

Lizard strategy for the Wellington region 2012-20

Produced by: The Wellington Regional Lizard Network



Lizard strategy for the Wellington region 2012-20

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1. Introduction

The Wellington Regional Lizard Network (WRLN) comprises conservation managers and lizard specialists from a variety of groups and organisations who aim to identify priorities for and lead lizard conservation throughout the Wellington region. The group promotes lizard conservation and provides advice and training to those involved in lizard conservation. The group's role is primarily to advise but it will actively identify work that needs to be done, promote this work and train people to do it, and facilitate its implementation.

The group will work closely with the New Zealand Lizard Technical Advisory Group (TAG) run by the Department of Conservation (DOC) whose purpose is to provide national leadership and advice on lizard conservation. Advice from the TAG will be fed to the region through members who participate in both groups. This will ensure that regional work aligns with national priorities and local enthusiasts are informed of the national developments and priorities. The regional focus will allow projects unable to attract funding nationally to be undertaken locally.

DOC has the statutory responsibility to protect lizards, and all New Zealand species are protected under the Wildlife Act 1953. Regional and local councils have powers under the Resource Management Act 1991 (RMA) to maintain indigenous biodiversity. See Appendix 1 for a summary of legislation and policy direction relevant to biodiversity. However, these organisations have limited capacity and can only undertake the highest priority tasks. Part of their responsibility is to increase capability and capacity of other groups and organisations. Lizard conservation techniques are advancing and, coupled with increasing community conservation initiatives, there is an opportunity for the WRLN to promote coordinated lizard conservation throughout the Wellington region.

One of the constraints to the implementation of lizard conservation is a lack of skills in lizard conservation (including awareness of lizards, monitoring techniques and management skills). Therefore, the primary role of the WRLN will be to gather a group of technical experts from the region who can identify, guide and lead the effort of increasing capability and capacity.

This regional lizard strategy outlines a coordinated approach to ensure the conservation and restoration of lizard communities within the Wellington region.

2. Current state of lizards in the region

2.1 Lizards of the region

The lizard fauna of the Wellington region is diverse, particularly for a region with such a large urban population. Seventeen lizard species have been recorded from the region, however Duvaucel's gecko (*Hoplodactylus duvaucelii*), goldstripe gecko (*Woodworthia chrysosiretica*) and McGregor's skink (*Oligosoma macgregori*) are no longer known from the mainland, and the robust skink (*O. alani*) is regionally extinct (Miskelly, 1999). The speckled skink (*O. infrapunctatum*) was deliberately translocated from Stephen's Island to Mana Island, but recent genetic work indicates that this species is probably not native to the Wellington region. See Table 1 for summary of species in the region.

2.2 Current threats to lizards in the region

The primary threats to lizards in the region are introduced mammalian predators and habitat destruction. These have led to the reduction in diversity, abundance and range of lizards. Larger nocturnal lizards are particularly vulnerable to predation and have become extinct or survived only on offshore islands that lacked all or most of the mammalian predators (Towns and Daugherty, 1994).

2.2.1. Introduced mammals

Lizards on the mainland often occur in low numbers in the presence of introduced mammalian predators (eg. mice, rats, hedgehogs, mustelids, cats and possums), and in many cases are still declining. It is often not until after many years of predator control that some lizard species are detected. Brown skinks were not identified on Mana Island until 6 years after mice were eradicated and common geckos were not detected on Tiritiri Matangi Island until fourteen years after the eradication of kiore. In both instances the lizards had been there all along but in such low numbers they had never been seen. Appendix 2 reviews some of research on the effects of introduced mammals on lizards.

2.2.2 Habitat destruction

Destruction of forests, scrub and coastal vegetation continues to threaten lizard communities. The destruction of manuka and kanuka for development is detrimental to forest species such as the Southern North Island forest gecko (*Mokopirirakau* "Southern North Island") and the Wellington green gecko (*Naultinus punctatus*). Beach grooming removes the debris that is important habitat for coastal lizards such as spotted skinks (*O. lineoocellatum*). Coastal habitats can also be destroyed by four-wheel driving, motorbikes, heavy foot and bicycle traffic and activities such as clearing crevices while rock climbing, removing driftwood and lighting fires. Boulder banks and scree slopes are often safe refuges for lizards but can be degraded as weeds invade. This reduces the gaps between the rocks where the lizards live and forces them to use habitats where they are more vulnerable to predators.

2.2.3 Other threats

Other threats to lizards in the region include the spread of invasive species such as rainbow skinks, Argentine ants and, potentially, fire bellied newts. There is also a risk from lizard smugglers who primarily target green geckos.

Table 1: Summary of lizard species known from the mainland in the Greater Wellington region (Miskelly, 1999), their threat status (Hitchmough et al., 2010) and distribution. Gecko genera are in accordance with latest genetic research (Nielsen et. al., 2011).

