THE SUBMITTER/S. The makes the submission process farcical.
>
> … [New Zealand Wildlands Biodiversity Management Society] emphatically objects to this type of arbitrary weighting of public input which can distort the inputs and then the outputs of submission processes and eventually Ministerial or legislative decisions affecting New Zealanders[27]."

[27] New Zealand Wildlands Biodiversity Management Society, submission reference number 14685

Operational issues

Public notification

Some submitters suggested amendments to the notification of pest control operations and/or signage requirements[28].

Two individual submitters made specific suggestions about public notification regarding VTA operations:

- public notifications should include the following wording, "As a result of aerial 1080 poison operations, poisoned baits will be discharged directly into streams and waterways within the operational area[29]". They also wanted to include contact information for people looking for further information
- aerial operations should be notified in every New Zealand newspaper at least three times.

The New Zealand Fish & Game Council urged public notification by pest control operators:

> "The only addition I would make is to urge the review you are conducting to formally require the authorised parties undertaking an operation to publicly accept responsibility for:
>
> - identifying and remedying any unintended consequences upon the legitimate interests of other affected parties, such as the trout fishery and Fish & Game
> - full and practical public messaging of all associated public health assurances or risk management requirements relating to the ingestion of trout flesh potentially contaminated with poison residues.
>
> In the case of this latter point the local Medical Officer of Health for the region in which a poisoning operation was to occur would be the logical medical expert to provide the necessary risk assurance and public advice. Fish & Game could assist public notification by prominently profiling any such message on our website[30]."

Owner/occupier permissions

Some NGOs, the Tasman District Council and Federated Farmers all raised the issue of whose permission should have to be obtained prior to a pest control operation.

Friends of Sherwood (NGO) suggested that permission be gained from all owners and occupiers of land "*upwind of and downstream of any operation*[31]".

The Tasman District Council wanted more specific information about whose consent was required.

Federated Farmers said:

> "The Federation supports the proposed conditions (page 10 of the consultation document) that occupier permission is obtained for the land where the discharge is to occur. The Federation further believes that it is important that the occupier confirm that they have the legal authority to allow (or otherwise) the proposed operation. Should this

[28] Notification and signage is currently required Standard Operating Procedures for pest control operations.

[29] Individual submitter, submission reference number 14684

[30] New Zealand Fish and Game Council, submission reference number 14658

[31] Friends of Sherwood, submission reference number 14692

not be obtained, the onus must be on the occupier to make contact with the owner (or their authorised representative) to obtain this agreement. If not already included, the Federation believes that a clause around this issue could usefully be included in, for example, farm lease agreement[32]."

Buffers and boundaries, maps and timetables for operations

A range of groups including individuals, NGOs, and industry groups commented on buffers and boundaries.

Royal Forest & Bird Protection Society of New Zealand Incorporated submitted that *"Any regulation should deal with the issue of whether, and in what circumstances, any buffers are required for boundaries and tracks, etc[33]".*

Some submitters wanted buffers and other kinds of exclusion areas to be used more frequently, and a requirement for buffers around:

- walking tracks
- the boundaries of areas targeted for pest control operations
- roads (including forestry roads)
- water (particularly drinking water).

Generally, these areas were suggested because of a fear that people and/or non-target animals might be at risk of poisoning:

> "Setbacks from public walking tracks need to be adhered to. These are highly toxic substances and public safety needs to be maintained. Tracks themselves may be cleared by poisonous baits but a child might spot a poisonous bait on the ground close to a track and consume it with serious consequences.[34]"

On the other hand, some organisations noted problems with buffers and other exclusion areas; Environment and Conservation Organisations of New Zealand said:

> "We share concerns about the wide buffer strips often imposed in the use of aerial VTAs, since these too often create reservoirs of infestations and this in turn encourages reinvasions, reapplications and attendant costs, withholding periods for stock, losses of production and access. Reapplications mostly will be needed, but perhaps less often if pest reservoirs are lesser and fewer.[35]"

The New Zealand Fur Council suggested that a comprehensive package of information about pest control operations nationally should be made available publically.

