



Conservation Status of Reptile Species in Otago

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August 2024

Otago Threat Classification Series 5

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Otago Threat Classification Series 5

ISSN 2816-00983 (web PDF)

ISBN 978-1-7385867-4-5 (web PDF)

Otago Threat Classification Series is a scientific monograph series presenting publications related to regional threats assessments of groups of taxa in the Otago region. Most will be lists providing regional threat assessments of members of a plant or animal group (e.g., reptiles, bats, birds, indigenous vascular plants), and leverages off national assessments for the New Zealand Threat Classification System within the regional context.

Recommended citation

Jarvie, S., Knox, C., Monks, J.M., Purdie, S., Reardon, J., Campbell, C. (2024). Regional conservation status of reptile species in Otago. Otago Regional Council, Otago Threat Classification Series, 2024/5

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Hura te ao gecko (*Mokopirirakau galaxias*), Threatened – Regionally Endangered. Photograph by Carey Knox.

Rockhopper skink (*Oligosoma eludens*), Threatened – Regionally Vulnerable. Photograph by Carey Knox.

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EXECUTIVE SUMMARY

This report provides an update to the regional conservation status of all known reptile taxa in the Otago region. Following standardised methodology, the regional threat status of all reptile taxa that occur in Otago was assessed. A total of 34 reptile taxa were identified as present in Otago, including 18 skinks, 13 geckos, two marine reptiles (both sea turtles), and tuatara. Fourteen taxa were assessed as Regionally Threatened (Regionally Critical: 2; Regionally Endangered: 4; Regionally Vulnerable: 8), sixteen as Regionally At Risk (Regionally Declining: 16), one as Regionally Not Threatened, and two as Regionally Non-resident Native (Regional Vagrant). Two terrestrial reptile taxa have been Regionally Extirpated, with one of these taxa being reintroduced back into the region (tuatara).

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Introduction

Threat classifications play an important role in monitoring biodiversity and informing conservation actions. The New Zealand Threat Classification System (NZTCS) is a tool used to assign a threat status to candidate taxa (species, subspecies, varieties, and forma) in Aotearoa New Zealand (Townsend et al. 2008). The classification system was developed to apply equally to terrestrial, freshwater, and marine biota (flora and fauna). The NZTCS scores taxa at the national scale against criteria based on an understanding of population state, size, and trend, while considering population status, impact of threats, recovery potential, and taxonomic certainty. The Department of Conservation | Te Papa Atawhai (DOC) administers the NZTCS in Aotearoa New Zealand, with national assessments used to inform conservation action, target resources, and monitor biodiversity trends and conservation effectiveness.

While DOC is tasked with managing indigenous taxa nationally, regional and district councils have statutory obligations to maintain indigenous biodiversity under the Resource Management Act 1991 (RMA), including to manage the habitats of threatened taxa. The regional threat status of taxa is particularly important in the context of the RMA and in conservation planning. A key requirement of managing the habitats of threatened taxa is to understand regional population sizes, and to monitor trends and conservation effectiveness. Regional threat assessments also provide a stronger foundation for assessing the threat status of taxa nationally.

This report is an update on the initial regional conservation status assessment for reptiles in the Otago Region (Jarvie et al. 2023a). Regional threat assessments have been completed following a standardised methodology by Otago Regional Council for four taxonomic groups (reptiles, Jarvie et al. 2023a; bats, Jarvie et al. 2023b; indigenous vascular plants, Jarvie et al. 2024a; amphibians, Jarvie et al. 2024b), Greater Wellington Regional Council for five taxonomic groups (birds, Crisp 2020a; indigenous freshwater fish, Crisp et al. 2022a; indigenous vascular plants, Crisp 2020b; reptiles, Crisp 2022b; bats, Crisp et al. 2023) and Auckland Council for four taxonomic groups (amphibians, Melzer et al. 2022a; reptiles, Melzer et al. 2022b; vascular plants, Simpkins et al. 2023, bats, Woolly et al. 2023) as of August 2024. The methodology for the regional threat assessments leverages off national threat assessments as determined using the NZTCS (Townsend et al. 2008, Rolfe et al. 2021, Michel 2021), with thresholds for area of occupancy or species numbers adjusted for the land area in the region (Appendix 1). National strongholds and additional regional qualifiers were also considered (Appendix 2).

Methods

The regional threat status of reptiles was initially assessed in May 2022, and updated in July 2024. This assessment covers all terrestrial and marine reptiles in the region, following standardised methodology for regional threat assessments as shown in Appendix 1, the list of regional qualifiers in Appendix 2, and the list of national qualifiers in Appendix 3. The national threat assessments and national qualifiers were from Hitchmough et al. (2021). Following Hitchmough et al. (2021), taxa were classified as: 1) 'taxonomically determinate', i.e., legitimately and effectively published and generally accepted by relevant experts as distinct; and 2) 'taxonomically unresolved', i.e., used loosely to include both undescribed entities which still require formal taxonomic research to confirm their validity and provide them with a formal name and, occasionally, described species whose validity is in question. Full details of the criteria included for Table 1 from the NZTCS can be found in Rolfe et al. (2021) and Michel (2021); summary definitions for the criteria are presented in Appendix 4.

Following the standardised methodology, reptile taxa not observed in the region were first removed from consideration based on those recognised in the NZTCS list and recent publications (Hitchmough et al. 2021; Jewell 2022a, b, c; Scarsbrook et al. 2023; see Appendix 5 for information on how these recent publications have changed the names used). The next step was to identify Nationally Threatened and At-Risk taxa that breed or are resident in the region. If more than 20% of the national population is breeding or resident for more than half their life cycle in the region, taxa were assigned National Stronghold status and the NZTCS criteria applied. The regional conservation status must not be a lower threat status than the national status, except if updated information is available. For example, a Nationally Endangered taxon cannot be assessed as Regionally Vulnerable or lower but could be assessed as Regionally Critical. Regional thresholds were set at more than 500 mature individuals present or occupancy of more than 250 ha. If taxa did not meet the threshold, they were assigned a regional threat status by applying the NZTCS criteria. If taxa did meet the threshold and the population trend was $\pm 10\%$ stable or increasing, they were assigned the status Regionally Not Threatened. For Nationally Not Threatened and Non-Resident taxa, the regional population threshold was applied. If the population was not stable to increasing/decreasing by more than 10%, the NZTCS criteria were used to determine the regional threat status. Population trend criteria were applied based on current knowledge, projecting from recent past into the future. Taxa that have become naturalised after deliberate or accidental introduction by humans are classified as Introduced and Naturalised. To be considered naturalised, taxa must have established a self-sustaining population in the wild over at least three generations and must have spread beyond the site of initial introduction.

To inform decisions on distributions and number of mature individuals or area of occupancy for the regional threat status of reptile taxa, occurrence records were used from the national DOC Herpetofauna database as well as additional records, including from Southern Scales and ORC staff. These occurrence records were taxonomically harmonised with the list of reptile taxa in the NZTCS and recent publications (Hitchmough et al. 2021; Jewell 2022a, b, c; Scarsbrook et al. 2023), then viewed in ArcGIS Pro v2.4.0 and the programming language R v. 4.2.0 (R Core Team 2022), in conjunction with other spatial layers for vegetation cover (Land Cover Database v. 5.0; Manaaki Whenua–Landcare Research 2020) and Land Information New Zealand topographic maps. The panel critically assessed the available data and drew on their own expert knowledge to consider current and likely future threats to determine the status and qualifiers for each taxon.

Information is also provided on whether taxa have been recently recorded in a territorial authority in the region, or by Freshwater Management Unit (FMU), of which the Clutha Mata-au FMU is further subdivided into five rohe (areas). Taxa are also identified that have been regionally extirpated, could occur in the region, or have been reintroduced to Otago.

Results

A total of 34 reptile taxa were recorded as being present in the Otago region (Table 1; Figure 1). The 32 terrestrial reptile taxa comprise 13 geckos, 18 skinks, and tuatara; while the two marine reptiles are both sea turtles. Of the resident native reptiles, 29 of the 31 (94%) taxa are considered Regionally Threatened or Regionally At Risk. The region was identified as a National Stronghold (containing > 20% national population) for 25 of the 32 (78%) resident taxa (Table 1). The seven regional endemics are Burgan skink (*Oligosoma burganae*), grand skink (*O. grande*), Kawarau gecko (*Woodworthia* "Cromwell"), orange-spotted gecko (*Mokopirirakau* "Roys Peak"), Otago skink (*O. otagense*), schist gecko (*W.* "Central Otago"), and Raggedy Range gecko (*W.* "Raggedy").

Of the 14 Regionally Threatened taxa recorded in the Otago region, two are Regionally Critical (Southland green skink, *O. chloronoton*; Takitimu gecko, *M. cryptozoicus*), four are Regionally Endangered (cascade gecko, *M.* "Cascades"; hura te ao gecko, *M. galaxias*; grand skink, Otago skink), and eight are Regionally Vulnerable (alpine rock skink, *O. aff. waimatense* "alpine rock"; Burgan skink; Lakes skink, *O. aff. chloronoton* "West Otago"; Oteake skink; Te Wāhipounamu skink, *O. pluvialis* "Raggedy Range gecko, *W.* "Raggedy"; rockhopper skink, *O. eludens*; scree skink, *O. waimatense*; Table 1). For the Regionally Critical taxa, there is a population of the Southland green skink found just north of the Southland–Otago boundary at the northernmost extent of its range; and Takitimu geckos have been found in ≤ 2 subpopulations, both with an estimated ≤ 200 mature individuals. Of the Regionally Endangered taxa, Otago and grand skinks are regional endemics; hura te ao geckos have national strongholds in the region; and cascade geckos are known from ≤ 3 subpopulations, with an estimated ≤ 200 mature individuals in total. Note that the cascade gecko has only recently been discovered in Otago, with little currently known of their distribution and abundance. For Regionally Vulnerable taxa, seven of the eight have national strongholds in Otago (alpine rock skink; Burgan skink; Lakes skink; Oteake skink; Te Wāhipounamu skink; Raggedy Range gecko; rockhopper skink), with the exception being the scree skink that has a natural southern range limit in the region. Two Regionally Vulnerable taxa are regional endemics, namely the Burgan skink and Raggedy Range gecko. Although the Burgan skink has a national threat listing of Nationally Endangered, recent surveys since the NZTCS assessment of reptile taxa have resulted in the discovery of new populations and, thus, they were considered Regionally Vulnerable.

