

IN THE MATTER OF THE RESOURCE MANAGEMENT ACT 1991

AND

**IN THE MATTER OF THE HANMER SPRINGS FLYRIDE APPLICATION, HANMER
REVIEW OF THE LIZARD MANAGEMENT PLAN**

LOCAL AUTHORITY HURUNUI DISTRICT COUNCIL

STATEMENT OF EVIDENCE OF

MARIEKE LETTINK

INTRODUCTION

1. My name is Marieke Lettink.
2. I am an independent wildlife ecologist specialising in herpetology, particularly New Zealand lizards. My ecological consultancy business (“Fauna Finders”), established in 2008, provides professional advice relating to lizard surveys, monitoring, research and management to a range of Government and non-Government clients. Within Canterbury, this includes the Canterbury Regional Council (Environment Canterbury or ECan), Christchurch City Council, Department of Conservation, Waka Kotahi NZ Transport Agency, North Canterbury Transport Infrastructure Recovery (NCTIR), iwi, and private landowners including developers.
3. My academic qualifications consist of a Doctorate of Philosophy in Zoology (PhD; University of Otago), Master of Science (First Class Honours; University of Canterbury), Post-graduate Diploma in Wildlife Management (Distinction; University of Otago) and Bachelor of Science (University of Canterbury). I completed my university studies between 1992 and 2007.
4. My professional outputs include a book chapter on lizard sampling methods, 22 scientific papers, 7 Department of Conservation publications and more than 100 unpublished contract reports covering fauna (bat, bird and lizard) surveys, monitoring, research and management, including lizard salvage. Of relevance, this includes a generic (basic) Lizard Management Plan for Conical Hill/Te Tihi O Rauheha Reserve, prepared for the Department of Conservation (DOC) to inform its planning for setting up a “Predator Free 2050” site in Hanmer Springs.
5. Since 2009, I have been a member of the expert panel that assesses the conservation status of New Zealand reptiles using the New Zealand Threat Classification System (NZTCS) developed by DOC. This panel meets every 3–5 years and I have been involved in four reptile assessments published in 2010, 2013, 2016 and 2021. I am also an external member of the DOC Lizard Technical Advisory Group and Lizard Salvage sub-group.
6. I have designed and am currently co-managing two biodiversity outcome monitoring programs in Canterbury that measure the response of lizards (geckos and skinks) and birds to small-scale predator control (suppression of pest mammals over 6 ha of forest on private land and c. 12 ha in a reserve on the Port Hills managed by Christchurch City Council).

7. Also relevant to this matter is a rough gecko (*Naultinus rudis*) survey I conducted between 2015 and 2019. This survey assessed distribution, relative abundance and threats at 20 sites throughout the species' range and was funded by Auckland Zoo's Conservation Fund. Data from this survey informed the threat ranking assigned to rough gecko in the two most recent (2015 & 2021) assessments of the conservation status of New Zealand reptiles.
8. Based on my knowledge of rough geckos and role as casual Technical Advisor for DOC, I identified threats and priority sites to survey in the Hanmer Springs area, resulting in rough geckos being found at several sites during a survey conducted by Boffa Miskell and DOC¹.
9. From 2009–2014, I assisted the former Wildlife Enforcement Group (WEG) with their investigations into the illegal collection (poaching) of New Zealand lizards by international wildlife traffickers for supply to a lucrative black market in exotic pets². I aided WEG in their prosecution of six foreign nationals who had poached New Zealand geckos and skinks with intent to illegally export and sell these animals overseas. While none of these cases involved rough geckos, I was party to sensitive information that revealed the species was targeted.
10. I am familiar with Conical Hill/Te Tihi o Rauheia Reserve and have visited it on many occasions over a 35-year period. These visits were unrelated to this application and all except two were undertaken for recreational purposes (mostly family holidays). My most recent visit (18 April 2019) was conducted to inform advice provided to DOC (including a Lizard Management Plan; Para 11(e)). On one other occasion, I conducted a brief (<1 h) unsuccessful search for rough geckos for personal interest. Although I have not conducted a general or comprehensive lizard survey of Conical Hill/ Te Tihi o Rauheia Reserve (i.e. one that targets all species potentially present), I am sufficiently familiar with the species and habitats present to conduct an informed review of the Applicant's Lizard Management Plan.
11. In preparing this evidence, I have consulted the following documents and data:
 - a. Tocher M 2021. Te Tihi o Rauheia, Conical Hill Reserve Switchback™ Project: Lizard Management Plan. Unpubl. Report, Hanmer Springs Thermal Pools & Spa. 72 pp.