Scientific name	Common name	New Zealand threat status	Regional Distribution
<i>Oligosoma alani</i>	Robust skink	Recovering (Conservation Dependent, Range Restricted)	Regionally extinct
<i>Oligosoma aeneum</i>	Copper skink	Not Threatened (Partial Decline)	Widespread
<i>Oligosoma lineocellatum</i>	Spotted skink	Relict (Conservation Dependent)	Sparse, scattered populations
<i>Oligosoma ornatum</i>	Ornate skink	Declining (Conservation Dependent, Partial Decline)	Widespread
<i>Oligosoma macgregori</i>	McGregor's skink	Recovering (Conservation Dependent, Range Restricted)	Mana Island
<i>Oligosoma polychroma</i>	Common skink	Not threatened	Widespread
<i>Oligosoma</i> "Southern North Island"	Southern North Island speckled skink	Nationally Vulnerable (Data Poor, Sparse)	Wairarapa
<i>Oligosoma infrapunctatum</i>	Speckled skink	Declining (Conservation Dependent, Partial Decline, Sparse)	Mana Island*
<i>Oligosoma whitakeri</i>	Whitaker's skink	Nationally Endangered (Conservation Dependent, Range Restricted)	Pukerua Bay
<i>Oligosoma zelandicum</i>	Brown skink	Not Threatened (Sparse)	West of Tararua Range
<i>Dactylocnemis pacificus</i>	Pacific gecko	Relict (Conservation Dependent)	Upper Hutt
<i>Hoplodactylus duvaucelii</i>	Duvaucel's gecko	Relict (Conservation Dependent)	Mana Island
<i>Mokopirirakau</i> "Southern North Island"	Southern North Island forest gecko	Not Threatened	Widespread
<i>Naultinus punctatus</i>	Wellington green gecko	Declining	Widespread
<i>Woodworthia chryosiretica</i>	Goldstripe gecko	Relict (Conservation Dependent, Range Restricted)	Mana Island
<i>Woodworthia maculata</i>	Common gecko	Not Threatened (Partial Decline)	Widespread
<i>Woodworthia</i> "Marlborough Mini"	Common gecko "Marlborough mini"	Not Threatened	Wellington south and west coast

* Species translocated outside its known natural distribution.

2.3 Damage to ecological communities

The reduced diversity, abundance and range of lizards has had an effect on ecological communities in the region. Lizards were once widespread throughout New Zealand and locally reached densities of up to 4,100 lizards / hectare (Whitaker, 1982). They pollinated plants and dispersed seeds (Whitaker, 1987; Wotton, 2002; Smith, 2009), and some plants may have evolved fruit specifically to be dispersed by lizards (Lord et al., 2002). Lizards included a variety of invertebrates in their diet, and in turn were eaten by a range of birds, tuatara, larger lizards and even some invertebrates. Lizards also formed close relationships with honey dew insects. The amount of honey dew available may have been a limiting factor on lizard populations (Townes, 2002; Gardner-Gee and Beggs, 2010).

2.4 Current lizard conservation in the region

Lizard conservation and research in the region has focused mainly on island sanctuaries and a few significant mainland sites.

2.4.1 Offshore islands

Most offshore islands in the region are administered by the Department of Conservation, except for Taputeranga Island which is managed by Wellington City Council. Islands are havens for the region's lizards because of the elimination of introduced predators. Kapiti Island, Mana Island, Matiu/Somes Island, Makaro/Ward Island, Mokopuna Island and Taputeranga Island all have several species of lizard naturally occurring. Mana and Matiu/Somes have also received translocations of species from the region and Mana has received species that have been extirpated from the region. Due to the ongoing management at these sites, the populations are considered secure, and for most species are large and increasing.

2.4.2 Fenced sanctuaries

Sanctuaries with predator-proof fences have also benefited lizards in the region. Ponatahi in Wairarapa has been created solely for the conservation of lizards. Zealandia in Wellington has several species of lizard which are benefiting from the fence. While lizard populations at these sites are still small, continued management will allow lizard populations to increase there.

2.4.3 Pukerua Bay

The Pukerua Bay Scientific Reserve is managed specifically for lizards. This site receives intensive predator control for the sole purpose of protecting the Nationally Vulnerable Whitaker's skink (*O. whitakeri*). A programme is in place to collect Whitaker's skinks for captive breeding so a new population on Mana Island (or other suitable sites) can be established.

2.4.4 Other restoration sites

Many parks and restoration sites throughout the region receive some predator control. In some cases this is beneficial for lizards, but not always. There

are few sites specifically targeting pest control to benefit lizards. Where predator control operations are able to keep all introduced mammals (including mice) to low numbers, lizards will probably do well. However, where predator control reduces one pest and allows others to increase, this may be detrimental for lizards as it may encourage mesopredator release and competitor release (Zavalet et al., 2001; Caut et al., 2007). For example, in some habitats controlling stoats but not rats may result in increased rat numbers and a net loss of biodiversity. Lizard surveys have been conducted only at a few sites to determine the lizard assemblages, and fewer sites have been monitored to determine the impacts of management on lizard populations.

2.5 Lizard research in the region

In the Wellington region, Stephenson (1977) and Parrish (1984) have discussed lizard distribution and habits, and Miskelly (1999) discussed extant and locally extinct species in the region.

Monitoring and research of lizards has occurred throughout the region. On the mainland, lizards have been studied at Kelburn (Barwick, 1959), Pukerua Bay (Townes, 1992; Townes and Elliott, 1996; Hoare et al., 2007a), Turakirae Head (Whitaker, 1982; Green, 2001) and Zealandia Karori Sanctuary (Empson et al., 2009; Bell and Herbert, 2010). Several Greater Wellington Regional Council parks have been surveyed (Romijn, 2010 and 2011).