The Otago region was recorded as having 16 Regionally At Risk taxa, all with the regional conservation status Regionally Declining (Table 1). Of these taxa, 13 were identified as having national strongholds in the region (jewelled gecko, *Naultinus gemmeus*; cryptic skink, *O. inconspicuum*; herffield skink, *O. murihiku*; Kawarau

gecko; kōrero gecko, *W.* "Otago/Southland large"; Nevis skink, *O. toka*; orange-spotted gecko; Otago green skink, *O. aff. chloronoton* "eastern Otago"; schist gecko; short-toed gecko, *Woodworthia* "southern mini"; south-western gecko, *W.* "south-western"; southern grass skink, *O. aff. polychroma* Clade 5; Tautuku gecko, *M.* "southern forest"). The three regional endemics are Kawarau gecko, orange-spotted gecko, and schist gecko. The three taxa identified as not having national strongholds do have range limits in Otago (Eyres skink, *O. repens*; Southern Alps gecko, *W.* "Southern Alps"; tussock skink, *O. chionocholescens*). The herbfield skink, Te Wāhipounamu skink and tussock skink were described after the NZTCS assessment for reptiles (Jewell 2022a, b, c).

For Regionally Not Threatened taxa in Otago, one taxon was recorded: McCann's skink (*O. maccanni*; Table 1). Two Non-Resident Natives were recorded, both Regional Vagrant, namely the leatherback turtle (*Dermochelys coriacea*) and olive Ridley turtle (*Lepidochelys olivacea*; Table 1). No reptile taxa were identified as Introduced and Naturalised in the Otago region, nor nationally extinct reptiles. Two taxa were assessed as being previously found in what is considered present-day Otago; that is, te mokomoko a Tohu (*Hoplodactylus tohu*) and tuatara (*Sphenodon punctatus*; Table 1). A conservation translocation of tuatara to Orokonui Ecosanctuary – Te Korowai o Mihiwaka, near Dunedin, in 2012, reintroduced this taxon to the region, with the population being reinforced in 2016 and 2017 (Table 2). Although provisional results for the translocation of tuatara are encouraging, the release was just over 10 years ago so for this long-lived taxon the population is not self-replacing yet (Jarvie et al. 2024). An additional lizard taxon that may be found in the region is the Barrier skink (*O. judgei*), but there are currently no validated records of the species in Otago (Table 3).

Terrestrial reptile taxa are present in every territorial authority in the Otago region (Table 3). The most speciose territorial authority is Central Otago District Council with 24 taxa, followed by Queenstown Lakes District Council with 17 taxa, Waitaki District Council with 11 taxa (for the Otago part only), Dunedin City Council with 10 taxa, and Clutha District Council with 9 taxa. Terrestrial reptile taxa have been recorded in all of Otago Regional Council's Freshwater Management Units (FMU) or rohe. The most speciose FMU or rohe is the Manuherekia Rohe with 17 taxa, followed by Dunstan Rohe with 16 taxa, Upper Lakes Rohe with 16 taxa, Taieri FMU with 16 taxa, North Otago FMU with 8 taxa, Lower Clutha Rohe with 8 taxa, Dunedin & Coast FMU with 7 taxa, Roxburgh Rohe with 7 taxa, and Catlins FMU with 3 taxa (Table 4).

Table 1: Regional conservation status of Otago reptiles

Regional and national qualifiers used in the assessment are abbreviated as follows: CD = Conservation Dependent; CI = Climate Impact; CRN = Conservation Research Needed; DPR = Data Poor Recognition; DPS = Data Poor Size; DPT = Data Poor Trend; DE = Designated; FR = Former Range; INC = Increasing; NR = Natural Range Limit; NStr = National Stronghold; OL = One Location; PD = Partial Decline; PF = Population Fragmentation; RE = Regional Endemic; RN = Restored Native; RR = Range Restricted; Sp = Biologically Sparse; TL = Type Locality; TO = Threatened Overseas. Further details about each of these qualifiers can be found at Appendix 2, 3 and <https://nztc.org.nz>. Other abbreviations are: SUBPOP = sub-populations; MATIND = mature individuals. Details of criteria are provided in Appendix 4 and <https://nztc.org.nz>.

Name and Authority	Common Name	National Conservation Status	Regional Conservation Status	Regional Criteria	National Stronghold	Regional Endemic	Regional Population	Regional Area	Regional Trend	Regional Confidence Population	Regional Confidence Trend	Regional Qualifiers	National Qualifiers
REGIONALLY EXTIRPATED (2)													
<i>Taxonomically determinate (2)</i>													
<i>Hoplodactylus tohu</i> Scarsbrook et al. 2023 *	te mokomoko a Tohu	Nationally Increasing	Regionally Extirpated									FR	CD, RR
<i>Sphenodon punctatus</i> (Gray, 1842) †	tuatara	Relict	Regionally Extirpated (but see footnote to this table, the main text, and table 2 for details of a population reintroduced to the region)									CD, CI, CRN, OL, RN	CI, CD, RR
REGIONALLY THREATENED (14)													
REGIONALLY CRITICAL (2)													
<i>Taxonomically determinate (2)</i>													
<i>Oligosoma chloronoton</i> (Hardy, 1977)	Southland green skink	Nationally Critical	Regionally Critical	C				≤10 ha	>70% decline	Medium	Medium	CI, CRN, DPS, DPT, DPR, NR, OL, PF	CD, PD
<i>Mokopirirakau cryptozoicus</i> Jewell & Leschen 2004	Takitimu gecko	Nationally Vulnerable	Regionally Critical	A(2)			SUBPOP ≤2, MATIND ≤200		10-30% decline	Low	Low	CI, CRN, DPS, DPT, DPR, NR, Sp	CI, DPS, DPT, Sp

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Name and Authority	Common Name	National Conservation Status	Regional Conservation Status	Regional Criteria	National Stronghold	Regional Endemic	Regional Population	Regional Area	Regional Trend	Regional Confidence Population	Regional Confidence Trend	Regional Qualifiers	National Qualifiers
REGIONALLY ENDANGERED (4)													
<i>Taxonomically determinate (3)</i>													
<i>Mokopirirakau galaxias</i> Knox et al., 2021	hura te ao gecko	Nationally Endangered	Regionally Endangered	A(2)	Yes		SUBPOP 3-5, MATIND ≤200		10–30% decline	Medium	Low	CI, CRN, DPS, DPT, NStr, NR, TL, RR	CI, DPS, DPT
<i>Oligosoma grande</i> (Gray, 1845)	grand skink	Nationally Endangered	Regionally Endangered	B(1)	Yes	Yes	MATIND=2 50-1000		±10% stable	High	High	CD, CI, NStr, PD, PF, RE, RR, TL	CD, CI, PD, RR
<i>Oligosoma otagense</i> (McCann, 1955)	Otago skink	Nationally Endangered	Regionally Endangered	B(1)	Yes	Yes	MATIND=2 50-1000		±10% stable	High	High	CD, CI, NStr, PD, PF, RE, RR, TL	CD, RR
<i>Taxonomically unresolved (1)</i>													
<i>Mokopirirakau "Cascades"</i>	cascade gecko	Declining	Regionally Endangered	A(2)			SUBPOP ≤3, MATIND ≤200		10–30% decline	Low	Low	CI, CRN, DPS, DPT, DPR	CI, DPT
REGIONALLY VULNERABLE (8)													
<i>Taxonomically determinate (2)</i>													
<i>Oligosoma burganae</i> Chapple et al., 2011	Burgan skink	Nationally Endangered	Regionally Vulnerable §	D(3)	Yes	Yes		≤1000 ha	30–50% decline	Medium	Low	CI, DE, DPS, DPT, NStr, RE, Sp, PF, TL	CI, DPT, RR, Sp
<i>Oligosoma waimatense</i> (McCann, 1955)	scree skink	Nationally Vulnerable	Regionally Vulnerable	C(3)				≤100 ha	30–50% decline	Medium	Low	CI, DPS, DPT, NStr NR, Sp, RR	CI, Sp
<i>Taxonomically unresolved (6)</i>													
<i>Oligosoma</i> aff. <i>chloronoton</i> "West Otago"	Lakes skink	Nationally Vulnerable	Regionally Vulnerable	D(3)	Yes			≤1000 ha	30–50% decline	Medium	Low	CI, DPS, DPT, NStr, NR, PF, Sp	CI, DPS, DPT, PF, Sp
<i>Oligosoma</i> aff. <i>inconspicuum</i> "North Otago"	Oteake skink	Nationally Vulnerable	Regionally Vulnerable	C(3)	Yes			≤100 ha	10–30% decline	Medium	Low	CI, DPS, DPT, DPR, NStr	CI, DPT, OL #