¹ Boffa Miskell, 2019. Hanmer Springs Rough Gecko Surveys Management Recommendations. Prepared for the Department of Conservation, 20 January 2020.

² Auliya M, Altherr S, Ariano-Sanchez D et al. 2016. Trade in live reptiles, its impact on wild populations, and the role of the European market. *Biological Conservation* 204: 103–119.

- b. Hitchmough RA, Barr B, Knox C, Lettink M, Monks JM, Patterson GB, Reardon JT, van Winkel D, Rolfe J & Michel P 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 pp.
- c. Hitchmough R, Barr B, Lettink M, Monks J, Reardon J, Tocher M, van Winkel D & Rolfe R 2016. Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. Department of Conservation, Wellington. 14 pp.
- d. Department of Conservation Lizard Technical Advisory Group. 2019. Key principles for lizard salvage and transfer in New Zealand. Department of Conservation, Wellington. 19 pp. ISBN 978-0-473-50697-1 (web PDF).
- e. Lettink M 2019. Lizard Management Plan for Conical Hill Reserve/Te Tihi o Rauheia, Hanmer Springs, North Canterbury. Unpubl. Report, Department of Conservation, Christchurch. 4 pp.
- f. The Department of Conservation Herpetofauna Database.
- g. Relevant published and unpublished documents, which are cited throughout.

12. In addition, I have discussed aspects of the Applicant's LMP with:

- a. Dr Mandy Tocher (NZ Lizard Expert, author of the Applicant's LMP)
- b. Lynn Adams (Department of Conservation, Lizard Technical Advisory Group Leader)
- c. Judith Batchelor (Hurunui District Council, Chief Strategy and Community Officer).

13. I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014. The evidence provided is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

14. I was commissioned by Hurunui District Council to provide an independent review of the Applicant's Lizard Management Plan (LMP). The scope of the review was "to consider what the analysis is based on and whether it is robust, how significant the effects on lizards will be, and whether the proposed mitigation contained within the LMP will be adequate and effective and be able to achieve what is proposed". There was a requirement for the review to be suitable for public circulation and not to contain "any material or details that might be considered confidential" (Hearing Commission's Minute 3, Review of Lizard Management).

15. In accordance with this request, I have not provided any specific location data in this assessment. Restriction of location data is appropriate for some New Zealand lizard species to reduce risk of illegal collection. Poaching is a significant threat to rough gecko (Figure 1) and its close relatives (nine species of *Naultinus* geckos, commonly known as “green geckos”) because they are attractive animals with unusual life-histories that cannot legally be sold in, or exported from, New Zealand.



Figure 1. A rough gecko (*Naultinus rudis*) basking in mānuka. This is a pregnant female from the Hanmer Springs area. The species is named for the enlarged scales on its body. Maximum total length is c. 18 cm.

16. My review consists of five sections:

- a. A description of the lizard fauna of Conical Hill/Te Tihi o Rauheia Reserve;
- b. An assessment of the Applicant’s LMP against key principles in DOC’s best-practice guidance for lizard salvage;
- c. Concerns regarding the proposed lizard management;
- d. Significance of the effects on lizards;
- e. Adequacy of the proposed mitigation package.

DESCRIPTION OF THE LIZARD FAUNA OF CONICAL HILL/TE TIHI O RAUHEA RESERVE

17. Two surveys conducted by Dr Mandy Tocher over a total of 8 days in February and April 2021 detected four species of lizard in Conical Hill/Te Tihi o Rauhea Reserve: rough gecko, Southern Alps gecko, pygmy gecko and Canterbury grass skink (Table 1)³. All four species were found in or in close proximity to the proposed footprint in low-moderate numbers.

Table 1. Lizard species that occur in Conical Hill/Te Tihi o Rauhea Reserve and their current and former conservation status. Species are ranked in order from most to least threatened.

| Common name | Scientific name | Conservation status (2021) | Conservation status (2015) |
|-------------------------------|---|------------------------------------|------------------------------------|
| Rough gecko | <i>Naultinus rudis</i> | Threatened - Nationally Endangered | Threatened - Nationally Vulnerable |
| Canterbury grass skink | <i>Oligosoma</i> aff. <i>polychroma</i> Clade 4 | At Risk - Declining | At Risk - Declining |
| Northern Southern Alps gecko* | <i>Woodworthia</i> "Southern Alps northern" | At Risk - Declining | Not listed |
| Pygmy gecko | <i>Woodworthia</i> "pygmy" | At Risk - Declining | Not Threatened |

* Formerly "Southern Alps gecko". This undescribed species was recently split into northern and southern taxa. For the purposes of this review, it was assumed that the "Southern Alps geckos" found in Conical Hill/Te Tihi o Rauhea Reserve are the northern taxon, which includes populations from the Arthurs Pass area northwards⁴.