Offshore islands have been the focus of much research. Mana Island has a restoration plan which identifies species to be translocated to the island (Miskelly, 1999). Research has been conducted on Kapiti Island (Gorman, 1995; Whitaker, 1995), Makaro / Ward Island (Cawthorn, 1973), Mana Island (Whitaker, 1993; Newman, 1994; Griffiths, 1999) and Matiu / Somes Island (Montoya and Burns, 2007).

Recovery plans have been written for robust skink and Whitaker's skink (Townes, 1992b) and for North Island skinks in general (Townes, 1999; Townes et al., 2002). There is currently a Lizard Action Plan for the Poneke Area of the Wellington Conservancy (Adams, 2009) and additional information about lizard observations is found on the Department of Conservation Herpetofauna Database. The New Zealand Lizard Technical Advisory Group (TAG) is currently developing a recovery strategy for all New Zealand lizards (L. Adams, personal communication, September 2012).

2.6 Opportunities

The Wellington region has a fantastic opportunity to conserve and restore lizard communities in the region because:

- There are sixteen species still present in the region.
- There are several predator-free offshore islands.
- There are many sites throughout the region (offshore islands and mainland) that still have lizard communities.

- There are large areas of good habitat (coastal and forest) throughout the region.
- There are fenced sanctuaries and mainland islands in the region.
- There is strong community support for conservation and restoration as can be seen by the abundance of community care groups.
- There are large urban populations of lizards.
- Local councils, Greater Wellington Regional Council (GWRC), DOC, Forest & Bird and Queen Elizabeth Trust are actively involved in conservation efforts in the region.
- Victoria University of Wellington has a strong herpetological team and good post-graduate programmes in Conservation Biology and Restoration Ecology.
- There is a wealth of herpetological knowledge in the region, including lizard breeders who could support captive breeding for release.



Common Gecko (*Woodworthia maculata*)

Photo: Richard Romijn

3. Regional lizard strategy

3.1 Wellington Regional Lizard Network Vision

The Wellington Regional Lizard Network has the following vision:

“Lizards thrive in the region and the community (lizard experts, agencies and the general public) are actively involved in the conservation and restoration of lizard communities.”

3.2 Guiding principles

The following principles should guide lizard conservation and restoration practices in the Wellington region (listed in no particular order):

- **At least three mainland populations** of each species should be managed in situ to secure their persistence in the region. Best-practice management techniques should be used to manage these populations.
- All **significant mainland lizard sites** should be included in national and local government plans, restoration plans and other planning documents to ensure ongoing protection.
- Tangata whenua have interests in many sites likely to be identified as “significant” either as owners or through statutory recognition resulting from treaty settlement, and also recognise iwi role as kaitiaki for flora and fauna in partnerships.
- If lizard species cannot be protected in situ, consideration must be given to translocation to establish secure populations on islands, restoration sites and actively managed sanctuaries, taking account of information on geographic variation in genetics/taxonomy, and following Department of Conservation best practice and permitting requirements.

- Potentially important sites should be surveyed for lizards (eg. historic lizard sites to confirm continued presence, areas of good lizard habitat that haven’t been searched and areas that receive intensive predator control for other purposes). This will assist with determining distributional ranges of species and will help to identify priority sites for lizard conservation.
- Support the ongoing protection, restoration and pest-free status of islands and predator-fenced sites.
- Management of sites should complement other biodiversity values because lizard conservation does not operate in isolation, and habitat and ecological restoration is required concurrently.
- Work in partnership with landowners of the region (including tangata whenua, private landowners, and local, regional and central government), to support restoration and protection of lizard habitat.
- Monitoring programmes should be implemented to determine the impacts of management on lizards.
- Research to investigate the main issues threatening lizards in the region should be undertaken.
- Public education and involvement in the conservation and restoration of lizard communities is essential and should include a tangata whenua perspective.



Copper Skink (*Oligosoma aeneum*)

Photo: Richard Romijn

4. Implementing lizard conservation and restoration

The following section outlines how WRLN will implement the guiding principles and provides specific actions that the WRLN will work on over the life of this plan.

4.1 Maintain management at island and sanctuary sites

Lizards are present on islands and in sanctuaries in the Wellington region (Table 2). Predator-free offshore islands and predator-free sanctuaries provide low risk environments for lizards. These sites are therefore ideal places to investigate the effect of predator removal, to research various aspects of lizard biology and to transfer threatened species.

Actions and Recommendation:

WRLN supports the continued present management activities at these sites including:

- Undertaking biosecurity measures to prevent the introduction of pest species,
- Development, maintenance and delivery of biosecurity plans,
- Development and/or maintenance of restoration plans.

WRLN to provide advice and support for the development and implementation of these plans, identifying opportunities for translocations on or off sites.

WRLN supports captive breeders who are supporting regional or national recovery programmes.

Table 2: Summary of offshore islands and sanctuaries with predator-proof fences and their lizard communities. Solid shading represents lizards naturally found at the location and hatching represents lizards translocated to islands. “p” indicates that a species has been flagged for potential translocation. Information gathered from Department of Conservation Herpetofauna Database and other references are listed below.