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Name and Authority	Common Name	National Conservation Status	Regional Conservation Status	Regional Criteria	National Stronghold	Regional Endemic	Regional Population	Regional Area	Regional Trend	Regional Confidence Population	Regional Confidence Trend	Regional Qualifiers	National Qualifiers
<i>Oligosoma pluvialis</i> Jewell, 2022a ‡	Te Wāhipounamu skink	Declining	Regionally Vulnerable	C(2)	Yes		SUBPOP 3–5, MATIND ≤ 500		10–30% decline	Medium	Low	CI, DPS, DPR, DPT, NStr, NR, PF, RR	CI, DPR, DPS, DPT, RR
<i>Oligosoma</i> aff. <i>waimatense</i> “alpine rock”	alpine rock skink	Nationally Vulnerable	Regionally Vulnerable	C(3)	Yes			≤100 ha	30–50% decline	Medium	Low	CI, DPS, DPT, NStr, NR, RR	CI, DPT, RR
<i>Oligosoma eludens</i> Knox et al., 2024	rockhopper skink	Declining	Regionally Vulnerable	C(1)	Yes			≤100 ha	10–30% decline	Medium	Low	CI, DPS, DPT, NStr, NR, RR, TL	CI, DPS, DPT, RR
<i>Woodworthia</i> “Raggedy”	Raggedy Range gecko	Nationally Vulnerable	Regionally Vulnerable	C(3)	Yes	Yes		≤100 ha	10–30% decline	Medium	Low	DPR, DPT, DPS, NStr, RE, RR	CI, DPT, RR
REGIONALLY AT RISK (16)													
REGIONALLY DECLINING (16)													
<i>Taxonomically determinate (4)</i>													
<i>Naultinus gemmeus</i> McCann, 1955	jewelled gecko	Declining	Regionally Declining	B(2)	Yes			≤10000 ha	10–30% decline	Medium	Medium	CI, NStr, PD, PF	CI, PD, PF
<i>Oligosoma inconspicuum</i> (Patterson & Daugherty, 1990)	cryptic skink	Declining	Regionally Declining	C(1)	Yes		MATIND> 100000		10–30% decline	High	Medium	CI, NStr, NR, TL	CI
<i>Oligosoma repens</i> Chapple et al., 2011	Eyres skink	Declining	Regionally Declining	A(2)				≤1000 ha	10–30% decline	Medium	Low	CI, DPR, DPT, NR, RR, Sp, TL ♥	DPR, DPT, RR, Sp
<i>Oligosoma toka</i> Chapple et al., 2011	Nevis skink	Declining	Regionally Declining	C(1)	Yes		MATIND> 100000		10–30% decline	Medium	Low	CI, DPT, NStr, NR, RR, TL	CI, DPT, RR
<i>Taxonomically unresolved (12)</i>													
<i>Mokopirirakau</i> “Roys Peak” ¶	orange-spotted gecko	Declining	Regionally Declining	A(2)	Yes	Yes §		≤1000 ha	10–30% decline	Medium	Low	CI, DPS, DPT, DPR, NStr, RE, RR, Sp	CI, DPT, RR, Sp

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Name and Authority	Common Name	National Conservation Status	Regional Conservation Status	Regional Criteria	National Stronghold	Regional Endemic	Regional Population	Regional Area	Regional Trend	Regional Confidence Population	Regional Confidence Trend	Regional Qualifiers	National Qualifiers
<i>Mokopirirakau</i> "southern forest"	Tautuku gecko	Declining	Regionally Declining	B(2)	Yes			≤10000 ha	10–30% decline	Medium	Low	CI, DPR, DPS, DPT, NStr, NR	CI, DPT
<i>Oligosoma</i> aff. <i>chloronoton</i> "eastern Otago"	Otago green skink	Declining	Regionally Declining	B(2)	Yes			≤10000 ha	30–50% decline	Medium	Low	CD, CI, DPS, DPT, NStr, NR, PD, PF	CD, CI, DPS, DPT
<i>Oligosoma murihiku</i> Jewell, 2022b ♣	herbfield skink	Declining	Regionally Declining	A(2)	Yes			≤10000 ha	10–30% decline	High	Medium	CD, CI, DPT, NStr, NR, PD, PF, RR	CD, DPT, PF, RR
<i>Oligosoma chionochloescens</i> Jewell, 2022c	tussock skink	♣	Regionally Declining	B(2)				≤10000 ha	10–30% decline	High	Medium	DPT, NR	DPT
<i>Oligosoma</i> aff. <i>polychroma</i> Clade 5	southern grass skink	Declining	Regionally Declining	C(1)	Yes		MATIND> 100000		10–30% decline	High	Medium	DPT, NStr, NR	DPT
<i>Woodworthia</i> "Central Otago"	schist gecko	Declining	Regionally Declining	C(2)	Yes	Yes		>10000 ha	10–30% decline	Medium	Low	CI, NStr, PD, RE	CI, PD
<i>Woodworthia</i> "Cromwell"	Kawarau gecko	Declining	Regionally Declining	C(2)	Yes	Yes		>10000 ha	10–30% decline	Medium	Low	CI, NStr, PD, RE	CI, DPT
<i>Woodworthia</i> "Otago/Southland large"	kōrero gecko	Declining	Regionally Declining	C(1)	Yes		MATIND> 100000		10–30% decline	High	Medium	NStr, PD	PD
<i>Woodworthia</i> "Southern Alps"	Southern Alps gecko	Declining	Regionally Declining	C(1)			MATIND> 100000		10–30% decline	Medium	Low	NR	
<i>Woodworthia</i> "southern mini"	short-toed gecko	Declining	Regionally Declining	B(2)	Yes			≤10000 ha	10–30% decline	Medium	Low	CI, DPT, NStr, NR	CI, DPT
<i>Woodworthia</i> "south-western"	south-western large gecko	Declining	Regionally Declining	C(2)	Yes			≥10000 ha	10–30% decline	Medium	Low	CI, DPT, NStr, NR, PD	CI, DPT, PD
REGIONALLY NOT THREATENED (1)													
<i>Taxonomically determinate (1)</i>													
<i>Oligosoma maccanni</i> (Patterson & Daugherty, 1990)	McCann's skink	Not Threatened	Regionally Not Threatened		Yes		MATIND> 100000		±10% stable	High	Medium	NStr, TL	
REGIONALLY NON-RESIDENT NATIVE (2)													
REGIONAL VAGRANT (2)													
<i>Taxonomically determinate (2)</i>													
<i>Dermochelys coriacea</i> (Vandelli, 1761)	leatherback turtle	Migrant	Regional Vagrant									TO	TO

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Name and Authority	Common Name	National Conservation Status	Regional Conservation Status	Regional Criteria	National Stronghold	Regional Endemic	Regional Population	Regional Area	Regional Trend	Regional Confidence Population	Regional Confidence Trend	Regional Qualifiers	National Qualifiers
<i>Lepidochelys olivacea</i> (Eschscholtz, 1829)	olive Ridley turtle	Vagrant	Regional Vagrant ♦									TO	DPS, DPT, TO

* *te mokomoko a Tohu* (*Hoplodactylus tohu*) has been described since the current national status for reptiles (Hitchmough et al. 2021; Scarsbrook et al. 2023), with same threat status as *Hoplodactylus duvaucelii* "southern" as in the NZTCS (Hitchmough et al. 2021). Note that no known subfossils have been found in Otago, but subfossils have been found south of the Waitaki River, <5 km from the regional boundary. This means the taxon was past the major biogeographical barrier of the Waitaki River (Chapple and Hitchmough 2016) and assessed as being previously found in what is considered present-day Otago with a reasonable degree of confidence. † tuatara (*Sphenodon punctatus*) were regionally extinct in Otago but were reintroduced to Orokonui Ecosanctuary, Te Korowai o Mihiwaka, near Dunedin, in 2012. See Table 2 and main text for more details. § For Burgan skink (*O. burganae*), the regional conservation status is lower than its current national conservation status due to the discovery of new populations after NZTCS assessment for reptiles (Hitchmough et al. 2021), thus extending the known range (Wildlands 2022); # Although the Oteake skink (*Oligosoma* aff. *inconspicuum* "North Otago") has been recorded in two broad locations in Otago, recent surveys failed to detect it at one of these locations, so it may no longer exist there. Although the Oteake skink had been considered to only be found in Otago, the discovery of a skink taxon on Mount Solution is synonymous with this taxon based on mitochondrial DNA. Consequently, the Oteake skink is no longer considered a regionally endemic species. ‡ Te Wāhipounamu skink (*O. pluvialis*) has been described since the current national conservation status for reptiles (Hitchmough et al. 2021; Jewell 2022a), with national qualifiers and trends likely the same as for the pallid (*O. aff. inconspicuum* "pallid") in the NZTCS of which it was split (Hitchmough et al. 2021); ¶ orange-spotted gecko (*M. "Roys Peak"*) have not been confirmed genetically outside the Otago region but are suspected based on morphology. The panel considered to use the Regional Endemic qualifier because of the precautionary principle and to acknowledge the uncertainty here; ♦ herbfield skink *O. murihiku* has been described since the current national status for reptiles (Hitchmough et al. 2021; Jewell 2022b), with same status as the herbfield skink (*O. aff. inconspicuum* "herbfield") as in the NZTCS (Hitchmough et al. 2021); ♣ tussock skink (*O. chionocholescens*) was described after the NZTCS assessment for reptiles (Hitchmough et al. 2021; Jewell 2022c); ♦ olive Ridley turtle (*L. olivacea*) was confirmed in the Otago region from specimens found at Kaka Point.; ♥ The type locality for the Eyres skink (*Oligosoma repens* Chapple et al., 2011) is <200 m on the Southland side of the Otago-Southland boundary.