18. The DOC Herpetofauna Database contains records of other species. I agree with Dr Tocher's assessment that these taxa were incorrectly identified. I note that species identification errors are not unusual for New Zealand lizards, and that the Database is not regularly revised to correct such errors. The errors arise because there are many cryptic species complexes (i.e. groups of closely-related species that look very similar), taxonomic knowledge is incomplete and reliable field identification keys are not available for all species⁵. Only 60% of the 135 known New Zealand reptile taxa in 2021 have been formally described and named⁴.

19. I agree with the assessment of lizard species provided by Dr Tocher but note that the names and/or threat rankings of three of the four species require updating to ensure consistency with the most recent (2021) assessment of the conservation status of New Zealand reptiles.

³ Tocher M 2021. Te Tihi o Rauhea, Conical Hill Reserve Switchback™ Project: Lizard Management Plan. Unpubl. Report, Hanmer Springs Thermal Pools & Spa. 72 pp.

⁴ Hitchmough RA, Barr B, Knox C, Lettink M, Monks JM, Patterson GB, Reardon JT, van Winkel D, Rolfe J & Michel P 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 pp.

⁵ Confirmation of species identity may in some cases require collection of a tissue sample for DNA analysis.

- 20.** Notably, the threat status of three of four the lizard species present in Conical Hill/Te Tihi o Rauheha Reserve has worsened between the two assessments. I will be using the most recent threat rankings throughout my evidence, which differ from the 2015 rankings used by Dr Tocher (both are given in Table 1). This difference is the result of the 2021 rankings being published after the completion of the Applicant's LMP, rather than a difference of opinion.
- 21.** The four lizard species differ in their habitat use and activity patterns. Rough geckos live in shrubs and trees (both native and exotic species). Northern Southern Alps and pygmy geckos are primarily found in rocky areas, including fissured rock outcrops, road cuttings, bluffs, talus and scree. Canterbury grass skinks inhabit open and sunny areas, typically containing a cover of exotic and/or native grasses, often in combination with various weed species, native shrubs and/or rocks. Rough geckos and Canterbury grass skinks are diurnal (active by day). The other two gecko species are predominantly nocturnal, though will move around within their retreat sites (in rock crevices, scree etc.) by day to maintain preferred body temperatures. Access to sun is vital for all lizards as they are ectothermic ("cold-blooded").
- 22.** In my view, the survey methods used by Dr Tocher were appropriate for the species, lizard habitats present in Conical Hill/Te Tihi o Rauheha Reserve were correctly identified, and survey limitations were clearly acknowledged. This included very warm (c. 29°C) temperatures experienced in February 2021, which limit the activity and detectability of lizards. In my experience, most terrestrial lizards "go to ground" (hide in dense vegetation, under logs, in rock piles etc.) on sunny days once shade air temperatures exceed 25°C, and arboreal (tree-dwelling) species seek shade by retreating inside their preferred vegetation.

ASSESSMENT OF THE APPLICANT'S LMP AGAINST DEPARTMENT OF CONSERVATION GUIDANCE

- 23.** I assessed the Applicant's LMP against nine key principles in DOC's best-practice guidance for lizard salvage⁶. This was considered appropriate because lizard salvage is part of the Applicant's mitigation package. DOC's definition of salvage is "the permanent removal of lizards from their existing location to another site to protect them from displacement or death caused by activities that have negative effects on them or their habitat". Dr Tocher is familiar with the DOC guidance as she prepared the initial draft of the document.

⁶ Department of Conservation Lizard Technical Advisory Group. 2019. Key principles for lizard salvage and transfer in New Zealand. Department of Conservation, Wellington. 19 pp. ISBN 978-0-473-50697-1 (web PDF).

24. According to this guidance, all nine key principles must be for lizard salvage to be successful. However, in practice this “gold standard” is rarely, if ever, achieved, often for valid reasons. Where such reasons exist, justification should be provided in the Lizard Management Plan (hereafter, LMP) and/or subsequent liaison and correspondence with DOC.

25. I found that eight of the nine principles were addressed in the Applicant’s LMP to varying degrees: five were fully satisfied, three were partially satisfied and one was not addressed (Table 2). Overall, I consider the LMP to be very comprehensive and well-informed. Subjectively, it is one of the two best LMPs of dozens I have reviewed over the last decade. Despite this, I do have some concerns which are set out below (Table 2 and Paras 26-36).