	Copper skink	Robust skink	Spotted skink	Ornate skink	McGregor's skink	Common skink	Speckled skink	Whitaker's skink	Brown skink	Goldstripe gecko	Duvaucel's gecko	Common gecko	"Marlborough mini"	Pacific gecko	Southern NI forest gecko	Wellington green gecko	References	
Islands (predator free)																		
Kapiti	Solid					Solid			Solid			Solid				Solid	Solid	Whitaker (1995) Gorman (1995)
Mana	Solid	p	Hatched		Solid	Solid	Hatched	p	Solid	Solid	Hatched	Solid				Hatched	Whitaker(1993) Newman (1994) Griffiths (1999)	
Makaro / Ward	Solid		Solid	Hatched		Solid			Solid			Solid					Cawthorn (1973)	
Matiu / Somes	Solid			Hatched			p		p		p	Solid		p	Hatched	Hatched	Adams (2009)	
Mokopuna			Solid			Solid												
Island (predators controlled)																		
Taputeranga						Solid								Solid				
Sanctuaries																		
Ponatahi			Solid			Solid										Solid	Solid	
Zealandia	Solid	p	p	Solid	p	Solid	p	p	Solid	p	p	Solid				Solid	Solid	Empson (2009) Bell & Herbert (2010)

4.2 Identify and actively manage significant mainland lizard sites

Lizards on the mainland are often in low numbers because of introduced mammalian predators, and in many cases are still declining. Therefore, it is imperative to actively manage significant mainland sites. The WRLN proposes the system below as the minimum needed to manage significant lizard sites in the region. Greater effort will be required to ensure that current lizard ranges and populations are protected. We note that information used in this analysis is incomplete. Re-analyses and updates of data will improve this system over time and may identify other significant sites.

4.2.1 Identify and select priority management sites

A process and criteria to determine significant lizard sites do not exist at present. WRLN will develop a process and criteria, and apply them to lizard populations in the region to identify significant lizard sites.

WRLN considers that active management at three sites for each species is the minimum necessary to secure their persistence in the region. Three highest priority sites will be chosen from the identified significant sites for each species. Table 3 lists some sites that are expected to be regionally significant for the conservation of lizards.

4.2.2 Manage significant mainland sites

All significant lizard sites will have an adaptive management plan that will involve the following components:

- Site restoration plan that includes how the lizard communities will be managed. See Appendix 3 for an example restoration plan.
- Management of identified threats (usually introduced mammals), including actions to minimise or reduce each threat.
- Monitoring plan to see how lizard communities respond to management, including baseline surveys before management begins.
- Monitoring plan to measure the impacts of threats, particularly introduced predators.
- Regular review to allow changes to be made as new information is acquired.

Actions and Recommendation:

WRLN will develop a process and criteria to identify significant mainland lizard sites and will review these in 2020 or sooner as needs dictate.

WRLN will assess the significance of lizard sites using the process and criteria.

WRLN will identify three priority mainland lizard management sites for each species.

WRLN will work with tangata whenua, land owners and managers to support the development of management plans for significant lizard sites.

WRLN will support land owners and managers in the implementation of management plans by providing advice and assistance in the management and monitoring at these sites.

WRLN will promote significant sites to appropriate agencies (eg. DOC, GWRC and territorial authorities) to ensure sites are protected through regional planning documents.



Southern North Island Forest Gecko (*Mokopirirakau* "Southern North Island")

Photo: Richard Romijn

Table 3: Sites likely to meet ‘significant mainland site’ status. Solid shading represents lizards naturally found at the location. Information gathered from Department of Conservation Herpetofauna Database and other references listed are below.

	Copper skink	Spotted skink	Ornate skink	Common skink	Whitaker’s skink	Brown skink	Common gecko	“Marlborough mini”	Southern NI forest gecko	Wellington green gecko	References
Turakirae Head											Whitaker (1982) Green (2001)
EHRP: Baring Head											Romijn (2011)
Red Rocks to Sinclair Head											
Makara											
Pukerua Bay											Hoare et al (2007a) Towns (1992a, 1992b, 1994) Towns & Elliott (1996)
EHRP: North Block											Romijn (2010)
Wainuiomata Water Catchment											
Otari Wiltons Bush											
Wrights Hill Reserve											Bell & Herbert (2010)
Fensham Reserve*											
Honeycomb Rock											Rebergen pers comm
Te Kawakawa											Rebergen pers comm
Wairarapa taipos											Rebergen pers comm
Wairarapa site A**											

* Historic records of Southern NI speckled skink close to this site.

** Site location confidential.



Spotted Skink (*Oligosoma lineoocellatum*)

Photo: Richard Romijn

4.3 Protect significant lizard sites to maintain the current geographic range of lizards within the region

Although priority management sites will be identified for the region's lizard species (see 4.2 above), each species still needs protection throughout its current range. This section outlines how the WRLN will work with the region's community to protect the current geographic range of all species.

Actions and Recommendation:

WRLN will identify which RMA activities will have adverse effects on lizard sites and populations and will develop best practice on how developers can avoid, remedy or mitigate these effects.

WRLN will be available to planners and developers to provide technical advice on specific RMA applications on how to avoid, remedy or mitigate these effects.

WRLN will provide a robust process to ensure advice given by the WRLN is technically accurate and reflects the views of the region's technical experts.

WRLN will identify important lizard sites to tangata whenua and landowners, provide information on how these could be protected, and will support landowners in the implementation of protection.

WRLN in conjunction with other agencies will promote the protection of other lizard sites by tangata whenua, landowners, community and restoration groups.

4.4 Determine current distribution and range of lizards

While DOC holds survey data for lizard species in the region, much of the information is dated. Up to date surveys and reports of lizard sightings are needed to determine current lizard ranges and populations.