Table 2: Conservation translocation of reptile taxa to the Otago Region

Name and Authority	Common Name	Notes
REINTRODUCTION		
<i>Taxonomically determinate (1)</i>		
<i>Sphenodon punctatus</i> (Gray, 1842)	tuatara	Tuatara were regionally extirpated from Otago but were reintroduced to Orokonui Ecosanctuary, Te Korowai o Mihiwaka, near Dunedin, in 2012, with the population being reinforced in 2016 and 2017 (Cree 2014, Jarvie et al. 2014a, b, 2015, 2016, 2021, 2024). Since the initial release of individuals over 10 years ago, high survival rates of founder animals and evidence of reproduction has been recorded (Jarvie et al. 2016, 2021, accepted). While early signs are promising with the population tracking towards re-establishment, it will be decades until its self-sustaining due to the extreme longevity of tuatara. The number of mature individuals in Otago is still < 250 individuals. The fenced ecosanctuary is mostly free of introduced mammalian predators except for the house mouse (<i>Mus musculus</i>).

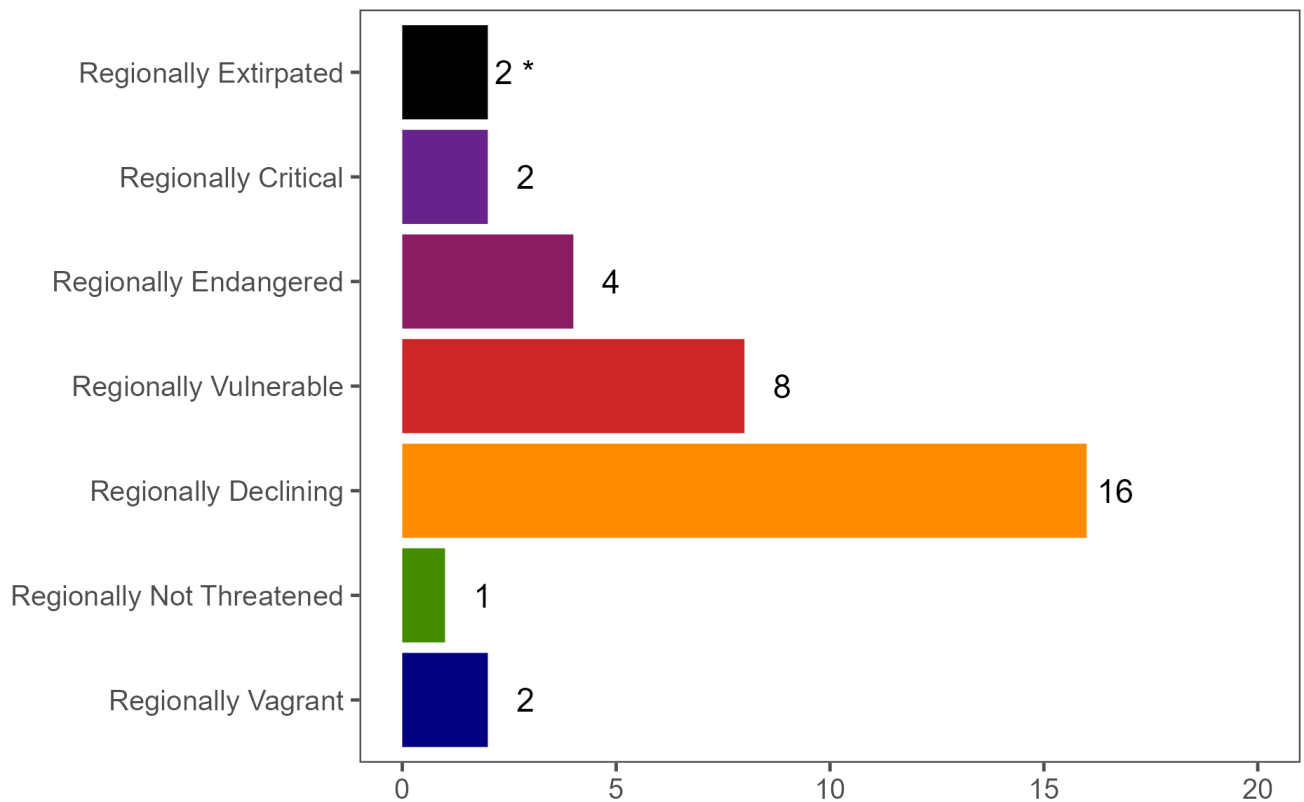


Figure 1: Regional conservation status of reptiles in the Otago Region.

*Although two reptile taxa were Regionally Extirpated in Otago, one of these taxa has been reintroduced to the region. This means there are currently 34 taxa known to be present in the region, including the two taxa that are Non-resident Natives (both Regional Vagrants).

Table 3: Reptile taxa that could occur in the Otago Region

Name and Authority	Common Name	Status	Justification
PUTATIVELY IN REGION (1)			
<i>Taxonomically determinate (1)</i>			
<i>Oligosoma judgei</i> Patterson & Bell, 2009	Barrier skink	Speculative	No confirmed sighting but reports of large skinks have been recorded from high elevation scree in the Otago part of the Eyre Mountains that may belong to this species

Table 3: Presence of terrestrial reptile taxa by territorial authority in the Otago Region. ● indicates a taxon has been observed from occurrence records in a territorial authority since 2000; ○ indicates a taxon was observed from occurrence records in a territorial authority before 2000.

Name and Authority	Common Name	Central Otago District Council	Clutha District Council	Dunedin City Council	Queenstown Lakes District Council	Waitaki District Council (Otago part only)
<i>Mokopirirakau</i> "Cascades"	cascade gecko				●	
<i>Mokopirirakau cryptozoicus</i> Jewell & Leschen 2004	Takitimu gecko				●	
<i>Mokopirirakau galaxias</i> Knox et al., 2021	hura te ao gecko	●				●
<i>Mokopirirakau</i> "Roys Peak"	orange-spotted gecko	●			●	●
<i>Mokopirirakau</i> "southern forest"	Tautuku gecko		●			
<i>Naultinus gemmeus</i> McCann, 1955	jewelled gecko	●	●	●	●	●
<i>Oligosoma</i> aff. <i>chloronoton</i> "eastern Otago"	Otago green skink	●		●	○	●
<i>Oligosoma</i> aff. <i>chloronoton</i> "West Otago"	Lakes skink	●			●	●
<i>Oligosoma murihiku</i> Jewell, 2022b	herbfield skink			●		●
<i>Oligosoma</i> aff. <i>inconspicuum</i> "North Otago"	Oteake skink	●				
<i>Oligosoma pluvialis</i> Jewell, 2022a	Te Wāhipounamu skink	●			●	
<i>Oligosoma</i> aff. <i>polychroma</i> Clade 5	southern grass skink	●			○	
<i>Oligosoma</i> aff. <i>waimatense</i> "alpine rock"	alpine rock skink	●				
<i>Oligosoma burganae</i> Chapple et al., 2011	Burgan skink	●		●		
<i>Oligosoma chionocholescens</i> Jewell, 2022c	tussock skink	●	○	●	●	●
<i>Oligosoma chloronoton</i> (Hardy, 1977)	Southland green skink		○			
<i>Oligosoma grande</i> (Gray, 1845)	grand skink	●	○	●	○	○
<i>Oligosoma inconspicuum</i> (Patterson & Daugherty, 1990)	cryptic skink	●	○		●	
<i>Oligosoma maccanni</i> (Patterson & Daugherty, 1990)	McCann's skink	●	○	●	●	●
<i>Oligosoma otagense</i> (McCann, 1955)	Otago skink	●		●	○	●
<i>Oligosoma repens</i> Chapple et al., 2011	Eyres skink				●	
<i>Oligosoma eludens</i> Knox et al., 2024	rockhopper skink	●				
<i>Oligosoma toka</i> Chapple et al., 2011	Nevis skink	●			●	
<i>Oligosoma waimatense</i> (McCann, 1955)	scree skink	●				
<i>Sphenodon punctatus</i> (Gray, 1842)	tuatara			●		

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Regional conservation status of reptile species in Otago

<i>Presence of terrestrial reptile taxa in a territorial authority</i>						
Name and Authority	Common Name	Central Otago District Council	Clutha District Council	Dunedin City Council	Queenstown Lakes District Council	Waitaki District Council (Otago part only)
<i>Woodworthia</i> "Central Otago"	schist gecko	●	●			
<i>Woodworthia</i> "Cromwell"	Kawarau gecko	●			●	
<i>Woodworthia</i> "Otago/Southland large"	kōrero gecko	●	○	●		●
<i>Woodworthia</i> "south-western"	south-western large gecko	●			●	
<i>Woodworthia</i> "Southern Alps"	Southern Alps gecko	●			●	
<i>Woodworthia</i> "southern mini"	short-toed gecko	○			●	
<i>Woodworthia</i> "Raggedy"	Raggedy Range gecko	●				

Table 4: Presence of terrestrial reptile taxa in freshwater management units (FMU) in the Otago Region. The Clutha Mata-au FMU has been further subdivided into five rohe (areas). • indicates a taxon has been observed from occurrence records in a FMU or Rohe since 2000; ○ indicates a taxon was observed from occurrence records in a FMU or rohe before 2000.

