



Looking after jewelled geckos & their habitats

A practical guide for landowners

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Department of
Conservation
Te Papa Atawhai

Contents

Why are lizards important?	2
Our geckos are unique	3
The jewelled gecko/moko-kākāriki	4
Their status	5
Why are they in trouble?	6
Protecting habitat	8
Restoring habitat	8
To graze or not to graze?	12
Predator control	15
Summing it up – six ways to make a difference	22
Acknowledgments	23
References	23
Appendix 1 – Resources	25

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the south-eastern South Island.
It is a taonga and undoubtedly
one of the most beautiful geckos
found in New Zealand.*



Why are lizards important?

Lizards are part of our natural heritage. Among vertebrates (animals with backbones), lizards are second only to birds in diversity, as measured by the number of species. Before the arrival of humans, and the pest animals they brought with them, lizards were a dominant and obvious component of the native fauna. Lizards helped some of our native plants thrive by dispersing their seeds and pollinating their flowers. They also provided a food source for other native animals like the tuatara. None of this is obvious today unless you visit an off-shore island that has never had introduced mammalian predators present—cats, ferrets, stoats, weasels, hedgehogs, rats and mice. All of these pest species eat lizards. Although lizard populations are now much reduced in their distributions and numbers due to predation and habitat loss, there are still a large number of species remaining, particularly for a small country with a cooler climate. The most recent (2009) revision of the New Zealand reptiles indentified 100 lizard species (43 geckos and 57 skinks), not all of which have been formally described. One of the 100 lizard species is not native to New Zealand—the rainbow skink, a native of Australia. These numbers will change in the future because new species are still being discovered and others are being revised. All skinks are currently classified into one group (the genus *Oligosoma*), while geckos have recently been divided into seven groups.



Geckos have baggy velvety skin and broad heads.

Skinks have shiny tight-fitting skins and look like snakes with legs.

Our geckos are unique

By world standards, New Zealand geckos are unique. This is because they:

- Are slow-growing, generally taking 2–8 years to reach maturity, at which time females are able to breed for the first time;
- Are incredibly long-lived; the current record-holder is a 48-year-old gecko living on a predator-free island in North Canterbury;
- Do not lay eggs, instead giving birth to perfectly-formed miniature versions of themselves (below). Females typically produce one set of twins per year, or every second year for animals living in cold climates;
- Include the brightly-coloured ‘green geckos’ (genus *Naultinus*), which are active by day (diurnal). In contrast, most of the 1000+ species of gecko found world-wide have drab colours and are active at night.

The ‘slow life-style’ of our geckos is thought to have evolved in response to New Zealand’s cool climate. Because of their slow growth rates and the small number of offspring produced, our gecko populations do not easily recover from losses and take a long time to respond to management actions designed to improve their status.



Gecko birth Photo:© R Morris

The jewelled gecko/moko-kākāriki

Naultinus gemmeus

The jewelled gecko is found only in the south-eastern South Island. It is a taonga and undoubtedly one of the most beautiful geckos found in New Zealand. Some green geckos are just that – plain green – but jewelled geckos certainly live up to their name. They may be studded with diamonds, stripes or a mixture of both, in intricate patterns and colours that are unique to each individual. These patterns provide the perfect camouflage in the shrublands and forests where they live.

Sadly, jewelled geckos are declining and need all the help they can get. Some populations are on the verge of extinction while others have been destroyed through the clearance of shrublands and forests. But it is not all bad news: there are an increasing number of individuals and organisations who want to help save this unique species. This booklet aims to help landowners look after jewelled geckos on their own land by providing advice on habitat and predator management, and links to resources, people and funding.



Their status

The Department of Conservation (DOC) has devised its own system for classifying species according to their threat of extinction. In the latest revision of New Zealand reptiles, all green geckos were given a threat status of At Risk – Declining. This means that green gecko species are declining, but are not at immediate risk of extinction because each species has a large (>10,000 ha) area of occupancy and/or a slow rate of decline. Deciding on threat status is very difficult because total population sizes and trends remain unknown for any green gecko species. The threat rankings are, therefore, an average best guess made by a panel of lizard experts (herpetologists).

The jewelled gecko is one of the better-known species of green gecko, partly because it is found in rural landscapes and areas of native bush that are close to urban centres, increasing the chance that they are encountered by humans. Although jewelled geckos have been the subject of research by students, academics and herpetologists, few populations have been monitored for a long enough time-frame to reveal trends. Alarmingly, one population is known to have declined by more than 95% over a 15-year period! Concern over the species status has led to the production of a community-based management plan for jewelled geckos on the Otago Peninsula by the DOC Otago Conservancy Office.