4.4.1 Lizard surveys

Below is a list of areas that require lizard surveys.

a. Historic sites of rare species

Two species (Southern North Island speckled skink and Pacific gecko) have not been included in the sites likely to meet 'significant mainland site' status table (Table 3) due to uncertainty about their ongoing presence. It is recommended that the last reported locations of these species be surveyed.

- Pacific geckos (*Dactylocnemis pacificus*) have been recorded in Upper Hutt-Blue Mountains (1965), Pinehaven (1965), Moonshine Valley (1987) and there is also one unconfirmed report at Butterfly Creek. There is some debate about whether these reports are of natural occurring populations or captive escapees. If animals are found they will need to be genetically tested to verify origins.
- Southern North Island speckled skink (*Oligosoma* "Southern North Island") has been recorded in Carterton (1970, 1974) and Mikimiki (1969).

b. Rocky coastal areas

Large areas of our coast have not been surveyed for lizards and are likely to have some of our rare species.

- The coast between Makara and Owhiro Quarry is likely to contain Marlborough mini geckos (*Woodworthia* "Marlborough Mini").
- The Wairarapa coast may have spotted skinks (*Oligosoma lineocellatum*).

c. Mountain ranges

There are few reports of lizards from the main ranges in the region. These areas are still covered in native forest and little is known about lizards in them.

d. Large predator-control operations

Large predator-control operations (eg. Greater Wellington mainland islands) that benefit biodiversity in general may provide opportunities for lizard survey and should be evaluated site by site. Lizard populations may respond positively to large scale operations and become detectable.

e. QE11 Covenanted land

These sites are privately owned lands that are legally protected for biodiversity values, and predator control is often undertaken. Therefore, lizards may be present and owners may be willing to assist with lizard conservation.

4.4.2 Train personnel to record all lizard sightings

Because there are so few reports of lizards in the region, all sightings are important. Lizard information may come from a range of sources including lizards observed/photographed in the field, sloughed skin found in the field, lizard tracks in tracking tunnels and lizard remains found in stomach contents of trapped mammals. Ideally, all people involved in biodiversity projects (DOC and council staff, community group members) and others involved in the outdoors (eg. trampers, hunters, farmers and botanical gardens staff) would be aware of the importance of lizard observations, and be trained to gather and record appropriate information so they could complete Amphibian and Reptile Distribution Scheme (ARDS) cards. This information could then be added to the Department of Conservation Herpetofauna Database. Refer to Appendix 4 for the web link to ARDS cards and other resources.

Actions and Recommendations

WRLN will encourage more survey effort to update records (especially records over 10 years old) to ensure survey information accurately reflects the current status of distribution.

WRLN will encourage surveys to determine distributional ranges within the region and where species overlaps may occur.

WRLN will encourage surveys at sites where there is significant conservation management that may protect lizards.

WRLN will promote the completion of ARDS cards by local and regional council staff, DOC staff, general public and community conservation groups.

WRLN will collaborate with QE11 Trust and landowners to identify potential private land sites to survey for lizards.

4.5 Support and promote lizard research in the region

4.5.1 Create a lizard guide for the Wellington Region

WRLN will create a simple identification system for the region's lizards to enable people to be actively involved in reporting lizard sightings.

4.5.2 Promote research opportunities

Different management treatments at sites will offer ideal research opportunities that will assist with lizard conservation throughout New Zealand. Therefore, a prioritised list of research topics will be created. There may be possibilities to collaborate with:

- Tertiary institutions (eg. Victoria University staff and students)
- Crown research Institutes (eg. Landcare)
- Consultants

WRLN is available to advise on applying for funds.

Actions and Recommendations:

WRLN will create a lizard guide for the region.

WRLN with TAG will create a prioritised list of research for the region.

WRLN will work with tertiary institutions and other researchers to progress priority research in the region and nationally.

WRLN will advise on the development and writing of funding proposals.

4.6 Engage public at known key lizard sites

An engaged public who value our lizard fauna and want to be actively involved in its protection is critical for lizard conservation. This can be achieved through education programmes and by involving the community in monitoring and other aspects of lizard conservation and restoration. Lizard poaching is potentially a serious issue for Wellington lizard populations and risks need to be assessed so appropriate information can be released.

Actions and Recommendations:

WRLN supports (where possible) the inclusion of the general public and community groups in restoration work.

WRLN will consider poaching risks when divulging detailed information about sites to the public.

WRLN will support school and community lizard education programmes.

WRLN supports the use of captive lizards (from lizard breeders) to promote conservation.

5. Summary

From the analysis of lizard information in the Greater Wellington region, the following conclusions about the lizard fauna can be made:

- The region, including offshore islands currently has a diverse lizard fauna of sixteen species, plus one species outside of its natural range.
- Twelve species are found on the mainland, but Whitaker's skink is found at only one site and the status of Southern North Island speckled skink and Pacific gecko needs to be clarified.
- Nine species are currently known from more than one site in the region and have been observed in the last 20 years.
- Mainland lizard populations are in decline and require protection.
- More survey is needed in the region to determine current range and distribution of lizards.
- Significant lizard sites need to be identified, protected and actively managed.
- There needs to be coordination between lizard experts, local agencies and the general public to ensure the conservation and restoration of lizard communities.