Name and Authority	Common name	Taieri FMU	North Otago FMU	Dunedin & Coast FMU	Catlins FMU	Clutha Mata-au FMU				
						Manuherekia Rohe	Roxburgh Rohe	Upper Lakes Rohe	Dunstan Rohe	Lower Clutha Rohe
<i>Mokopirirakau</i> "Cascades"	cascade gecko							•		
<i>Mokopirirakau cryptozoicus</i> Jewell & Leschen 2004	Takitimu gecko							•		
<i>Mokopirirakau galaxias</i> Knox et al., 2021	hura te ao gecko	•				•				
<i>Mokopirirakau</i> "Roys Peak"	orange-spotted gecko					•		•	•	
<i>Mokopirirakau</i> "southern forest"	Tautuku gecko				•					
<i>Naultinus gemmeus</i> McCann, 1955	jewelled gecko	•	•	•	○		○	•		
<i>Oligosoma</i> aff. <i>chloronoton</i> "eastern Otago"	Otago green skink	•	○	•		•			○	○
<i>Oligosoma</i> aff. <i>chloronoton</i> "West Otago"	Lakes skink					•		○	•	
<i>Oligosoma murihiku</i> Jewell, 2022b	herbfield skink	•	○	•						
<i>Oligosoma</i> aff. <i>inconspicuum</i> "North Otago"	Oteake skink	•								
<i>Oligosoma pluvialis</i> Jewell, 2022a	Te Wāhipounamu skink								•	
<i>Oligosoma</i> aff. <i>polychroma</i> Clade 5	southern grass skink					○		○	•	
<i>Oligosoma</i> aff. <i>waimatense</i> "alpine rock"	alpine rock skink					•				
<i>Oligosoma burganae</i> Chapple et al., 2011	Burgan skink	•					•			
<i>Oligosoma chionocholescens</i> Jewell, 2022c	tussock skink	•	•	•		•	•	•	•	○
<i>Oligosoma chloronoton</i> (Hardy, 1977)	Southland green skink									○
<i>Oligosoma inconspicuum</i> (Patterson & Daugherty, 1990)	cryptic skink							•	•	○
<i>Oligosoma grande</i> (Gray, 1845)	grand skink	•	○			○		○	•	○
<i>Oligosoma maccanni</i> (Patterson & Daugherty, 1990)	McCann's skink	•	•	•		•	•	•	•	○
<i>Oligosoma otagense</i> (McCann, 1955)	Otago skink	•	•			•	○	○	•	
<i>Oligosoma repens</i> Chapple et al., 2011	Eyres skink							•		
<i>Oligosoma eludens</i> Knox et al., 2024	rockhopper skink	•				•				

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Regional conservation status of reptile species in Otago

Presence of terrestrial reptile taxa in FMU

Name and Authority	Common name	Taieri FMU	North Otago FMU	Dunedin & Coast FMU	Catlins FMU	Clutha Mata-au FMU				
						Manuherekiia Rohe	Roxburgh Rohe	Upper Lakes Rohe	Dunstan Rohe	Lower Clutha Rohe
<i>Oligosoma waimatense</i> (McCann, 1955)	scree skink	●				●				
<i>Sphenodon punctatus</i> (Gray, 1842)	tuatara			●						
<i>Woodworthia</i> "Central Otago"	schist gecko	●				●	●			○
<i>Woodworthia</i> "Cromwell"	Kawarau gecko							○	●	
<i>Woodworthia</i> "Otago/Southland large"	kōrero gecko	●	●	●	○	●	●		●	○
<i>Woodworthia</i> "south-western"	south-western large gecko							●	●	
<i>Woodworthia</i> "Southern Alps"	Southern Alps gecko	●				●		●	●	
<i>Woodworthia</i> "southern mini"	short-toed gecko							●	●	
<i>Woodworthia</i> "Raggedy"	Raggedy Range gecko	●				●				

Discussion

Regional threat assessments have been completed by regional councils in Aotearoa New Zealand, with the resulting regional threat lists being used as a tool to help maintain indigenous biodiversity. For example, regional threat lists have been used to advise resource consent applications, inform conservation actions and target resources, as well as monitor biodiversity trends and conservation effectiveness. This report is an update of the initial regional threat assessment for reptiles in the Otago region. A total of 34 reptile taxa are recorded as present in the Otago region, including 32 terrestrial reptiles and two marine reptiles. Of these reptile taxa, 25 have national strongholds in Otago, with seven of those taxa being regional endemics. Two terrestrial reptile taxa have been Regionally Extirpated, with one of these taxa being reintroduced back into the region in 2012.

For national assessments of Threatened and At Risk resident reptiles, there is a similarly extremely high number of taxa in these threat categories in Otago as nationally (94% cf. 93%). The regional threat ranking was higher than national assessments for four threatened reptile taxa: cascade gecko, Te Wāhipounamu skink, rockhopper skink, and Takitimu gecko. For cascade gecko (Regionally Endangered cf. Declining), Te Wāhipounamu skink (Regionally Vulnerable cf. Declining), rockhopper skink (Regionally Vulnerable cf. Declining), and Takitimu gecko (Nationally Vulnerable cf. Regionally Critical), this was because only a fraction of their national distribution occurs in Otago, with the rate of decline in the region estimated to be the same as nationally. The cascade gecko was also only recently discovered in Otago region, with little currently known about their distribution and abundance, so this listing is precautionary. For the Burgan skink, the regional conservation assessment was lower than the national assessment due to the discovery of new populations of this taxon since the conservation status of reptiles was assessed in 2021 (Regionally Vulnerable cf. Nationally Endangered; Hitchmough et al. 2021; Wildlands 2022).

Conservation actions have improved the threat status of reptiles in Otago. For example, grand and Otago skinks have recovered sufficiently following intensive predator control at Macraes (Reardon et al. 2012) to downgrade their national threat assessments from Nationally Critical to Nationally Endangered status in the conservation status of reptiles (Hitchmough et al. 2013). Conservation and restoration efforts to eradicate introduced mammals, and in fencing to prevent mammals from reinvading (Burns et al. 2012), have also increased the suitability of mainland sites for reptiles (Hitchmough et al. 2016; Nelson et al. 2014). For example, at Orokonui Ecosanctuary several years after introduced mammals were eradicated, except for the house mouse (*Mus musculus*) which are mostly maintained at low levels, allowed for a previously undetectable population of herbfield skinks to be discovered. This discovery of herbfield skinks provides further evidence lizard recovery can occur at mainland sites where mammalian pests are excluded or intensively controlled at a landscape scale (Reardon et al. 2012; Hitchmough et al. 2016; Nelson et al. 2014). The Otago Region also has the Mokomoko Drylands Sanctuary near Alexandra, Central Otago, currently the country's only mainland

fenced sanctuary dedicated to dryland habitats and lizards (<https://www.mokomokosanctuary.com/>). However, taxon-specific responses to mammalian predator suppression or eradication are also common (Reardon et al. 2012; Hitchmough et al. 2016; Nelson et al. 2014; Norbury et al. 2022), including for some taxa vulnerable not only to larger introduced mammalian predators but also the house mouse (Norbury et al. 2022).

For reptiles in Otago, conservation translocations – the intentional movement and release of organisms to restore populations – have been used to establish populations (IUCN/SCC 2013). Types of conservation translocations already used have included reintroduction, the re-establishment of focal taxa within its indigenous range, including for those that are locally extinct in parts of the region, such as the jewelled gecko (e.g., Knox et al. 2014, 2017), the grand skink (e.g., Whitmore et al. 2011), the Otago green skink, and the Otago skink (e.g., Hare et al. 2012), as well as for a taxon that was regionally extirpated in the tuatara (e.g., Cree 2014; Jarvie et al. 2014a, 2021, accepted). Tuatara were reintroduced to Orokonui Ecosanctuary in 2012, with subsequent reinforcements in 2016 and 2017 (Cree 2014; Jarvie et al. 2014a, 2021, accepted). Since the release of tuatara at Orokonui Ecosanctuary over 10 years ago, provisional results from monitoring are encouraging for this population with high survival rates and evidence of reproduction (Jarvie et al. 2014b, 2015, 2016, 2021, 2024, accepted). While the population is not yet self-replacing with at least half the breeding adults being products of natural replenishment due to the slow life-history characteristics of tuatara and reintroduction only in 2012, the population is tracking towards re-establishment with the fenced ecosanctuary mostly free of introduced mammalian predators except for the house mouse (Jarvie et al. accepted).

Future conservation translocations of candidate taxa discussed in restoration plans for mainland sanctuaries include the grand skink, te mokomoko a Tohu, and Tautuku gecko to Orokonui Ecosanctuary (Otago Natural History Trust 2019). In future, another type of conservation translocation in managed relocations, the movement of the focal taxa outside its indigenous range to avoid extinctions, could be used (Seddon et al. 2014). This could include for population of reptiles threatened under human-induced climate change by sea-level rise in low-lying coastal areas, such as the herffield skink at Victory Beach, or under future climates where reptile taxa are not be able to move to a climatically suitable area (Jarvie et al. 2021, 2022). Furthermore, marine reptiles like the olive Ridley turtle identified as present in the region from dead specimen records from the DOC Herpetofauna database, might survive in Otago under climate change.