Table 2. Assessment of the Applicant’s Lizard Management Plan (LMP) for the proposed Hanmer Springs Flyride Project in relation to nine Department of Conservation key principles for lizard salvage.

| Principle | Explanation | Has/will this be achieved? |
|---|---|--|
| 1. Lizard species’ values and site significance must be assessed at both the impact (development) and receiving sites | An assessment of lizard values that includes information on species’ presence, distribution, relative abundance, habitats and the significance of these habitats. Generally requires a desktop review and lizard survey. | Yes <ul style="list-style-type: none"> The LMP contains detailed information on lizard species’ presence, distribution, habitat use, and estimates of the numbers of individuals of each species potentially affected by the proposed development. The project area (hereafter ‘footprint’) was correctly assessed as containing significant habitats of indigenous fauna (lizards) using appropriate criteria⁷. The footprint was estimated to contain c. 1406 m² of habitat for lizards, comprising 1.2% of the 11.7 ha Reserve. The Reserve is both the impact and receiving site because relocation of lizards to other areas is not proposed. |
| 2. Actual and potential development-related effects and their significance must be assessed. | An assessment of effects on lizards and their significance is required by DOC (for Wildlife Act Authority applications; WAAs) and relevant territorial authorities (for Resource Consent applications). This should include consideration of all actual and potential effects and their significance. | Yes <ul style="list-style-type: none"> A detailed assessment of the potential and actual adverse effects on local (within-Reserve) populations of all four species was provided. The adverse effects are mortality, injury, disturbance and displacement. The total number of lizards (all species combined) anticipated to be adversely affected was estimated to be c. 30–105 individuals. Uncertainties in estimates of numbers are acknowledged. Of greatest concern were the anticipated loss of up to 60% of the |

⁷ Significance was assessed using criteria in the Canterbury Regional Policy Statement, Hurunui District Plan and Department of Conservation guidelines for assessing significant ecological values.

| | | |
|---|--|---|
| | | Reserve’s population of Canterbury grass skinks and an unknown number of rough geckos (0–14 individuals). |
| 3. Alternatives to moving lizards must be considered. | Lizard salvage is a last resort activity that should only be undertaken if avoidance and remediation measures cannot be applied and/or will not be adequate to achieve no-net-loss of lizard values. Lizard salvage alone does not achieve no-net-loss. | Partially <ul style="list-style-type: none"> • The LMP does not consider alternative sites. I do not know whether alternative sites were identified during the project’s planning phase. • Avoidance of some lizard habitat has been achieved by re-design of the project layout (e.g. micro-siting access track sections to avoid habitat). • The lizard mitigation package includes habitat rehabilitation, enhancement (via restoration planting) and creation. • Formal protection of rough gecko habitat by conservation covenant is proposed for at least one site on private land, but details (e.g. area and location) are not given. The ambiguous language used in the LMP (e.g. “possible establishment of a conservation covenant”, “if secured”) imply that this is not a firm commitment. |
| 4. Threatened lizard species require more careful consideration than less-threatened species. | While all lizard species are absolutely protected by the Wildlife Act, the most threatened species (threat rankings of Nationally Critical, Nationally Endangered or Nationally Vulnerable) require greater consideration. | Yes <ul style="list-style-type: none"> • The Reserve is a well-known location for the Threatened rough gecko. The conservation status of this species was recently upgraded from Nationally Vulnerable to Nationally Endangered⁸. • Proposed actions for this species include salvage and relocation, rehabilitation of disturbed areas, restoration planting to enhance degraded existing habitat, control of woody weeds and wasps, and a possible covenant to protect habitat on private land at an unspecified site. |
| 5. Lizard salvage, transfer and release must use the best available methodology. | Lizard salvage must follow DOC and International Union for the Conservation of Nature (IUCN) translocation guidelines. Salvage should use appropriate methods and continue until no further lizards are recovered, with ecological compensation offered for the proportion of lizards left behind and the loss of lizard habitats. | Partially <p>The proposed salvage methods are generally appropriate; however:</p> <ul style="list-style-type: none"> • Release sites for rough gecko require further consideration. Geckos will likely return to their capture sites if moved over short distances (see Paras 28–30). • Temporary captive holding may be appropriate to ensure rough geckos are not harmed while attempting to home back to their capture sites. |

⁸ “Nationally Endangered” is the second-highest threat category used in the New Zealand Threat Classification System. Among native birds (which are more familiar to most people than lizards), species with this status include kea, yellow-eyed penguin/hoiho and kiwi (Stewart Island and Southern Fiordland taxa only).