Why are they in trouble?

The main threats to jewelled geckos are habitat loss, predation and illegal collection by wildlife smugglers (poaching). All of these threats have to potential to wipe out entire populations.

Habitat loss

Jewelled gecko habitat may be lost by changes in land use, including conversion of shrublands to pasture for grazing stock, planting exotic forestry, building roads and subdivisions, weed encroachment and fire. Although jewelled geckos and their habitats are legally protected under the Wildlife Act and the Resource Management Act, their presence may not be known. Their habitat may be lost without anyone knowing jewelled geckos were ever present! For this reason, reporting sightings of jewelled geckos to DOC is important and could help protect their habitat from insensitive development.



Photos: M Lettink

Figure 1. The jewelled gecko living in this native Coprosma shrub (centre) will have to find a new home when the macrocarpa trees planted around her grow tall enough to shade out her habitat. She would be unwise to shift up into the trees: any geckos remaining in this plantation when it is harvested are likely to be injured or killed.



Figure 2. The jewelled gecko living in this native Coprosma shrub (centre) is surrounded by gorse. Left uncontrolled, the gorse may take over and displace him from his habitat. He may be harmed if the gorse is sprayed with herbicide or burnt: both are commonly-used control methods for this invasive weed.

Predation

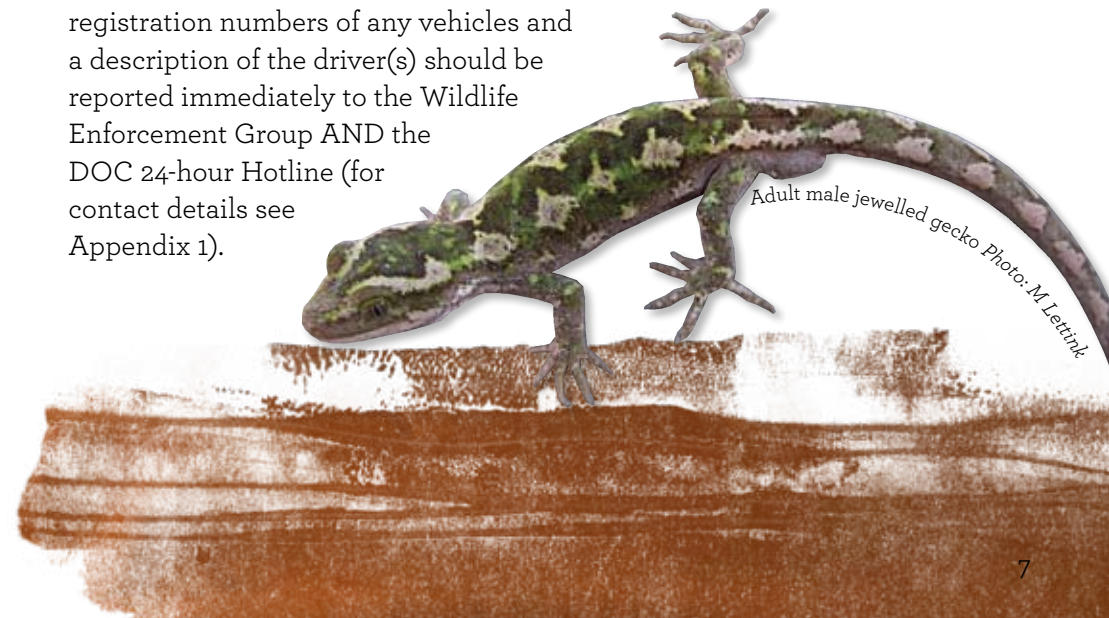
Like much of our native fauna, jewelled geckos are preyed on by pest mammals (cats, ferrets, stoats, weasels, hedgehogs, rats and mice) and some birds (e.g. magpies, kingfishers). Being arboreal (living above the ground in vegetation) may help protect jewelled geckos from predators that live only on the ground. However, other predators, such as rats and mice, are nimble and able to climb. Unfortunately, the 'freeze-and-rely-on-camouflage' strategy used by jewelled geckos and many native flightless birds when disturbed by a predator is no match for the mammal nose and its keen sense of smell.