In recent years, surveys for reptiles in Otago have resulted in the discovery of new taxa (e.g., the rockhopper skink, alpine rock skink, and hura te ao gecko in 2018; Wildland Consultants 2019; Knox et al. 2021; orange-spotted gecko in 1998; Tocher & Marshall 2001; Nielsen et al. 2011) and new populations (e.g., for orange-spotted geckos across 3000 km²; Knox et al. 2019; cascade gecko; CK pers. obs. 2022). For some subalpine and alpine populations of reptile taxa found in Otago, isolated individuals have been recorded at much lower altitude, suggesting populations were more widespread (Hitchmough et al. 2016). Further

development of surveying and monitoring techniques is needed for reptiles as approaches to detect some taxa can be specialised (Hitchmough et al. 2016; Lettink & Monks, 2016). For example, emerging approaches such as drones have been trialled as a tool to survey and monitor lizards, including in Otago (Monks et al. 2022). Ongoing research has also indicated new listing of taxa in Otago between NZTCS assessments from 2015 and 2021, i.e., alpine rock skink, rockhopper skink, and Raggedy Range gecko. The recently described te mokomoko a Tohu was a new split from *H. duvaucelii* (Hitchmough et al. 2016, 2021; Scarsbrook et al. 2023), with this taxon having a subfossil record < 5 km from the regional boundary of Otago and south of the major biogeographical boundary of the Waitaki River (Hitchmough & Chapple 2016), thus a large-bodied gecko species was assessed as previously found in or near present-day Otago. The tussock skink, Te Wāhipounamu skink, and herbfield skink were all described after the NZTCS assessment for reptiles (Jewell 2022a, b, c). Although there is dispute on the validity of these taxa, they have been included in this regional threat classification for reptiles as a precautionary measure.

Acknowledgements

Thanks to Philippa Crisp and Roger Uys from Greater Wellington Regional Council and Sabine Melzer from Auckland Council for advice on the regional conservation status process, Pascale Michel from the Department of Conservation | Te Papa Atawhai (DOC) for advice on the national assessments, Rod Hitchmough and Geoff Patterson for advice on taxonomy, Trent Bell for providing coordinates for a type locality, Rod Hitchmough for advice on the New Zealand Threat Classification System, Alison Cree for discussion on tuatara, Tony Jewell for advice on a scientific name, Lachie Scarsbrook and Nic Rawlence for discussions on a subfossil site, and Tim Ware for editorial advice.

References

- Burns, B., Innes, J., Day, T. (2012). The use and potential of pestproof fencing for ecosystem restoration and fauna conservation in New Zealand. In: Somers, M.J., Hayward, M.W. (eds) *Fencing for conservation: restriction of evolutionary potential or a riposte to threatening processes?* Springer, New York, USA. 65–90 p.
- Chapple, D.G., Hitchmough, R.A. (2016). Biogeography of New Zealand Lizards. In: Chapple, D. (ed) *New Zealand Lizards*. Springer, Cham. 109–131 p.
- Crisp, P. (2020a). Conservation status of native bird species in the Wellington region. Greater Wellington Regional Council, Publication No. GW/ESCI-G-20/75, Wellington. 37 p.
- Crisp, P. (2020b). Conservation status of indigenous vascular plant species in the Wellington region. Greater Wellington Regional Council Publication No. GW/ESCI-G-20/20 Wellington. 39 p.
- Crisp, P., Hitchmough, R., Newman, D., Adams, L., Lennon, O., Woolley, C., Hulme-Moir, A., Bell, T., Herbert, S., Spearpoint, O., Nelson, N. (2022b). Conservation status of reptile species in the Wellington region. Greater Wellington Regional Council, Publication No. GW/ESCI-G-23/03, Wellington. 23 p.
- Crisp, P., O'Donnell, C., Pryde, M., Ryan, J., Spearpoint, O. (2023). Conservation status of bat species in the Wellington region. Greater Wellington Regional Council, Publication No. GW/ESCI-G-23/01, Wellington. 13 p.
- Crisp, P., Perrie, A., Morar, A., Royal, C. (2022a). Conservation status of indigenous freshwater fish in the Wellington region. Greater Wellington Regional Council Publication No. GW/ESCI-T-22/02. 8 p.
- Hare, K.M., Norbury, G., Judd, L.M., Cree, A. (2012). Survival of captive-bred skinks following reintroduction to the wild is not explained by variation in speed or body condition index. *New Zealand Journal of Zoology*, 39: 319–328.
- Hitchmough, R.A., Adams, L.K., Reardon, J.T., Monks, J.M. (2016). Current challenges and future directions in lizard conservation in New Zealand. *Journal of the Royal Society of New Zealand*, 46: 29–39.
- Hitchmough, R.A., Anderson, P., Barr, B., Monks, J.M., Lettink, M., Reardon, J., Tocher, M., Whitaker, T. (2013). Conservation status of New Zealand reptiles, 2012. *New Zealand Threat Classification Series 2*. Department of Conservation, Wellington. 16 p.
- Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson, G.B., Reardon, J.T., 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 p.

Hitchmough, R.A., Barr, B., Lettink, M., Monks, J., Reardon, J., Tocher, M., van Winkel, D., Rolfe, J. (2016). Conservation status of New Zealand reptiles, 2015. Department of Conservation, Wellington. 14 p

IUCN/SSC. (2013). Guidelines for reintroductions and other conservation translocations. Version 1.0. Gland, Switzerland, IUCN Species Survival Commission. 57 p.

Jarvie, S. (2024). Regional conservation status of Otago's amphibians. Otago Regional Council, Otago Threat Classification Series, 2024/1. 24 p.

Jarvie, S., Barkla, J., Rance, B., Rogers, G., Ewans, R., Thorsen, M. (2024a). Regional conservation status of indigenous vascular plants in Otago. Otago Regional Council, Otago Threat Classification Series, 2024/2. 137 p.

Jarvie, S., Besson., A.A., Carter, L., Christiansen, J., Gardiner-Rodden, J., Godfrey, S., McGregor, N., Nelson, N., Mello, R., Seddon, P., Smith, E., Cree, A. (accepted). Reintroduction of tuatara to a cool-temperate mainland sanctuary in south-eastern Aotearoa New Zealand. In: Soorae, P.S. (ed.). Global Re-introduction Perspectives: Case-studies from around the globe. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, UAE: Environment. xiv + 276 pp.

Jarvie, S., Besson. A.A., Seddon, P.J., Cree, A. (2014a). Assessing thermal suitability of translocation release sites for egg-laying reptiles with temperature-dependent sex determination: A case study with tuatara. *Animal Conservation*, 17: 48–55.

Jarvie, S., Davidson-Watts, I., Dennis, G., Gower, C., Pryde, M. (2023b). Regional conservation status of bat species in Otago. Otago Regional Council, Otago Threat Classification Series, 2023/2. 19 p.

Jarvie, S., Ingram, T., Chapple, D.G., Hitchmough, R.A., Nielsen, S.V., Monks, J.M. (2022). Variable vulnerability to climate change in New Zealand lizards. *Journal of Biogeography*, 49: 43 –442.

Jarvie, S., Knox, C., Monks, J.M., Reardon, J., Campbell, C. (2023a). Regional conservation status of reptile species in Otago. Otago Regional Council, Otago Threat Classification Series, 2023/1. 24 p.

Jarvie, S., Price, S., Nelson, N., Cree, A. (2014). Conservation translocations of tuatara: restoring populations in Aotearoa New Zealand of an evolutionary relict. In: Walls SC, O'Donnell KM (eds), *Strategies for the Study of Amphibians and Reptiles*, Herpetological Conservation Series, vol 4, Society for the Study of Amphibians and Reptiles.

Jarvie, S., Ramirez, A.E., Dolia, J., Adolph, S.C., Seddon, P.J., Cree, A. (2014b). Attaching radio-transmitters does not affect mass, growth or dispersal of translocated juvenile tuatara (*Sphenodon punctatus*). *Herpetological Review*, 45: 417–421.

Jarvie, S., Recio, M.R., Adolph, S.C., Seddon, P.J., Cree, A. (2016). Resource selection of tuatara following translocation: a comparison of wild-caught and captive-reared juveniles. *New Zealand Journal of Ecology*, 40: 334–341.

Jarvie, S., Senior, A.M., Adolph, S.C., Seddon, P.J., Cree, A. (2015). Captive-rearing affects growth but not survival in translocated juvenile tuatara. *Journal of Zoology*, 291: 184–93.

Jarvie, S., Worthy, T.H., Saltré, F., Scofield, R.P., Seddon, P.J., Cree, A. (2021). Using Holocene fossils to model the future: Distribution of climate suitability for tuatara, the last rhynchocephalian. *Journal of Biogeography*, 48: 1489–1502.

Jewell, T. (2022a). *Oligosoma pluvialis* n. sp. (Reptilia: Scincidae) from Te Wāhipounamu/ South West New Zealand. In: 'Contributions to the taxonomy of New Zealand lizards (3)'. Jewell Publications. 1–14 p.

Jewell T. (2022b). *Oligosoma murihiku* n. sp. (Reptilia: Scincidae) from the south-eastern South Island of New Zealand. In: 'Contributions to the taxonomy of New Zealand lizards (2)'. Jewell Publications. 3–14 p.

Jewell, T. (2022c). Discovery of an abrupt contact zone supports recognition of a new species of grass skink in southern New Zealand. In: 'Contributions to the taxonomy of New Zealand lizards (1)'. Jewell Publications. 10–16 p.

Knox, C., Hitchmough, R.A., Nielsen, S.V., Jewell, T., Bell, T. (2021). A new, enigmatic species of black-eyed gecko (Reptilia: Diplodactylidae: *Mokopirirakau*) from North Otago, New Zealand, *Zootaxa*, 4964: 140–156.

Knox, C., Jarvie, S., Easton, L., Monks, J. (2017). Soft-release, but not cool winter temperatures, reduces post-translocation dispersal of jewelled geckos. *Journal of Herpetology*, 51: 490–496.

Knox, C.D., Jewell, T.R., Monks, J.M. (2019). Ecology of orange-spotted geckos (*Mokopirirakau* “Roys Peak”) in Central Otago and Queenstown-Lakes districts. *New Zealand Journal of Ecology*, 43: 3365

Knox, C., Monks, J.M. (2014). Penning prior to release decreases post-translocation dispersal of jewelled geckos. *Animal Conservation*, 17: 18–26.