The Wellington Regional Lizard Network is available to:

- Provide technical advice on lizard issues in the region.
- Assist with lizard education.
- Advocate for lizards in the region.

Appendix 5 summarises all the actions and recommendations from this document.



Ornate Skink (*Oligosoma ornatum*)

Photo: Richard Romijn

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Goldstripe Gecko (*Woodworthia chrysosiretica*)

Photo: Richard Romijn

Appendix 1: Legislation and policy direction relevant to biodiversity (including lizards)

Resource Management Act 1991

It is the statutory responsibility of regional and local authorities under the Resource Management Act 1991 to maintain indigenous biodiversity.

Section 30 (1) Every regional council shall have the following functions for the purpose of giving effect to this Act in its region:

- (b) The preparation of objectives and policies in relation to any actual or potential effects of the use, development, or protection of land which is of regional significance.
- (ga) The establishment, implementation and review of objectives, policies, and methods for maintaining indigenous biological diversity.

Section 31 (1) Every territorial authority shall have the following functions for the purpose of giving effect to this Act in its district

- (b) The control of any actual or potential effects of the use, development, or protection of land, including for the purposes of:
 - (iii) The maintenance of indigenous biodiversity.

New Zealand Biodiversity Strategy

Central Government policy direction clearly states the commitment to maintaining and restoring New Zealand's biodiversity. The New Zealand Biodiversity Strategy sets out national goals and principles for managing biodiversity. Goal Three is most relevant for the conservation of lizards.

Goal Three - Halt the decline in New Zealand's indigenous biodiversity

Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments; and do what is necessary to maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain genetic diversity.

National Priorities for Protecting Rare and Threatened Biodiversity on Private Land

In 2007, the Government issued Protecting Our Places – Information about the Statement of National Priorities for Protecting Rare and Threatened Biodiversity on Private Land. This statement was intended to be of particular use to local government, which has the primary responsibility for protecting native biodiversity on private land. Four priorities were outlined of which one is significant for lizard conservation.

- National Priority 4 - To protect habitats of acutely and chronically threatened indigenous species.

Proposed National Policy Statement on Indigenous Biodiversity

The Proposed National Policy Statement on Indigenous Biodiversity sets out the objective and policies to manage resources to maintain indigenous biodiversity under the RMA. The statement gives clear direction that significant lizard habitat should be protected.

The statement's objective promotes the maintenance of biodiversity by protecting areas of significant native vegetation and significant habitat of native fauna (in this case lizards).

- Policy 1 describes significant habitat of indigenous fauna as an area or habitat whose protection is important for the maintenance of indigenous biological diversity.
- Policy 3 states that regional policy statements will be required to include criteria for the identification of areas of significant habitat of indigenous fauna.
- Policy 4 states that district and relevant regional plans shall identify areas of significant habitat of indigenous fauna.
- Policy 5 requires councils to ensure 'no net loss' of significant habitats for indigenous fauna.
- Policy 6 promotes the maintenance of biodiversity outside of identified areas of significant indigenous vegetation and significant habitats of indigenous fauna.

Appendix 2: Key conclusions of literature review on the effects of introduced mammals on lizards

Class	Species	Effect on Lizards	Reference
Rodents	Kiore	There are differences in the lizard assemblages of islands with and without kiore. Large nocturnal, forest-dwelling and fossorial skink species (<i>O. whitakeri</i> , <i>O. alani</i> and <i>O. oliveri</i>) were never found in co-existence with kiore. Populations of lizard species that co-existed with kiore demonstrated changes in productivity and range after kiore were removed.	Towns 1991
		Shore skink (<i>O. smithi</i>) captures increased up to 50-fold in 5 years after eradication of kiore from Korapuki island.	Towns 1996
		In the presence of rats, Duvaucel's gecko (<i>H. duvaucelii</i>) capture rates and recruitment were reduced. However, 6 months after rat eradication, and prior to any recruitment, capture rates of adult geckos increased fourfold and geckos were using a greater proportion of habitat used by rats. Conclusion: Pacific rats ecologically displace Duvaucel's geckos.	Hoare et al. 2007b
	Mice	Between 1987 and 1989 the capture rate for McGregor's skink (<i>O. macgregori</i>) on Mana Island declined significantly due to increased predation by mice following a build up of mouse numbers after cattle were removed from the island in 1986. In August 1989 a successful programme to eradicate mice was implemented and since then capture rates have increased significantly. Adults appear more vulnerable to predation than juveniles.	Newman 1994
Mice and rats	Effects of stock exclusion without mammal control or trapping are detrimental to lizard populations.	Hoare et al. 2007a Knox et al. 2012	
Mustelids	Stoats	Lizards made up 8% of the diet of stoats in the Orongorongo Valley.	Fitzgerald & Karl 1979
		Skinks were found in 33% of stoat droppings in the McKenzie basin.	Pierce 1987
		Lizards made up 21% of stoat diet in braided river systems.	Murphy et al. 2004
	Weasels	A juvenile Whitaker's (<i>O. whitakeri</i>) and adult brown (<i>O. zealandicum</i>) skinks remains were found in the stomach of a weasel at Pukerua Bay.	Miskelly 1997
	Ferrets	Skinks found in 15% of ferret droppings in the McKenzie Basin	Pierce 1987 Norbury 2001
Cats	Skinks were found in 13% of cat droppings in the McKenzie Basin.	Pierce 1987	
	Lizards made up 7% of prey items brought home by 80 domestic cats in two Auckland suburbs over a year.	Gillies & Clout 2003	
	Lizards made up 30% of cat diet in braided river systems.	Murphy et al. 2004	
Hedgehogs	Lizard remains were found in 6% of 615 guts. Small, localised populations of lizards may be threatened by hedgehog predation.	Jones et al. 2005	
	Skinks were found in 21% of examined hedgehogs. Results suggest that the presence of large numbers of hedgehogs can have a high impact on native reptile populations in New Zealand and therefore they should be targeted in future trapping programmes.	Spitzen-van der Sluij et al. 2009	
Rabbits	Abundance of rabbits is positively correlated with abundance of ferrets and cats. Sudden decline in rabbit numbers leads to an increase of skink consumption by cats and ferrets (prey-switching). Rabbit grazing also reduces refuge availability and food for skinks. Optimal management of rabbits for skinks is likely to need avoidance of large swings in rabbit abundance, or increase predator control when rabbit numbers decline.	Norbury 2001	