Illustrations: S Parkkali

Illegal collection

Sadly, jewelled geckos are increasingly targeted by smugglers for supply to an overseas illegal or black market. To date, five people have been convicted for smuggling and received prison sentences. If you have jewelled geckos on your property, it is best not to make their presence widely-known and avoid posting any information on the internet; a rich source of information for would-be smugglers. Any suspicious activity should be monitored, and if possible, the registration numbers of any vehicles and a description of the driver(s) should be reported immediately to the Wildlife Enforcement Group AND the DOC 24-hour Hotline (for contact details see Appendix 1).



Adult male jewelled gecko. Photo: M Lettink

Protecting habitat

The actions of individual landowners can have major impacts on jewelled geckos and their habitats. Seeking some form of legal protection for the jewelled gecko habitat on your property will ensure that existing conservation achievements will continue if the property changes hands. The basic steps for obtaining legal protection are two-fold: 1) defining by survey the area that is to be protected; 2) deciding on what sort of protection and management you want for your property. There are a number of options available to suit the preferences and needs of individual landowners (Table 1).

Restoring habitat

Jewelled gecko habitat can be increased and restored by planting appropriate species (Table 2). Native species can be added to existing habitat to increase its size, condition and diversity, or be planted in ‘corridors’ to link shrubland and forest remnants separated by pasture. Jewelled geckos are commonly found on plants with tight, interlacing architectures, such as Coprosma shrubs. The so-called ‘small-leaved Coprosmas’ (not all members of the genus Coprosma are shrubs with small leaves) provide jewelled geckos with excellent refuge from predators, protection against the elements, and a rich food supply that includes insects and berries. Another of their favoured plant species is kānuka. Most gecko sightings are made at heights of less than 5 m above the ground. Jewelled geckos also use taller vegetation but are impossible to observe in the forest canopy. This means that any list of preferred plants based on sightings will inevitably favour shorter plants on which geckos are most easily seen. Although jewelled geckos do use some introduced plants (e.g. gorse), such species should not be planted because most are serious weeds that are likely to spread and eventually displace native plants.

Table 1. Options for the legal protection of jewelled gecko habitat on private land

Option	Details
Selling or gifting land	Land may be sold or gifted to various agencies, organisations or trusts for protection purposes. The buyer usually meets some or all of the transaction costs.
Conservation covenant	A legal agreement between a landowner, who retains ownership of the land, and a covenanting agency (e.g. DOC, Queen Elizabeth II National Trust, Banks Peninsula Conservation Trust). The agreement stipulates how the natural values of a site are to be protected and monitored. Both parties manage covenanted land in accordance with the agreement. Covenants are usually registered against the title of a property and bind future landowners in perpetuity. Covenanting agencies may offer specialist advice and financial assistance towards survey, legal and fencing costs. Landowners may be able to apply to the local authority (council) for rates relief.
Protected private land agreement	Landowners can make a protected private land agreement with DOC. The landowner retains ownership and the agreement is recorded against the title by way of a gazette notice.
Land exchange	Land can be exchanged if it is of interest to both parties. Landowners may be required to meet costs related to equality of exchange, survey and legal requirements.
Management agreement	A temporary agreement between a landowner and DOC that is legally-binding under section 29 of the Conservation Act.

Management agreements are not registered against the title, do not bind future owners, and keep your managements options open until you reach a final agreement for improved protection.



Table 2. Plant species used by jewelled geckos on the Otago and Banks peninsulas, with species recommended for restoration plantings highlighted in green. Before planting, it is best to seek advice from your local native plant nursery on the most appropriate species to use for your area and property.