| | | |
|---|--|---|
| 6. Receiving sites and their carrying capacities must be suitable in the long-term | The selection of a suitable receiving site is the most important element of lizard salvage, yet it is often poorly-considered. The site must be within the species' natural range, allow for growth of a sustainable population, have legal protection, remain suitable for the target species over time, have appropriate pest control, and be protected from future human disturbance. | Partially <ul style="list-style-type: none"> • The site has legal protection (albeit as a Recreation Reserve) • Control of introduced wasps and woody weeds is proposed • Control of pest mammals is limited to rodent control in a 500 m² area of habitat for grass skinks for a 1-year period. Complexities and uncertainties regarding outcomes of pest-mammal control for lizards are acknowledged⁹. • There will be on-going human disturbance from the project, the effects of which will be greatest for day-active species (rough gecko & grass skink). |
| 7. Monitoring is required to evaluate the salvage operation | Post-release monitoring is generally required, unless outcomes are known in advance (rarely true for lizards). | No <ul style="list-style-type: none"> • Post-release monitoring is not proposed for any lizard species (See Paras 34-36). |
| 8. Reporting is required to communicate outcomes of salvage operations and facilitate process improvements. | A report is usually required as a condition of a WAA and most Resource Consents. This should include details of the salvage operation, results of post-release monitoring and progress made against objectives/milestones listed in the LMP | Yes <ul style="list-style-type: none"> • A lizard salvage report will be provided to DOC • Rodent monitoring data will be provided to DOC (in summary form each June for the life of the project). |
| 9. Contingency actions are required when lizard salvage and transfer activities fail. | Contingency (back-up) actions that will be implemented if salvage and transfer fails (e.g. lizards at release sites perish) should be included in Lizard Management Plan | Yes <ul style="list-style-type: none"> • The LMP contains contingency actions that will be triggered if the salvage yields more lizards than anticipated (defined as >14 rough geckos and/or >26 grass skinks; see Para 32). • The possibility of incidental discovery of additional lizard species is also acknowledged. |

CONCERNS REGARDING THE PROPOSED LIZARD MANAGEMENT

26. The Applicant's LMP proposed salvage and release of "threatened at at-risk lizard species" to be carried out prior to construction to "avoid injury and death of individual rough geckos and Canterbury grass skinks". Under the 2021 threat rankings, all four lizard species qualify for salvage. The LMP needs to clarify whether salvage of all four species will be undertaken.

⁹ To date, benefits of small-scale predator control have not been demonstrated for lizard mitigation translocations in New Zealand. Predator control at mainland sites can fail for various reasons. For example, the scale and/or intensity may be insufficient resulting in constant re-invasion, not all of the mammalian predators (incl. mice, rats, hedgehogs, cats, weasels, stoats, ferrets) are controlled and/or the control has unintended consequences that have negative outcomes for lizards (e.g. meso-predator release and prey-switching).

27. It is acknowledged that only a “fraction” of the rough geckos residing in the footprint will be detected and thus able to be salvaged and relocated. I agree with this assessment. Rough geckos have cryptic basking behaviour and excellent camouflage (an example is provided in Figure 2), are not inclined to enter traps or other capture devices used for lizard salvage¹⁰, and tend to live in visually-complex, dense and/or tall vegetation (e.g. closed-canopy forest including exotic conifers). For all of these reasons, it is not possible to determine population size in Conical Hill/Te Tihi o Rauhea or conduct any meaningful population trend monitoring.



Figure 2. A rough gecko basking in a *Coprosma* shrub. Note the camouflage. This fully-emerged gecko would be an easy find; depending on weather conditions, geckos are often partly or fully hidden in vegetation. Animals living in tall vegetation and/or closed-canopy forest are practically invisible to ground-based observers.

¹⁰ Lettink M & Hare KM 2016. Sampling techniques for New Zealand lizards. Pp: 269–291 in: Chapple DG (ed.) 2016. New Zealand Lizards. Springer International Publishing, Switzerland.