Enforcement/compliance/monitoring and evaluation

The group of submitters who raised concerns around compliance and monitoring were a very diverse group of submitters. This group included:

- the Parliamentary Commissioner for the Environment
- NGOs

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[32] Federated Farmers of New Zealand, submission reference number 14630

[33] Royal Forest & Bird Protection Society of New Zealand Incorporated, submission reference number 14628

[34] Individual submitter, submission reference number 14581

[35] Environment and Conservation Organisations of New Zealand, submission reference number 14686

- individuals
- iwi
- Medical Officers of Health
- Federated Farmers
- other industry groups
- private businesses
- councils.

The PCE supported the proposed conditions, but suggested that the condition for compliance with HSNO Act controls seemed unnecessary.

The importance of monitoring pest control operations was raised by many submitters including Federated Farmers, Dairy NZ, Epro Ltd, the Canterbury District Health Board, and Ngāti Rangi Trust. They noted that the proposal removed the ability of councils to recover their costs for monitoring pest control operations and suggested other options for enabling monitoring to be undertaken.

Submitters who discussed compliance and monitoring issues almost always raised the issue of cost recovery too.

Dairy NZ noted that the inability of councils to recover costs associated with compliance and monitoring may act as a disincentive for councils to do this work.

There was concern expressed primarily by councils that ratepayers would suffer the cost of monitoring pest control operations if councils were no longer able to recover costs as part of the resource consent process under the RMA.

Environment and Conservation Organisations said:

> "We note the proposal for no cost-recovery of monitoring of the applications. We sympathise with this given the costs of such for councils, but we also note that the proposed changes in the Resource Legislation Bill do have provisions for councils to cost-recover where there are permitted uses. The two provisions seem to be at odds. Lack of funding may mean no monitoring, violations and discrediting the regime with resultant lack of public confidence. On the other hand, having to pay for monitoring will be prohibitive for many community groups[36]."

Extension of proposal to include other pests

Federated Farmers suggested that the proposal could benefit operations against other pests, specifically rabbits.

[36] Environment and Conservation Organisations, submission reference number 14686

Iwi submissions

Submissions were received from:

- Tūwharetoa Māori Trust Board[37]
- Maungaharuru-Tangitū Trust[38]
- Te Runanga O Ngati Whatua[39]
- Ngati Rangi Trust[40].

All iwi submissions discussed the importance of consultation regarding pest control operations in their rohe. Two submissions spoke of the duty of kaitiaki to ensure the mauri/mouri, and the spiritual and physical health of their rohe.

One submission opposed the proposal; one submission supported the proposal; one submission opposed the proposal in part; and one submission requested further information about the proposal.

Tūwharetoa Māori Trust Board

The Tūwharetoa Māori Trust Board did not state whether they supported or opposed the proposal; rather they stated their concerns about the Ministry for the Environment consultation process and sought further information about how the proposal would work at a local level.

Maungaharuru-Tangitū Trust

Maungaharuru-Tangitū Trust opposed the proposal.

Their submission noted that the key principle behind Poutiri Ao ō Tāne Project – a community conservation and restoration project with DoC and the Hawkes Bay Regional Council, is to move to wide-scale, ultra-low-cost trapping with the aim of reducing toxin use on farmland in the long-term.

In regard to consultation, Maungaharuru-Tangitū Trust said that they:

> "… expect that provision be made for adequate time for Regional Councils and unitary authorities to notify Tangata Whenua for the area or areas where the VTA is to be used and or [sic] proposed"

and

> "… expect that full consultation with Tangata Whenua is made in accordance to the RMA as a notified party if and when VTA is to be used within the Takiwā."

They also expect that they will receive the relevant reports from agencies tasked with compliance responsibilities[41] as Tangata Whenua in their Takiwā and as part of the "due consultation of any proposed VTA application".