Plant species	Common and/or Maori name	Origin	Number of geckos seen in this plant	% of geckos
<i>Coprosma propinqua</i>	Mikimiki	Native	719	41.8
<i>Kunzea ericoides</i>	Kānuka	Native	345	20.0
<i>Coprosma crassifolia</i>	Thick-leaved mikimiki	Native	217	12.6
<i>Muehlenbeckia australis</i>	Pōhuehue	Native	70	4.1
<i>Ileostylus micranthus</i>	Green mistletoe/pirita	Native	49	2.8
<i>Leptospermum scoparium</i>	Mānuka	Native	46	2.7
<i>Helichrysum lanceolatum</i>	Niniao	Native	36	2.1
<i>Pseudowintera colorata</i>	Pepper tree/horopito	Native	29	1.7
<i>Ulex europaeus</i>	Gorse	Introduced	25	1.5
<i>Podocarpus totara</i>	Tōtara	Native	21	1.2
<i>Corokia cotoneaster</i>	Korokio	Native	15	0.9
Ground / grass / log		N/A	15	0.9
<i>Coprosma virescens</i>	Pale green mikimiki	Native	13	0.8
<i>Coprosma areolata</i>	Thin-leaved mikimiki	Native	12	0.7
<i>Coprosma tayloriae</i>	Mikimiki	Native	9	0.5
<i>Pittosporum tenuifolium</i>	Kōhūhū/black matipo	Native	8	0.5
<i>Rubus</i> sp.	Bush lawyer	Native	8	0.5
<i>Pseudopanax arboreus</i>	Five-finger/whauwhaupaku	Native	8	0.5
<i>Myrsine australis</i>	Mapou/red matipo	Native	7	0.4
<i>Coprosma rotundifolia</i>	Round-leaved mikimiki	Native	7	0.4
<i>Melicope simplex</i>	Poataniwha	Native	6	0.3
<i>Clematis</i> sp.		Native	5	0.3
<i>Coprosma rhamnoides</i>	Mikimiki/twiggy coprosma	Native	5	0.3
<i>Coprosma rugosa</i>	Mikimiki	Native	4	0.2
<i>Pteridium esculentum</i>	Bracken fern/rahurahu	Native	4	0.2
<i>Myrsine divaricata</i>	Weeping māpou/matipo	Native	4	0.2
<i>Muehlenbeckia complexa</i>	Tororaro	Native	4	0.2
<i>Pinus radiata</i>	Radiata pine/Monterey pine	Introduced	3	0.2
<i>Lophomyrtus obcordata</i>	NZ myrtle/rohūtu	Native	3	0.2
<i>Discaria toumatou</i>	Matagouri/tūmatakuru	Native	3	0.2
<i>Olearia avicenniifolia</i>	Tree daisy/mountain akeake	Native	2	0.1
<i>Metrosideros diffusa</i>	Climbing rata	Native	2	0.1
<i>Polystichum</i> sp.	Prickly shield fern	Native	2	0.1
<i>Carmichaelia australis</i>	NZ broom	Native	2	0.1
<i>Griselinia littoralis</i>	Broadleaf/pāpāuma	Native	2	0.1
<i>Parsonsia heterophylla</i>	NZ jasmine/kaihua	Native	2	0.1
<i>Cytisus scoparius</i>	English/Scotch broom	Introduced	1	0.1
<i>Lupinus arboreus</i>	Yellow/tree lupin	Introduced	1	0.1
<i>Cupressus macrocarpa</i>	Macrocarpa	Introduced	1	0.1
<i>Hebe decumbens</i>	Hebe	Native	1	0.1
<i>Fuchsia procumbens</i>	Creeping fuchsia	Native	1	0.1
<i>Phormium tenax</i>	Flax/harakeke	Native	1	0.1
<i>Fuchsia excorticata</i>	Tree fuchsia/kōtukutuku	Native	1	0.1
<i>Parsonsia capsularis</i>	NZ jasmine	Native	1	0.1
<i>Hoheria angustifolia</i>	Narrow-leaved lacebark	Native	1	0.1
	/houhere/houhi		1721	100.0

To graze or not to graze?

Research on the Otago Peninsula and at other sites has shown that rodents (rats and mice) and mustelids (ferrets, stoats and weasels) are more abundant on land that is not grazed relative to land grazed by livestock. This is because rodents are attracted to areas of rank grass and dense ground cover, which provide an abundance of food and excellent shelter. Higher rodent numbers can in turn attract mustelids and feral cats. This higher mammalian predator presence on ungrazed land can sometimes have disastrous consequences for native lizards.

Because grazing prevents the build-up of rank grasses (which attract rodents), it may reduce the frequency of rodent predation on lizards. Research conducted by Carey Knox on the Otago Peninsula revealed that the average density of jewelled geckos was four times higher at grazed *Coprosma* shrubland sites compared with ungrazed *Coprosma* sites, and that rodent activity was higher (1.5 times for mice and 8 times for rats) at ungrazed versus grazed *Coprosma* sites. In contrast, there was no difference in the average density of jewelled geckos at grazed and ungrazed sites where kānuka and/or mānuka was the dominant habitat. The kānuka sites typically had a more consistent canopy with less rank grass and dense ground cover (making it less suitable for rodents).