- 28.** Salvaged rough geckos are to be relocated “at least 50 m from the capture site ... to ensure the released rough gecko do not home back to the works area...” (p. 53, Applicant’s LMP). Although homing capabilities are unknown in this species, related (*Naultinus*) species are capable of homing over similar distances. For example, an elegant gecko (*N. elegans*) that was captured and transferred to a pen used to contain salvaged lizards escaped and returned to its capture tree c. 60 m away, where it was found 2 weeks following the initial capture¹¹, and a jewelled gecko (*N. gemmeus*) moved 101 m from its release tree and back within a 24-h period¹². Homing is one of the most-commonly reported issues associated with mitigation translocations of reptiles worldwide and a common cause of failure¹³.
- 29.** In my view, release protocols for rough gecko require further consideration given its threat ranking, considerable cost and time required for salvage, very low detectability and potential for geckos to be harmed (injured or killed) by construction activities if homing occurs.
- 30.** DOC best-practice for translocations of *Naultinus* geckos requires the use of temporary pens to prevent homing and increase the likelihood of animals remaining at the release site in the long-term; however, this is not advised if release sites are visible to the public and unable to be adequately concealed¹⁴. This would not appear to be a suitable option for rough geckos salvaged from the footprint. Alternatives include temporary (off-site) captive holding, releasing geckos over greater distances and/or fitting animals with small radio-transmitters to monitor movements in the weeks following release, with intervention if homing occurs. Of the above options, off-site captive holding in an approved facility may be the best option.
- 31.** Salvaged Canterbury grass skinks are to be temporarily contained in a skink-proof pen, with habitat enhancement by planting suitable native species and the addition of rock habitat, and weed and rodent control. I agree that this is appropriate and that the indicative location would be suitable for grass skinks. However, this area may also be required for the release of pygmy and northern Southern Alps geckos if salvage of these species is undertaken. The high public use of this area poses a considerable risk of human interference with lizard habitat (especially the new rock habitat), the skink pen and rodent bait stations.

¹¹ Paul Battersby, Epoch Ecology (pers. comm. to the DOC Lizard Technical Advisory Group, 5 October 2018).

¹² McClure C 2011. Testing translocation, detection and live trapping methods for New Zealand lizards. Unpubl. BSc (Hons) thesis, Lincoln University. 81 pp.

¹³ Germano JM & Bishop PJ, 2009. Suitability of amphibians and reptiles for translocation. *Conservation biology* 23: 7-15.

¹⁴ Monks J, Knox C & Sidaway K 2017. Best practice techniques for the translocation of green geckos (*Naultinus* spp.). Department of Conservation, Wellington. 8 pp.

- 32.** Given the small size (36 m²) of the penned area for Canterbury grass skinks and the possibility that >26 individuals will be recovered during salvage, contingency actions (e.g. second release site and/or larger area) should be defined well in advance of skink salvage. Grass skinks can be very abundant and the numbers of animals recovered during salvage operations often exceed expectations. This is a recurring issue for salvage operations of grass skinks (five species) nationwide, resulting in poor outcomes in some development projects. For example, the loss of 46.4% of northern grass skinks salvaged from a site in the Wellington region due to poor planning and inadequate captive holding facilities¹⁵.
- 33.** Construction of the skink-proof pen in the indicative location could adversely affect Canterbury grass skinks already living in this area (i.e. by causing injury, mortality and/or displacement of resident animals). This should be acknowledged, particularly if earthworks and vegetation clearance are required for construction of the pen. Alternatively, the pen could be constructed in an area that does not contain any lizard habitat (if available).
- 34.** Post-release monitoring of salvaged lizards is not proposed for any species in the Applicant's LMP. This is required under Principle 7 of the DOC guidance for lizard salvage due to very low success rates of mitigation translocations (another term for salvage) documented for amphibians and reptiles world-wide¹⁶. New Zealand is no exception: a recent study found that the success rates of lizard mitigation translocations were much lower than those undertaken for conservation purposes, with success rates of 22% and 88.9%, respectively¹⁷.
- 35.** Although DOC generally considers it necessary to conduct post-release monitoring of salvaged lizards to inform its own best practice and ultimately improve outcomes of future mitigation translocations, this requirement may be waived in some cases. For example, where it is extremely difficult or impossible to conduct any type of meaningful monitoring due to very low detectability of the target species or because salvaged lizards cannot be distinguished from resident lizards. Also, DOC may accept that other activities offered as compensation have greater benefits than post-release monitoring.

¹⁵ Bell T 2019. Lizard salvage compliance report: 32 Adventure Drive, Whitby. Unpubl. Report, EcoGecko Consultants.

¹⁶ Germano JM & Bishop PJ, 2009. Suitability of amphibians and reptiles for translocation. Conservation biology 23: 7-15.

¹⁷ Lennon O 2019. Mitigation translocation for conservation of New Zealand skinks. Unpubl. PhD Thesis, Victoria University of Wellington, New Zealand. 179 pp.

36. In my view, the Applicant's LMP needs to address post-release monitoring of salvaged lizards (e.g. by providing a commitment to monitoring or adequate justification for not doing so).