Appendix 3: Example of significant lizard site management plan

1. East Harbour Regional Park: Baring Head

Conservation Value: HIGH

Level of management: LOW

Risk: HIGH

Lizard species present: *W. maculata*, *O. aeneum*, *O. polychroma* and *O. lineocellatum*.

The High conservation status of this site is due the recent capture of *O. lineocellatum* and of the lizard abundance at this site. Lizards (mainly *W. maculata*) were found at a rate of thirty-five lizards per hour.

Habitats:

The area is mainly pasture however lizards are found along the coast (beach and escarpments) and the escarpment in the Wainuiomata River valley.

Landowner/manager: Baring Head in 2010 became part of East Harbour Regional Park administered by the Greater Wellington Regional Council.

Community groups and other interested parties: Mainland Island Restoration Operation (MIRO) is a volunteer group who work in partnership with Greater Wellington Regional Council in East Harbour Regional Park.

Threats: The main threats to this site are introduced predators and the possible degradation over time of the scree banks where lizards are abundant. Any plans to restore the original coastal forest ecosystem without intensive introduced mammal control could have devastating effects on lizard communities. Disturbance and habitat destruction through inappropriate vehicle damage, particularly on beach areas, is also a potential threat.

Research requirements: Baring Head is an ideal site to research the impact of management techniques (eg. grazing regimes) on the species present at this site. Comparisons could be made with East Harbour Regional Park: Parangarahu Reserve as it has similar habitat and lizard community.

Suggested actions:

High priority

- Need to manage grazed areas around the escarpment to ensure there is not a build up of rodents (and their predators) which could invade the site and prey on lizards.
- Set up a long-term lizard monitoring programme to assess change over time in response to predator control and other management.
- Survey for distribution and abundance of spotted skinks.
- Set up predator control and predator outcome monitoring.

Medium priority

- Survey for other species, particularly geckos in scrubland habitat.
- Investigate the impact of weeds (and sprays) on the scree banks (filling gaps between rocks and providing habitat and seed food source for rodents).

Low priority

- Consider species translocation once it can be determined what species are already present and the site is low risk for lizard communities.

References: Romijn (2011)

Appendix 4: Other resources

NZ Lizards Database

The NZ Lizards Database is a searchable online system that provides access information describing the lizard species of New Zealand. The NZ Lizards Database provides:

- A series of species synopses describing lizard species of New Zealand, their taxonomic and conservation status, distribution, conservation requirements, and factors such as ecology, behaviour, and population dynamics.
- An up-to-date annotated bibliography of New Zealand lizard literature. The original bibliography was compiled by Tony Whitaker and Bruce Thomas in 1990 and, together with new material, the online version now contains a list of over 3000 published and unpublished articles.

<http://nzlizards.landcareresearch.co.nz/>

Inventory and monitoring toolbox (lizard section)

The Inventory and Monitoring Toolbox describes standard methods for sampling populations and communities of plants and animals and includes a section on herpetofauna. Standardising data we collect is fundamental to establishing consistent and compatible methods to underpin monitoring from local to national levels. The toolbox is the authoritative source for the methods used in DOC. The herpetofauna module has tools to help you choose appropriate inventory or monitoring methods suitable for your population study.

<http://www.doc.govt.nz/publications/science-and-technical/doc-procedures-and-sops/biodiversity-inventory-and-monitoring/taxa-modules/herpetofauna/>

Atlas of reptiles in New Zealand

The Atlas purpose is to develop an up-to-date electronic distribution atlas of the amphibians and reptiles of New Zealand providing database generated national distribution maps for each species recorded in New Zealand from verified data. It also allows people to report lizard sightings by completing ARDS cards.

<http://www.doc.govt.nz/conservation/native-animals/reptiles-and-frogs/reptiles-and-frogs-distribution-information/atlas-of-the-amphibians-and-reptiles-of-nz/electronic-atlas/>

Biosecurity New Zealand

This website provides information about unwanted organisms including the introduced rainbow skink (*Lampropholis delicata*) from Australia.

<http://www.biosecurity.govt.nz/pests/rainbow-skink>

Society for Research on Amphibians and Reptiles in New Zealand (SRARNZ)

The objectives of the Society are to promote the scientific study of all aspects of the biology of the amphibians and reptiles of the New Zealand region and to promote the conservation of the region's indigenous herpetofauna. Membership of the Society is open to professional scientists, scientifically-interested amateurs and the professional staff of institutions engaged in the study of amphibians and reptiles in New Zealand. Members are admitted to the Society at the discretion of its Council.