From this research, it was concluded that regulated grazing (i.e. grazing at an appropriate intensity which reduces rodent numbers but does not compromise the long-term viability of the habitat) can be an effective conservation strategy for jewelled geckos living in *Coprosma* shrublands. For sites with a consistent canopy of kānuka, broadleaf, beech or mixed forest, grazing has not been shown to be beneficial to jewelled geckos and may negatively impact on the regeneration of the forest; therefore, Carey Knox did

not recommend grazing at these 'forest' sites but suggested that predator control would be likely to benefit any resident geckos.

Grazing reduces the number of rodents present for as long as grazing continues, thereby reducing the need for predator control (which could be equally effective if done correctly). As predator control (particularly rodent control) can be expensive, time-consuming and difficult to implement on large properties, regulated grazing can be an effective and easier way to conserve jewelled geckos based in *Coprosma* shrubland relative to rodent control. Regulated grazing is likely to be most useful as a means of reducing predators at sites with fragmented *Coprosma* shrublands and an abundance of grass cover.

It is up to the individual landowner as to whether they choose to graze or not. Grazing can benefit some species but not others in the ecosystem. With jewelled geckos primarily in mind, Carey Knox recommends that those who choose to graze focus on protecting vulnerable seedlings or plants of importance to jewelled geckos (e.g. *Coprosma*s) and expanding available habitat by planting dense divaricating shrub species (Figure 3). For those who choose not to graze, long-term predator control should be considered a high priority. If stock removal is desired from a previously grazed site, landowners should carefully consider what impact this will have on pest mammals and any jewelled geckos present.

Gecko in clematis Photo: C Knox



14 Figure 3. Conservation priorities for shrubland and forest sites with and without grazing



Predator control

Naive natives are ill-equipped against teeth and fur

New Zealand has unique plants and animals because of its geographic isolation and evolutionary history. Present-day New Zealand is part of Zealandia, a mostly-submerged continent that separated from Gondwana (a supercontinent containing most of the landmasses present in the Southern Hemisphere today) approximately 80 million years ago. The recent discovery of parts of a small, shrew-like mammal that could not fly is the only evidence that New Zealand once had land mammals. By the time Polynesian settlers arrived in New Zealand c. 1230–1280 AD, the only land mammals remaining were three species of bat. Due to this complete lack of experience with predatory mammals, encounters between our ecologically-naïve reptiles and birds, and the mammalian predators humans brought with them were disastrous, sparking a wave of extinctions. Strategies that worked well for avoiding the avian predators our fauna co-evolved with—such as freezing and relying on one’s camouflage—were not effective against this new enemy.

Leading the world in pest mammal control

By necessity, New Zealanders have become world-leaders in the field of pest-mammal control. Islands up to 11300 ha in size have been cleared of pest mammals to become sanctuaries for threatened biodiversity. Options for mainland sites include reducing predator numbers by trapping and/or poisoning, and excluding predators by using pest-mammal-proof fencing. New traps and poisons are constantly being developed and tested by innovative individuals and companies. One to watch out for is the series of self-setting traps currently being field-tested on unsuspecting rats, stoats and possums, developed by a small Wellington company (Goodnature Ltd.) in conjunction with DOC.

Lessons learnt about protecting lizards

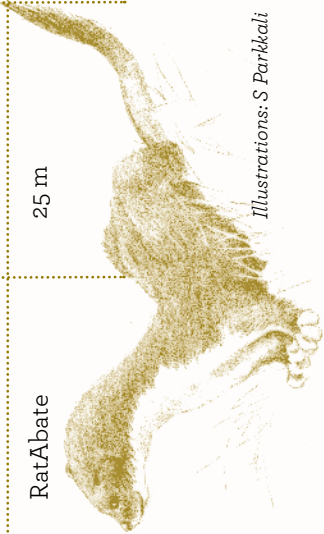
For predator control to be effective at protecting lizard populations, it must:

- 1. Target multiple species.** Relationships between predators and their prey can be complex and unpredictable. Targetting only the top predators in a system (e.g. feral cats and ferrets) can cause increases in the number of smaller predators (e.g. weasels, rats and mice) because these species are no longer being controlled by the top predators. This process is called ‘meso-predator release’. Irruptions of smaller predators can be more disastrous for the prey than having the entire predator guild present.
- 2. Be done at the right intensity and scale.** To be effective, trapping and/or poisoning must be done regularly and over a sufficiently-large area and long time-frame. It should also include a trapping buffer (i.e. extend beyond the immediate area being protected) to reduce predator reinvasions.
- 3. Be monitored to insure its effectiveness.** Following commonly-used targets for pest mammal control (e.g. controlling rats to < 5% residual trap catch index) does not necessarily guarantee benefits to biodiversity. Monitoring should be done to assess the response of the target species that is supposed to benefit from the control alongside that of the predators.
- 4. Consider the role of introduced prey species.** Rabbits and hares are an important food source for cats and ferrets. Sudden reductions in their numbers can cause predators to turn their attention elsewhere and consume more native animals, a process known as ‘prey-switching’.
- 5. Be humane.** Poisons and traps must not cause unnecessary suffering to animals. The Ministry of Agriculture and Forestry (MAF) is responsible for animal welfare policy (Animal Welfare Act 1999).



Table 3. Example of multi-species predator control recommended for jewelled geckos, based on approved Department of Conservation (DOC) series trapping systems (www.predatortraps.com) and Connovation’s bait-delivery systems (www.connovation.co.nz). Prices are current at the time of writing and do not include GST and freight charges. Two options are given for cat control (with possum by-catch), depending on whether domestic cats are present in the area. Traps and bait stations need to be checked regularly, with the frequency depending on predator densities and time of year. Rodent-tracking tunnels (www.gotchatraps.co.nz) should be run concurrently with the trapping operation to evaluate its effectiveness.

Species	Trap/poison	Spacing	Cost	Supplier
Feral cat/possum —domestic cats present —domestic cats not present	Havahart model 1089 cage trap	200 m	\$107.83	MS Woodcraft Ltd. Ph (07) 575 5920
	Timms trap		\$46.00	Philproof Ltd. Ph (07) 859 2943
Ferret/stoat/rat/ hedgehog	DOC 200 & DOC 250 traps in 2:1 ratio	No greater than 100 x 50 m apart with perimeter traps 25 m apart	DOC 200 trap \$18.00 with timber box \$45.70 DOC 250 trap \$39.00 With timber box \$62.70	Haines Pallet Co. Ltd. Ph (04) 568 6898
	RatAbate		\$42 bait \$26.25 bait station	Connovation Ltd. Ph (03) 9749141
Rat/mouse		25 m		



Illustrations: S Parkkali

Protecting jewelled gecko populations

At this stage, there are no best-practice guidelines for doing predator control to protect jewelled geckos. Multi-species predator control is now being undertaken by some landowners with jewelled gecko populations on their properties. It is too early to say whether this is having a positive effect. Based on a review of the literature and conversations with landowners and pest control practitioners, we provide an example for multi-species predator control and associated costs (materials only; Table 3). **We strongly advise that predator control targets feral cats, mustelids, hedgehogs and rodents.** It is essential that rats and mice be included, as rodents are likely to be major predators of jewelled geckos. We also provide an 'on-the-ground' example that is based on the experiences of an Otago Peninsula landowner.

A landowner's perspective—practical pest control for jewelled geckos in regenerating kānuka forest

Kānuka forest has begun to take over large tracts of former pasture land on the Otago Peninsula over the last half century, increasing the amount of habitat available for jewelled geckos. It is reasonable to expect that reducing predator pressure on jewelled geckos in regenerating kānuka forest will, over time, result in an increase in gecko numbers. A balanced reduction of mammalian predators, regardless of size of reduction, should have a commensurate benefit for jewelled geckos and other native wildlife. Many landowners are put off implementing predator control to help jewelled geckos by the cost and time involved. Most authorities advocate regimes that reduce predators to levels close to zero. These regimes, whilst acceptable for well resourced organizations who are often attempting to protect critically-endangered animals, are impractical and/or prohibitively expensive for private landowners, who are simply trying to reduce predator pressure on resurgent populations of jewelled geckos.



Brightly-marked baby
Photo: M Lettink

I started doing predator control about four years ago and consider it to be an ongoing experiment that is constantly evolving. I have a flexible approach, being prepared to change type and location of traps and bait stations. I have discovered that some rats will not use certain bait stations or traps – hence the variety. Otago University students have helped to monitor both rodents and geckos during this time. The 0.5-ha core predator control area contains a mixture of traps and bait stations, including:

- Four rat snap traps in wooden boxes, baited with peanut butter and located away from the immediate gecko basking area (I have not caught any lizards in them in four years of use);
- Three Fenn traps in wooden boxes (ex-DOC model) baited with hen eggs;
- A very effective live-capture cat trap purchased from Cyanide Trappers Limited (www.traps.co.nz/) baited with fish tails or heads;
- A Timms trap baited with apple or carrot;
- Ten ground-based rodent bait stations of a variety of commercial and homemade styles;
- Five tree-based rodent bait stations made from 1 L-milk bottles.