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[37] Tūwharetoa Māori Trust Board, submission reference number 14727

[38] Maungaharuru-Tangitū Trust, submission reference number 14707

[39] Te Rūnanga o Ngāti Whātua, submission reference number 14696

[40] Ngāti Rangi Trust, submission reference number 14612

Te Rūnanga o Ngāti Whātua

Te Rūnanga o Ngāti Whātua supported the proposal.

They noted that the proposal is consistent with 'Local Government's approach to controlling VTAs as a permitted activity' and that it is unlikely to significantly change the way VTAs are used or controlled in their tribal area. They note that HSNO provides environmental protection when pest control is a permitted activity.

On consultation, they noted that one of their key requirements is to be advised of operations in their area so that they can respond to public enquiries.

They note that:

> "The proposal is unlikely to affect the way Te Rūnanga monitors general regulatory controls for pest management in any practical way. Te Rūnanga does not routinely monitor permitted activities. Previous engagements have been triggered by compliance or an environmental incident."

They also note that several other agencies are also involved in monitoring pest control operations.

Ngāti Rangi Trust

Ngāti Rangi Trust opposed the proposal in part.

Ngāti Rangi Trust is currently facilitating the consultation process for TBFree New Zealand for their proposed pest control operation in the Horopito, National Park, Karioi and southern Ruapehu area. Part of this facilitation process involved '*address[ing] the myths surrounding Sodium Fluoroacetate (1080)*".

Their submission acknowledges the importance of pest control operations in protecting New Zealand's native species, but expressed concern about the use of VTAs within their rohe because "*there will always be an impact on the mouri*[42] *of the environment*".

In reply to consultation question 2(a), Ngāti Rangi Trust stated:

> "NRT recognise that there are still sufficient safeguards under the HSNO Act 1996 to reduce or eliminate the RMA layer that requires resource consent and therefore 'streamlining the process'. Despite this, we request that specific mechanisms outlined within the RMA remains in place to trigger the following:
>
> 1) Section 6Cc: The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna,
>
> 2) Section 6e: The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga,
>
> 3) Section 7a: Kaitiakitanga,
>
> 4) Section 7d: Intrinsic values of ecosystems,
>
> 5) Section 8: Treaty of Waitangi"

[41] Such as Worksafe New Zealand, the Ministry of Health, the Environmental Protection Authority, the Department of Conservation, TBFree, and regional councils.

[42] Ngāti Rangi dialect for mauri (life-force).

They also note:

> "The resource consent process, or more importantly the pre-application phase offers iwi an opportunity to engage and offer mechanisms of protection and recognition of these key principles with applicants.
>
> Therefore, NRT oppose this streamlining unless the opportunity to engage at the local level remains as part of the process, eg. [sic] through the resource consent process."

Ngāti Rangi Trust supports other parts of the proposal.

On compliance and monitoring, Ngāti Rangi Trust raised the issue of cost recovery:

> "NRT see the utmost importance of continuing the monitoring and compliance duties. We also recognise that there needs to be the ability to recover costs of the monitoring and compliance checks from the applicant. We view this as another opportunity for local iwi to engage in these duties (monitoring and compliance) to help alleviate long distance logistical issues. A collaborative approach from Worksafe NZ, Ministry of Health (MOH), Environmental Protection Authority, Department of Conservation, TBFree and iwi would be able to establish a streamlined cost effective monitoring and compliance audit program for all applications across the country."

Councils

This section of the submissions report summarises responses from local government (councils and Local Government New Zealand) on the proposal.

A total of eight councils made submissions. Local Government New Zealand, the representative organisation for all 78 councils, also made a submission.

While the proposal directly affects all councils, it affects them in different ways. Councils with plans containing permitted activity rules for 1080, are affected minimally by the proposal. Councils with plans requiring resource consent for aerial 1080 operations[43] are more affected by the proposal.

Adding context to their own and councils' submissions, Local Government New Zealand noted that councils are currently carrying out work to ensure their Regional Pest Management Strategies align with the National Policy Direction for Pest Management[44].