Lettink, M., Monks, J.M. (2016). Survey and monitoring methods for New Zealand lizards. *Journal of the Royal Society New Zealand*. 46: 35–47.

Manaaki Whenua – Landcare Research (2020). Land Cover Database v. 5.0. Available online: <https://iris.scinfo.org.nz/layer/104400-lcdb-v50-land-cover-database-version-50-mainland-new-zealand/>. (Accessed on 2 May 2022).

Melzer, S., Hitchmough, R., van Winkel, D., Wedding, C., Chapman, S., Rixon, M., Moreno, V., J. Germano, J. (2022a). Conservation status of amphibian species in Tāmaki Makaurau/Auckland. Auckland Council Technical Report, TR2022/4.

- Melzer, S., Hitchmough, R., van Winkel, D., Wedding, C., Chapman, S., Rixon, M. (2022b). Conservation status of reptile species in Tāmaki Makaurau/Auckland. Auckland Council Technical Report, TR2022/3.
- Michel, P. (2021). Amendment to the New Zealand Threat Classification System 2008: revised categories 2021. Department of Conservation, Wellington. 5 p.
- Miller, K.A., Bell, T.P., Germano, J.M. (2014). Understanding publication bias in reintroduction biology by assessing translocations of New Zealand's herpetofauna. *Conservation Biology* 28:1045–1056.
- Monks, J. M., Wills, H. P., & Knox, C. D. (2022). Testing drones as a tool for surveying lizards. *Drones*, 6, 199: <https://doi.org/10.3390/drones6080199>
- Nelson, N.J., Hitchmough, R.A., Monks, J.M. (2014). New Zealand reptiles and their conservation. In: Stow, A., Holwell, G., Maclean, N. (eds) *Austral Ark*. Cambridge, UK, Cambridge University Press. 382–404 p.
- Nielsen, S.V., Bauer, A.M., Jackman, T.R., Hitchmough, R.A., Daugherty, C.H. (2011). New Zealand geckos (Diplodactylidae): cryptic diversity in a post-Gondwanan lineage with trans-Tasman affinities. *Molecular Phylogenetics and Evolution* 59: 1–22.
- Otago Natural History Trust. (2019). Orokonui Ecosanctuary Restoration Plan. Unpublished Orokonui report. 51 p.
- Rearson, J.T., Whitmore, N., Holmes, K.M., Judd, L.M., Hutcheon, A.D., Norbury, G., Mackenzie, D.I. (2012). Predator control allows critically endangered lizards to recover on mainland New Zealand. *New Zealand Journal of Ecology* 36:141–150.
- Rolfe, J., Makan, T. Tait, A. (2021). Supplement to the New Zealand Threat Classification System manual 2008: new qualifiers and amendments to qualifier definitions, 2021. Department of Conservation, Wellington. 7 p.
- Scarsbrook, L., Walton, K., Rawlence, N.J., Hitchmough, R.A. (2023). Revision of the New Zealand gecko genus *Hoplodactylus*, with the description of a new species. *Zootaxa* 5228: 267–291.
- Seddon, P.J., Griffiths, C.J., Soorae, P.S., Armstrong, D.P. (2014). Reversing defaunation: Restoring species in a changing world. *Science*, 345: 406–412.
- Simpkins, E., Woolly, J., de Lange, P., Kilgour, C., Cameron, E., Melzer, S. (2023). Conservation status of vascular plant species in Tāmaki Makaurau/Auckland. Auckland Council Technical Report, TR2022/19.
- Tocher, M.D., Marshall, L.J. (2001). Surveys for *Hoplodactylus* aff. *granulatus*, Roys Peak and Mount Alpha, Wanaka. Conservation Advisory Science Notes 344. Department of Conservation, Wellington. 27 p.

Townsend, A.J., de Lange, P.J., Duffy, C.A.J., Miskelly, C.M., Molloy, J., Norton, D.A. (2008): New Zealand Threat Classification System manual. Department of Conservation, Wellington. 35 p.

Wildland Consultants (2019). Field surveys and evaluation of four data deficient lizard taxa in Oteake Conservation Park, Otago. Wildland Consultant Ltd Contract Report No. 4963a. Prepared for Auckland Zoo and the Department of Conservation. 34 p.

Wildland Consultants (2022). Monitoring of Burgan skinks at Deep Creek, Lammermoor Range. Wildland Consultants Ltd Contract Report No. 5961. 10 p.

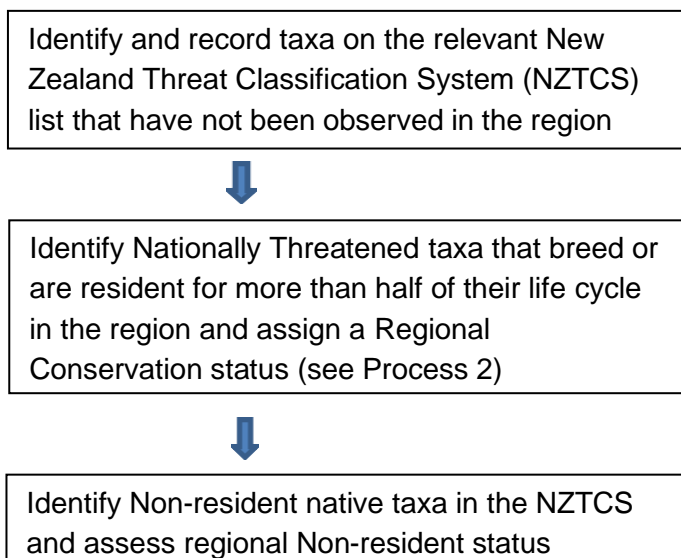
Whitmore, N., Judd, L.M., Mules, R.D., Webster, T.A., Madill, S.C., Hutcheon, A.D. (2011). A trial wild-wild translocation of the critically endangered grand skink *Oligosoma grande* in Otago, New Zealand. Conservation Evidence, 9: 28–35.

Woolly, J.B., Paris, B., Borkin, K., Davidson-Watts, I., Clarke, D., Davies, F., Burton, C., Melzer, S. (2023). Conservation status of bat species in Tāmaki Makaurau / Auckland. Auckland Council Technical Report, TR2023/4. 18 p.

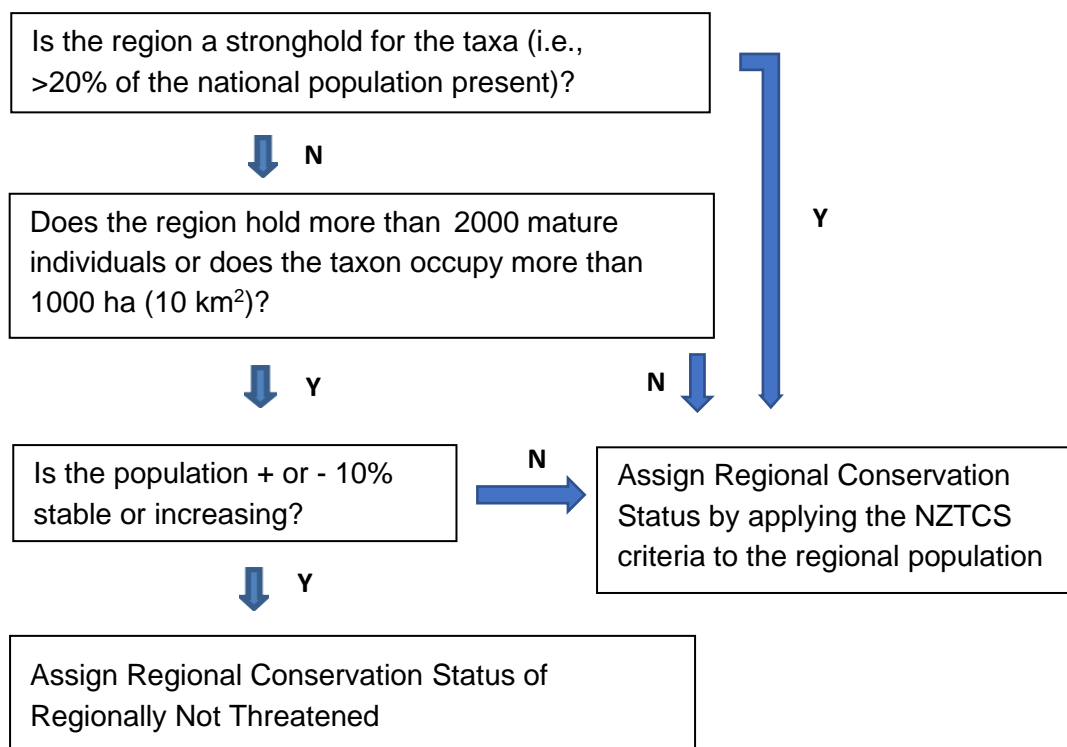
Worthy, T.H. (1998). Quaternary fossil faunas of Otago, South Island, New Zealand. Journal of the Royal Society of New Zealand, 28: 421–521.

Appendix 1: Process for determining the regional threat status of taxa

Process 1: Determination of regional threat status



Process 2: Determination of strongholds and Regionally Not Threatened species



Appendix 2: List of Regional Qualifiers for Regional Conservation Threat Assessments.

National qualifiers can also be used as regional qualifiers according to the methodology in regional threat assessments (see Appendix 3 for more details).