The ground-based rodent bait stations are either the commercially-available Pestoff 'Departure Lounge' or the homemade draincoil type described below. The tree-based milk bottle bait stations are based on a design that Connovation once recommended. I have had very little bait take from the tree-based stations – possibly because ship rats in kānuka tend to be largely ground based. I started out using Connovation's RatAbate (diphacinone)



Male gecko on kānuka Photo: M Lettink

paste, but had problems with it being eaten by birds. One of my dogs also likes RatAbate, resulting in an expensive trip to the vet and a long course of vitamin K. I now use floucoumafen (as Storm wax blocks) and diphacinone (as Ditrac wax blocks). The Ditrac blocks certainly have a better take than the Storm. I am still searching for the perfect poison (a highly palatable, effective poison that has low environmental persistence and is of low risk to dogs

In autumn, I often move some of the bait stations to ensure that they are in close proximity to gravid female geckos. I think this is important to counter predation of juveniles by mice, given the known small home range of mice. I am part-way through adding a wider perimeter of rodent bait stations that covers c. 4 ha around the core area. The perimeter bait stations are spaced 30–50 m apart and the lines tend to follow easy routes rather than exact transects through difficult country. These bait stations are made of 1 m-lengths of 100 mm-diameter unpunched drain coil (Figure 4). They have an access hole cut in the top, drainage holes drilled into the bottom, and are secured to the ground by surplus No. 8 fencing wire. The cost per bait station is approximately \$10 (compared to about \$32 for the Pestoff Departure Lounge).

Is it working? Well, take from the bait stations is now very low and it is unusual to catch rodents in the traps these days. Tracking tunnel results indicate rodent levels are very low in the core area and have been for some months. Can we see this reflected in jewelled gecko numbers? Whilst we have found more juveniles than compared to a similar but untrapped/unpoisoned control area, it is probably too early to say. And it may never become completely apparent as the core area is not isolated, but part of a wider area of regenerating kānuka that geckos can move freely in and out of. My suspicion is that if numbers start to increase the geckos will simply disperse to adjacent habitat. Birdlife seems to have greatly increased and I now regularly find native snails and wētā taking up residency in the bait stations—both of which I seldom encountered before I started on the project.



Figure 4. A 1 m-long, 100 mm-diameter draincoil rodent bait station secured to the ground with No. 8 wire (left). Internal spikes secure Ditrac and Storm anti-coagulant poison blocks (right).

Unfortunately, predator control is not cheap and will be difficult to implement on large properties. For small sites, using mammal-proof fencing may be more cost effective in the long-term than doing predator control. A comparison of the relative costs of these methods, as used for the protection of endangered grand and Otago skinks at Macraes Flat in Otago, has revealed that fencing is the cheaper option for areas < 15 ha in size, but that predator control becomes more cost-effective for areas larger than 15 ha (Dr Andy Hutcheon, DOC, Dunedin, pers. comm.). To provide a rough indication of fencing costs, the Xcluder® pest proof fence costs approximately \$150/m for materials only or \$240/m for the fence fully installed (not including GST; Richard Guest, Xcluder Pest Proof Fencing Ltd, Rotorua, pers. comm.).

Nation-wide, there are three areas where fencing has been undertaken for lizard conservation, with installation costs ranging from \$172/m for the 1.2-ha Ponatahi Lizard Sanctuary in the Wairarapa (Tim Hewitt, Martinborough, pers. comm.), \$300/m for the 11- and 22-ha mammal-proof fences at Macraes Flat (Dr Andy Hutcheon, pers. comm.) and \$455/m for the 0.3-ha Mokomoko Sanctuary in Central Otago (Dr Grant Norbury, Landcare Research, Alexandra,

pers. comm.). The Mokomoko Sanctuary fence was more expensive because it required blasting, drilling and special mesh capable of withstanding the temperature extremes that Central Otago is prone to.