The consultation document sought feedback on the proposal that three conditions be included in the regulation. These conditions covered:

- occupier permission for the land where the aerial discharge is occurring
- information to be provided to councils
- compliance with HSNO controls.

Council submissions were mostly concerned with the second and third conditions.

Information to be provided to councils about individual pest control operations

The proposed condition relating to the information pest control operators would be required to provide to their local councils with about their operations was to cover:

- location of the planned operation (GPS data)
- timing of the operation
- chemical being used.

The West Coast Regional Council and Horizons Regional Council supported the proposed information requirements on the basis that they will be able to use the information to answer queries from the public.

Waikato Regional Council agreed with the proposed information requirements, and suggested other information that would also add value.

The Tasman District Council stated that the conditions are not specific enough to be enforceable.

[43] Plans might require resource consent for aerial 1080 operations as either a controlled, restricted discretionary, discretionary or non-complying activity. Plans might also require resource consent for aerial 1080 operations despite having permitted activity rules for the aerial discharge of 1080.

[44] This work is associated with the 2012 changes to the Biosecurity Act.

Compliance with HSNO controls

Overall, councils were concerned about what their monitoring requirements will be under the new proposal.

Councils also expressed concern about possible duplication between the proposed compliance condition in the regulation and the compliance and monitoring work other agencies undertake.

The West Coast Regional Council said:

> **"**Reference to regional councils monitoring in the proposal is confusing. Councils should not undertake monitoring and compliance if the regulation is passed. This should be done by a Ministry department for efficiency and to reduce duplication between agencies.[45]**"**

The Greater Wellington Regional Council said:

> **"**Conflict if regional council officers are undertaking investigations or compliance audits no longer managed under RMA. Any compliance checks and issues should be dealt with by the authority tasked with that particular legislation. Reference to compliance with HSNO controls should be removed[46]."

[45] West Coast Regional Council, submission reference number 14698

[46] Greater Wellington Regional Council, submission reference number 14688

Conclusion

This report is intended to provide a concise summary of the views expressed. It is not intended to provide an analysis of those views or recommendations in response to the submissions. Any recommendations in response to submissions are made through policy advice to Cabinet, delivered later in 2016.

"NRS-8"

This is the exhibit marked "**NRS-8**" referred to in the annexed Affidavit of **NICOLAS REX SMITH** sworn at **Wellington** this **10th** day of **July 2017** before me:

Miriam Sophie B[illegible]
Solicitor
WELLINGTON

Solicitor of the High Court of New Zealand

In Confidence

Office of the Minister for the Environment

Chair

Cabinet Legislation Committee

Pest Control - Minor Amendment to Resource Management (Exemption) Regulations 2017

Proposal

1. This paper proposes that the Cabinet Legislation Committee authorise submission to the Executive Council of the *Resource Management (Exemption) Amendment Regulations 2017*. These Amendment Regulations correct a drafting issue in the recently-passed Regulations to ensure that their policy intent is achieved by enabling aerial brodifacoum operations within predator-proof sanctuaries.

Background

2. The Resource Management (Exemption) Regulations 2017 (the Original Regulations) came into force on 1 April 2017 and exempt pest control operations discharging 1080, brodifacoum, and rotenone from regional council controls under the Resource Management Act 1991 (RMA). These controls were found not to add any useful regulation beyond the Hazardous Substances and New Organisms Act 1996 (and the Agricultural Compounds and Veterinary Medicines Act 1997.
3. A drafting issue in regulation 5(b)(i) has resulted in the brodifacoum exemption applying when "the discharge is into or onto... land protected by predator-proof fencing". There is a risk that a strict interpretation of "land" would mean that an aerial brodifacoum operation in a sanctuary which incidentally discharged to water may not be covered by the original Regulations.
4. The policy intent of the original Regulations was to enable aerial brodifacoum operations within a sanctuary. The risks from brodifacoum discharged to water within sanctuaries are already effectively regulated by the Code of Practice under the Agricultural Compounds and Veterinary Medicines Act (Aerial and Hand Broadcast Application of Pestoff® Rodent Bait 20R for the Intended Eradication of Rodents from Specified Areas of New Zealand), which prevents bait getting outside the sanctuary during and after the operation. Controls on brodifacoum under the Hazardous Substances and New Organisms Act also manage risks from aerial operations flying over water bodies.
5. Brodifacoum is discharged aerially within sanctuaries for initial eradication of rodents once the fenced perimeter is secure. These aerial operations inevitably result in discharge to water bodies within a sanctuary.
6. This drafting issue affects new sanctuaries which have not yet undertaken an initial aerial eradication operation. The drafting issue will not affect existing sanctuaries, nine of which (including Zealandia, Maungatautari, and Rotokare) have already undertaken initial eradication operations using brodifacoum.