SIGNIFICANCE OF THE EFFECTS ON LIZARDS

37. I agree with Dr Tocher's assessment of the significance of effects, which is consistent with DOC's approach. The Applicant's LMP (p. 40) states that "DOC regards all adverse effects on New Zealand lizards, and their habitats, as significant because all indigenous New Zealand lizards are absolutely protected under the Wildlife Act (1953)...". Thus, adverse effects on all four lizard species are considered significant irrespective of their threat status.

38. I am unable to quantify **how** significant these effects will be due to uncertainties regarding both the numbers of individuals affected in relation to local (Conical Hill/Te Tihi o Rauheha Reserve) population sizes and the effectiveness of the proposed mitigation (Paras 39-58). This is a generic problem for New Zealand lizards because it is very difficult to obtain the necessary data (i.e. robust estimates of population sizes) and response to management is largely unknown.

ADEQUACY OF THE PROPOSED MITIGATION PACKAGE

39. The Applicant's lizard mitigation package includes the following measures: (1) salvage and relocation of two species (rough gecko and Canterbury grass skink) to suitable habitats within the Reserve; (2) indigenous plantings to create habitat and restore linkages, including a c. 1 ha planting of dense kānuka for rough gecko; (3) new rock habitat for the other three species; (4) control of woody weeds and wasps; (5) rodent monitoring; and (6) the possible establishment of at least one covenant to protect rough gecko habitat on private land.
40. According to the Applicant's LMP (p. 60), there will be no significant residual adverse effects once the above actions have been implemented effectively.
41. I agree that most of these actions, if implemented effectively, could be beneficial to lizards and their habitats in Conical Hill/Te Tihi o Rauheha Reserve, and will consider each in turn.

- 42.** Firstly, salvage and relocation is proposed to prevent individual lizards being killed or injured during construction activities. This in itself does not achieve “no-net-loss” in lizard values because it is rarely possible to capture all individuals present in the affected area, replacement habitats are rarely equivalent to those lost, and survival of relocated animals is not guaranteed. Notwithstanding these limitations, I agree that salvage and relocation of Threatened and At Risk lizard species is appropriate and should be undertaken.
- 43.** Secondly, I agree that indigenous plantings can create lizard habitat and restore linkages, and that a 1-ha planting of dense kānuka would be beneficial to rough geckos in the Reserve. I have similarly recommended bulk-planting of kānuka to create habitat for rough gecko within the Reserve and identified several areas where this could be undertaken. My LMP also noted that on-going maintenance of the plantings would be required to remove exotic broom, wilding conifers, cotoneaster, rowan and blackberry.
- 44.** Thirdly, I agree that creating new rocky habitat will benefit Canterbury grass skinks. It could also be beneficial to pygmy gecko and northern Southern Alps geckos if new rock habitats are positioned near existing rocky areas to permit colonisation by these species. I note that the new rock habitats are small and not equivalent to high-value habitat that is affected (e.g. the fissured greywacke rock outcrop near Tower 5 where by Dr Tocher found 18 Southern Alps geckos under one rock slab during her survey, which will be permanently removed).
- 45.** Fourthly, I agree that control of woody weeds is not only beneficial but essential for maintaining new lizard habitats and rehabilitated areas. This is proposed for at least 5 years but should in my view be undertaken for the project’s lifetime. A clear definition of the target species should also be provided. The Applicant’s LMP uses the term “woody weeds” throughout but does not provide a definition (other than a passing reference to the removal of *Cotoneaster* sp. and scotch broom from new rocky habitats on p. 57).
- 46.** Control of introduced vespulid wasps (German wasp *Vespula germanica* and common wasp *V. vulgaris*; hereafter ‘wasps’) is likely to benefit at least some lizard species in the Reserve. Wasps are competitors and predators of native New Zealand fauna¹⁸, and are incredibly abundant in South Island beech forest. In such forests, the consumption of honeydew (a sugar-rich waste product produced by native scale insects) enables wasps to reach densities

¹⁸ Beggs JR & Wardle DA 2006. Keystone species: competition for honeydew among exotic and indigenous species. In: Biological Invasions in New Zealand (pp. 281-294). Springer Berlin Heidelberg.

of 10,000 workers per hectare: more than the combined biomass of birds, rodents and stoats¹⁹.