<http://www.srarnz.org.nz/>

The New Zealand Herpetological Society (NZHS)

The Society endeavours to cater for all levels of interest in herpetology, from the school pupil who finds that lizards and frogs make interesting pets, to the person engaged in serious scientific study or captive breeding programmes. The majority of members keep and breed native geckos and skinks in captivity, or are engaged in the field study of these animals.

<http://www.reptiles.org.nz/>

ARDS CARD	NEW ZEALAND AMPHIBIAN/REPTILE DISTRIBUTION SCHEME		Card No:
Herpetofauna Administrator, RD&I, Department of Conservation, P.O. Box 10420, Wellington.			
Observer:		Locality Name:	
Initials _____	Surname _____	Date: _____	
Address:		Alt (m): _____	
GPS Easting <input type="text"/> <input type="text"/> Northing <input type="text"/> <input type="text"/> Series <input type="text"/> <input type="text"/> <input type="text"/> Map No. <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Easting <input type="text"/> <input type="text"/> Northing <input type="text"/> <input type="text"/> Area Office: _____ Conservancy: _____ Ecol. District: _____			
Affiliation:			
Species name	No.	Time	Weather
e.g. <i>Hoplobdactylus maculatus</i>	6	18:00	Light 1 Fine/Sunny 2 Part Cloudy 3 Overcast 4 Showers 5 Rain 6 Night 7 0-1/2 Moonlit 8 1/2-1 Moonlit
			<u>Temperature</u> 1 Hot 2 Warm 3 Moderate 4 Cool 5 Cold
			<u>Wind</u> 1 Calm 2 Light breeze 3 Mod breeze 4 Gusty 5 Strong winds
Voucher specimen(s)		Yes/No	Major Habitat Types
Photograph(s)		Yes/No	1 Beech Forest 2 Podocarp forest 3 Broadleaf forest 4 Exotic forest 5 Scrub 6 Sub-alpine 7 Alpine 8 Undeveloped tussock land 9 Developed farmland 10 River terrace 11 Fresh water 12 Wet land 13 Coastal 14 Scree 15 Bare rocks 16 Beach 17 Urban 18 19 20
Extra notes on reverse side		Yes/No	Micro habitats A Foliage B Trunk C Branches D Under stones E Under wood F Open ground G Crevices H
Notes:			
Identified by:			
Authority used:			

Appendix 5: Summary of actions and recommendations

Island and mainland sanctuary sites

WRLN supports the continued present management activities at these sites including:

- Undertaking biosecurity measures to prevent the introduction of pest species,
- Development, maintenance and delivery of biosecurity plans,
- Development and/or maintenance of restoration plans.

WRLN to provide advice and support for the development and implementation of these plans, identifying opportunities for translocations on or off sites.

WRLN supports captive breeders who are supporting regional or national recovery programmes.

Significant Mainland sites

WRLN will develop a process and criteria to identify significant mainland lizard sites and will review these in 2020 or sooner as needs dictate.

WRLN will assess the significance of lizard sites using the process and criteria.

WRLN will identify three priority mainland lizard management sites for each species.

WRLN will work with tangata whenua, land owners and managers to support the development of management plans for significant lizard sites.

WRLN will support land owners and managers in the implementation of management plans by providing advice and assistance in the management and monitoring at these sites.

WRLN will promote significant sites to appropriate agencies (eg. DOC, GWRC and territorial authorities) to ensure sites are protected through regional planning documents.

Protect significant lizard sites

WRLN will identify which RMA activities will have adverse effects on lizard sites and populations and will develop best practice on how developers can avoid, remedy or mitigate these effects.

WRLN will be available to planners and developers to provide technical advice on specific RMA applications on how to avoid, remedy or mitigate these effects.

WRLN will provide a robust process to ensure advice given by the WRLN technically accurate and reflects the views of the region's technical experts.

WRLN will identify important lizard sites to tangata whenua and landowners, provide information on how these could be protected, and will support landowners in the implementation of these.

WRLN in conjunction with other agencies will promote the protection of other lizard sites by tangata whenua, landowners, community and restoration groups.

Determine current distribution and range of lizards

WRLN will encourage more survey effort to update records (especially records over 10 years old) to ensure survey information accurately reflects the current status of distribution.

WRLN will encourage surveys to determine distributional ranges within the region and where species overlaps may occur.

WRLN will encourage surveys at sites where there is significant conservation management that may protect lizards.

WRLN will promote the completion of ARDS cards by local and regional council staff, DOC staff, general public and community conservation groups.

WRLN will collaborate with QE11 Trust and landowners to identify potential private land sites to survey for lizards.

Supporting and promoting research in the region

WRLN will create a lizard guide for the region.

WRLN with TAG will create a prioritised list of research for the region.

WRLN will work with tertiary institutions and other researchers to progress priority research in the region and nationally.

WRLN will advise on the development and writing of funding proposals.

Engaging the public

WRLN supports (where possible) the inclusion of the general public and community groups in restoration work.

WRLN will consider poaching risks when divulging detailed information about sites to the public.

WRLN will support school lizard education programmes.

WRLN supports the use of captive lizards (from lizard breeders) to promote conservation.