7. One affected sanctuary is Brook Waimarama Sanctuary, which is planning an initial eradication operation using aerial brodifacoum for winter 2017. Brook Waimarama is aware of the drafting issue. The original Regulations could be amended in sufficient time for Brook Waimarama to conduct its operation this winter.

Policy

8. The policy approved by Cabinet intended to exempt all discharges of brodifacoum within a predator-proof sanctuary, thus a proposed amendment to correct the drafting issue can be directly considered by Cabinet Legislation Committee.
9. The Amendment Regulations correct the drafting issue in the original Regulations by specifying that brodifacoum discharge is enabled in all area (including land, water, and air) protected by predator-proof fencing.

Timing and 28-day rule

10. The Order is proposed to be notified in the Gazette on 1 June 2017 and come into force on 29 June 2017, following usual procedures including the 28-day rule.

Compliance

11. The proposed amendments comply with the:
    a. principles of the Treaty of Waitangi
    b. rights and freedoms contained in the New Zealand Bill of Rights Act 1990 and the Human Rights Act 1993
    c. principles and guidelines set out in the Privacy Act 1993
    d. relevant international standards and obligations
    e. LAC Guidelines on the Process and Content of Legislation.

Regulations Review Committee

12. I do not consider there are any grounds for the Regulations Review Committee to draw the Amendment Regulations to the attention of the House of Representatives under Standing Order 319.

Certification by Parliamentary Council

13. The Amendment Regulations have been certified by Parliamentary Counsel Office as being in order for submission to Cabinet.

Regulatory Impact Analysis

14. A Regulatory Impact Statement was prepared and submitted at the time that Cabinet approval was sought for the policy decisions. The policy has not changed.

Publicity

15. No press release will be issued by the Minister for the Environment upon gazettal as this is a minor amendment.
16. There may be reaction from community groups who oppose aerial pest control operations.

17. The Ministry for the Environment webpage will be updated with an explanation of the amendment, including an explanation of how risks from aerial brodifacoum operations are managed by the Agricultural Compounds and Veterinary Medicines Act and Hazardous Substances and New Organisms Act.

18. I propose that this paper is proactively released at the same time as the Amendment Regulations are gazetted, to enable any concerned persons to ascertain the intention of the amendment.

Consultation

19. This paper was prepared by Ministry for the Environment. The Ministry for Primary Industries, Department of Conservation, Environmental Protection Agency, the Ministry of Health, the Department of Internal Affairs, Land Information New Zealand, and Treasury were consulted during the preparation of this paper.

20. The Department of Prime Minister & Cabinet was informed of this paper.

Recommendations

The Minister for the Environment recommends that the Committee:

1. **note** that the *Resource Management (Exemption) Amendment Regulations 2017* give effect to the decisions referred to in EGI-16-MIN-0211;

2. **authorise** the submission of the *Resource Management (Exemption) Amendment Regulations 2017* to the Executive Council; and

3. **authorise** the proactive public release of this paper at the time the Amendment Regulations are promulgated.

Authorised for lodgement.

Hon Dr Nick Smith
Minister for the Environment