While at first glance these options seem prohibitively expensive, there is financial assistance available for landowners wanting to protect biodiversity values on their properties. Potential sources of funding (see also DOC 2010) include the Biodiversity Condition Fund, WWW Habitat Protection Fund, Dunedin Biodiversity Fund (Dunedin City Council), Josef Langer and Rod Donald Trusts (Banks Peninsula only). Some organisations, such as the Banks Peninsula Conservation Trust (BPCT), have traps available at reduced prices. Also, some companies offer bulk discounts for substantial orders and provide significant discounts for conservation projects. It pays to shop around and talk to other landowners, conservation agencies and local councils.

Summing it up – six ways to make a difference

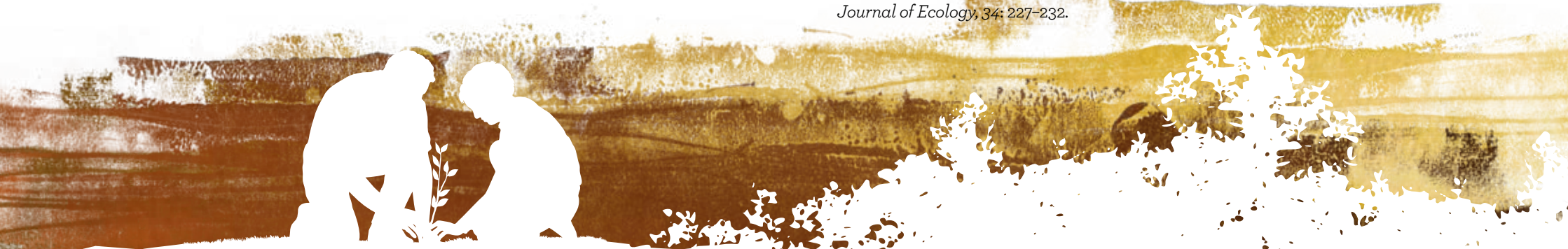
- Record sightings of jewelled geckos and submit these to your local DOC office;
- Join a community group that participates in jewelled gecko conservation;
- Plant shrubs and trees to enhance and connect jewelled gecko habitat and remove weeds;
- Protect jewelled gecko habitat by means of a covenant or land protection agreement;
- Immediately report sightings of people acting suspiciously to the Wildlife Enforcement Group and DOC 24-hour Hotline;
- Do multi-species predator control or construct mammal-proof fencing.

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Clematis flowers Photo: M Lettink



Coprosma berries Photo: M Lettink

Appendix 1 – Resources

Topic	Who to contact	Phone	Website or email address
Covenantee	Banks Peninsula Conservation Trust QEII National Trust Department of Conservation	03 329 6340/03 329 6341 04 472 6626/0800 467 367 04 471 0726	www.bpct.org.nz www.openspace.org.nz www.doc.govt.nz
Predator control	Department of Conservation Sanctuaries of New Zealand Connovation Ltd.	09 273 4333 or 03 974 9141	www.doc.govt.nz sanctuariesnz.org www.connovation.co.nz
Pest mammal fencing	Pest Proof Fencing Ltd. Xcluder® Pest Proof Fencing Ltd.	021 338 872 07 349 4505	www.pestproofences.co.nz www.xcluder.co.nz
Restoration groups	Save the Otago Peninsula (STOP) Banks Peninsula Restoration Group	03 478 0339 03 251 1229	stopincsoc@gmail.com anne.peke@xtra.co.nz
Gecko monitoring	Carey Knox Alf Webb Shaun Murphy Dr Mandy Tocher	03 472 8393 03 478 0900 03 478 0140 03 474 6949	knoca801@student.otago.ac.nz alfwebb@hotmail.com shhlm@xtra.co.nz mtocher@doc.govt.nz
Biosecurity	Wildlife Enforcement Group DOC 24 h Hotline	09 927 8427/ 0292 726 043 09 927 8496/0292 726042 0800 DOCHOTline/0800 362 468	weg@iconz.co.nz (cleared 24/7) weg@customs.govt.nz
District Planning	Dunedin City Council Christchurch City Council	03 477 4000 03 941 8999	dcc@dcc.govt.nz info@ccc.govt.nz
New Zealand lizards	New Zealand Herpetological Society Society for Research on Amphibians and Reptiles in NZ (SRARNZ) NZ Lizards Database		reptiles.org.nz srarnz.org.nz nzlizards.landcareresearch.co.nz



Spot the gecko?



barcode here