47. While the impacts of wasps on lizard populations are unknown, I am aware of several observations of wasps stinging and/or killing lizards, including this ghastly account: "... I witnessed wasps flushing out a forest gecko from under a boulder, once they got it outside it disappeared inside a black and yellow ball. It took them just over half an hour to strip all the edible parts off the poor creature. All that was left was skin, ligaments/tendons and bones"²⁰.
48. Diurnal species (most skinks and all *Naultinus* gecko species) are likely to be most vulnerable to wasp predation as their activity phase overlaps with that of wasps. The above account suggests that populations of nocturnal lizards may also be affected as wasps are easily able to access rock and soil crevices, tree holes and other retreat sites used by inactive lizards.
49. Uncertainties regarding the use of fipronil-based Vespex[®] bait were clearly acknowledged in the Applicant's LMP. I agree with Dr Tocher that the benefits of undertaking wasp control to enhance lizard habitat in Conical Hill/Te Tihi o Rauheha Reserve outweigh the risks.
50. The fifth component of the lizard mitigation package is rodent monitoring. Technically, this is not a mitigation action (as lizards will not benefit from monitoring alone). However, it will contribute to an understanding of rodent activity in the Reserve and is therefore supported.
51. Dr Tocher and I agree that predator management for lizards is complex and has the potential to have negative outcomes for the target species, especially if outcome monitoring is not conducted. Effective predator control is much harder to achieve for native lizards than birds. Herpetologists generally agree that the entire mammalian predator guild (from mice to cats) should be controlled but tools for the effective long-term suppression of mice are currently lacking²¹. Also, cats are often omitted from predator control operations (e.g. the nationwide "Predator-Free 2050" initiative) for socio-political reasons.

¹⁹ Thomas CD, Moller H, Plunkett GM & Harris RJ 1990. The prevalence of introduced *Vespula vulgaris* wasps in a New Zealand beech forest community. *New Zealand Journal of Ecology* 13: 63–72.

²⁰ Pers. comm. from Graeme Atkins to Avi Holzapfel (both DOC staff) on 20 October 2015.

²¹ Hitchmough RA, Adams LK, Reardon JR & Monks JM 2019. Current challenges and future directions in lizard conservation in New Zealand. *Journal of the Royal Society of New Zealand* 46: 29-39.

- 52.** I have previously advised DOC that an intensive, multi-species predator control programme designed for lizards would be beneficial for lizards on Conical Hill/Te Tihi o Rauheia Reserve. However, I am also of the view that this should not be initiated without effective control of mice and cats, and robust outcome monitoring to determine response in the target species. I accept that some or all of these things may not be possible in the Reserve. Thus, focusing on habitat creation and enhancement should take precedence over pest-mammal control.
- 53.** The sixth and final component of the Applicant’s lizard mitigation package is the possible establishment of at least one covenant to protect rough gecko habitat on private land. This is compensation rather than mitigation as it does not apply to the impact site. Compensation actions are sometimes informally referred to as offsets or off-site mitigation. Here, I consider it as compensation rather than an offset, following the BBOP definitions of these terms²².
- 54.** In my view, securing one or more covenant(s) to protect rough gecko habitat on private land would be a significant conservation outcome, particularly if the site(s) was managed in a way that allowed rough geckos to increase in abundance and/or distribution. This would likely have concomitant benefits to other native species and the protected habitat(s) generally.
- 55.** To provide some context, the rough gecko is only found in North Canterbury and Marlborough, east of the Main Divide and between the Waiau and Wairau Rivers, with historic strongholds in the Hanmer Basin, Waiau Valley and Seaward Kaikōura Range²³. Large parts of its range have been developed for agriculture, housing and exotic forestry. Rough geckos do occur on public conservation land but there is no targeted management of the species at any site. I am unaware of any covenants that protect known sites on private land.
- 56.** The most significant threats to rough geckos are predation and habitat loss. Within the Hanmer Basin alone, I am aware of two other current development proposals for areas that contain rough geckos, and losses of individuals and habitats at two other sites from fire and agricultural development (the latter leading to the loss of an entire population). Known sites in the Hanmer Basin and Waiau Valley face a greater array of threats than those Seaward Kaikōura Range because the latter contains significant areas of protected conservation land.

²² Following the definitions of ‘compensation’ and ‘offset’ in Business and Biodiversity Offsets Programme (BBOP) 2018. Glossary. BBOP, Washington, D.C. 3rd updated edition.

²³ DOC Herpetofauna Database and personal observations (Unpubl. Data).

CONCLUSION

57. Considering the mitigation package in its entirety, I am of the view that there will be significant residual adverse effects if restricted to the proposed mitigation and remediation actions within the Reserve (Para 39, measures 1-4), and the rodent monitoring (measure 5) which is neither mitigation nor remediation). However, securing a sizeable covenant over an appropriate site that supports a viable population of rough geckos would alter my view.