Code	Qualifier	Description
FR	Former Resident	Breeding population (existed for more than 50 years) extirpated from region but continues to arrive as a regional vagrant or migrant.
HR	Historical Range	The inferred range (extending in any direction) of the taxon in pre-human times meets its natural limit in the region.
IN	Introduced Native	Introduced to the region, though not known to have previously occurred in it.
NS	National Stronghold	More than 20% of the national population breeding or resident for more than half their life cycle in the region.
NR	Natural Range	The known range (extending in any direction) of the taxon meets its natural limit in the region.
RE	Regional Endemic	Known to breed only in the region.
RN	Restored Native	Reintroduced to the region after having previously gone extinct there.
TL	Type Locality	The type locality of the taxon is within the region.

Appendix 3: List of National Qualifiers from the New Zealand Threat Classification System (Townsend et al. 2008; Michel 2021; Rolfe et al. 2021).

National qualifiers can be used as regional qualifiers according to the methodology in regional threat assessments (see Appendix 2 for more details)

Code	Qualifier	Qualifier Type	Description
DPR	Data Poor: Recognition	Assessment Process Qualifier	Confidence in the assessment is low because of difficulties determining the identity of taxon in the field and/or in the laboratory. Taxa that are DPR will often be DPS and DPT. In such cases, the taxon is most likely to be Data Deficient.
DPS	Data Poor: Size	Assessment Process Qualifier	Confidence in the assessment is low because of a lack of data on population size.
DPT	Data Poor: Trend	Assessment Process Qualifier	Confidence in the assessment is low because of a lack of data on population trend.
DE	Designated	Assessment Process Qualifier	A taxon that the Expert Panel has assigned to what they consider to be the most appropriate status without full application of the criteria. For example, a commercial fish that is being fished down to Biomass Maximum Sustainable yield (BMSy) may meet criteria for 'Declining', however, it could be designated as 'Not Threatened' if the Expert Panel believes that this better describes the taxon's risk of extinction.
IE	Island Endemic	Biological Attribute Qualifier	A taxon whose naturally distribution is restricted to one island archipelago (e.g., Auckland Islands) and is not part of the North or South Islands or Steward Island/Rakiura. This qualifier is equivalent to the 'Natural' Population State value in the database.
NS	Natural State	Biological Attribute Qualifier	A taxon that has a stable or increasing population that is presumed to be in a natural condition, i.e., has not experienced historical human-induced decline.
RR	Range Restricted	Biological Attribute Qualifier	A taxon naturally confined to specific substrates, habitats or geographic areas of less than 100 km ² (100,000 ha), this is assessed by taking into account the area of occupied habitat of all sub-populations (and summing the areas of habitat if there is more than one sub-population), e.g., Chatham Island forget-me-not (<i>Myosotidium hortensia</i>) and Auckland Island snipe (<i>Coenocorypha aucklandica aucklandica</i>). This qualifier can apply to any 'Threatened' or 'At Risk' taxon. It is redundant if a taxon is confined to 'One Location' (OL)
Sp	Sparse	Biological Attribute Qualifier	The taxon naturally occurs within typically small and widely scattered subpopulations. This qualifier can apply to any 'Threatened' or 'At Risk' taxon.

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Regional conservation status of reptile species in Otago

List of National Qualifiers from the New Zealand Threat Classification System

Code	Qualifier	Qualifier Type	Description
NO	Naturalized Overseas	Population State Qualifier	A New Zealand endemic taxon that has been introduced by human agency to another country (deliberately or accidentally) and has naturalised there, e.g., <i>Olearia traversiourum</i> in the Republic of Ireland.
OL	One Location	Population State Qualifier	Found at one location in New Zealand (geographically or ecologically distinct area) of less than 100,000 ha (1000 km ²), in which a single event (e.g., a predator irruption) could easily affect all individuals of the taxon, e.g., L'Esperance Rock groundsel (<i>Senecio esperensis</i>) and Open Bay leech (<i>Hirudobdella antipodum</i>). 'OL' can apply to all 'Threatened', 'At Risk', 'Non-resident Native' – Coloniser and Non-resident Native – Migrant taxa, regardless of whether their restricted distribution in New Zealand is natural or human-induced. Resident native taxa with restricted distributions but where it is unlikely that all sub-populations would be threatened by a single event (e.g., because water channels within an archipelago are larger than known terrestrial predator swimming distances) should be qualified as 'Range Restricted' (RR).
SO	Secure Overseas	Population State Qualifier	The taxon is secure in the parts of its natural range outside New Zealand
SO?	Secure Overseas?	Population State Qualifier	It is uncertain whether a taxon of the same that is secure in the parts of its natural range outside New Zealand is conspecific with the New Zealand taxon.
S?O	Secure? Overseas	Population State Qualifier	It is uncertain whether the taxon is secure in the parts of its natural range outside New Zealand.
TO	Threatened Overseas	Population State Qualifier	The taxon is threatened in the parts of its natural range outside New Zealand.
T?O	Threatened Overseas?	Population State Qualifier	It is uncertain whether a taxon of the same name that is threatened in the parts of its natural range outside New Zealand is conspecific with the New Zealand taxon.
T?O	Threatened? Overseas	Population State Qualifier	It is uncertain whether the taxon is threatened in the parts of its natural range outside New Zealand.

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Regional conservation status of reptile species in Otago

List of National Qualifiers from the New Zealand Threat Classification System

Code	Qualifier	Qualifier Type	Description
CI	Climate Impact	Pressure Management Qualifier	<p>The taxon is adversely affected by long-term climate trends and/or extreme climatic events.</p> <p>The following questions provide a guide to using the CI Qualifier: Is the taxon adversely affected by long-term changes in the climate, such as an increase in average temperature or sea-level rise? If NO = no Qualifier but needs monitoring and periodic re-evaluation because projected changes to the average climate and sea-level rise may adversely impact the taxon (including via changes to the distribution and prevalence of pests, weeds and predators) in the future. If YES = CI Qualifier Is the taxon adversely affected by extreme climate events, such as a drought, storm or heatwave? If No = no Qualifier but needs monitoring and periodic re-evaluation because projected changes to the climate are likely to increase the frequency and/or severity of these events in the future. If YES = CI Qualifier</p> <p>Use of the Climate Impact Qualifier would indicate the need for more in-depth research, ongoing monitoring of climate impacts, and potentially a climate change adaptation plan for the taxon</p>
CD	Conservation Dependent	Pressure Management Qualifier	<p>The taxon is likely to move to a worse conservation status if current management ceases. The term 'management' can include indirect actions that benefit taxa, such as island biosecurity.</p> <p>Management can make a taxon CD only if cessation of the management would result in a worse conservation status. The influence of the benefits of management on the total population must be considered before using CD. The benefit of managing a single subpopulation may not be adequate to trigger CD, but may trigger Partial Decline (PD).</p> <p>Taxa qualified CD may also be PD because of the benefits of management.</p>
CR	Conservation Research Needed	Pressure Management Qualifier	Causes of decline and/or solutions for recovery are poorly understood and research is required.

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Regional conservation status of reptile species in Otago

List of National Qualifiers from the New Zealand Threat Classification System

Code	Qualifier	Qualifier Type	Description
EW	Extinct In The Wild	Pressure Management Qualifier	The taxon is known only in captivity or cultivation or has been reintroduced to the wild but is not self-sustaining. Assessment of a reintroduced population should be considered only when it is self-sustaining. A population is deemed to be self-sustaining when the following two criteria have been fulfilled: it is expanding or has reached a stable state through natural replenishment and at least half the breeding adults are products of the natural replenishment, and it has been at least 10 years since reintroduction
EF	Extreme Fluctuations	Pressure Management Qualifier	The taxon experiences extreme unnatural population fluctuations, or natural fluctuations overlaying human-induced declines, that increase the threat of extinction. When ranking taxa with extreme fluctuations, the lowest estimate of mature individuals should be used for determining population size, as a precautionary measure.
INC	Increasing	Pressure Management Qualifier	There is an ongoing or forecast increase of > 10% in the total population, taken over the next 10 years or three generations, whichever is longer. This qualifier is redundant for taxa ranked as 'Recovering'.
PD	Partial Decline	Pressure Management Qualifier	The taxon is declining over most of its range, but with one or more secure populations (such as on offshore islands). Partial decline taxa (e.g., North Island kākā <i>Nestor meridionalis septentrionalis</i> and Pacific gecko <i>Dactylocnemis pacificus</i>) are declining towards a small stable population. The Relict qualifier may be appropriate when the population has stabilised
PF	Population Fragmentation	Pressure Management Qualifier	Gene flow between subpopulations is hampered as a direct or indirect result of human activity. Naturally disjunct populations are not considered to be 'fragmented'.
PE	Possibly/Presumed Extinct	Pressure Management Qualifier	A taxon that has not been observed for more than 50 years but for which there is little or no evidence to support declaring it extinct. This qualifier might apply to several Data Deficient and Nationally Critical taxa.
RF	Recruitment Failure	Pressure Management Qualifier	The age structure of the current population is such that a catastrophic decline is likely in the future. Failure to produce new progeny or failure of progeny to reach maturity can be masked by apparently healthy populations of mature specimens.

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Regional conservation status of reptile species in Otago

List of National Qualifiers from the New Zealand Threat Classification System

Code	Qualifier	Qualifier Type	Description
Rel	Relict	Pressure Management Qualifier	<p>The taxon has declined since human arrival to less than 10% of its former range but its population has stabilised.</p> <p>The range of a relictual taxon takes into account the area currently occupied as a ratio of its former extent. Reintroduced and self-sustaining populations within or outside the former known range of a taxon should be considered when determining whether a taxon is relictual.</p> <p>This definition is modified from the definition of the At Risk – Relict category in the NZTCS manual (Townsend et al. 2008). The main difference is that trend is not included in the qualifier definition. This enables the qualifier to be applied to any taxon that has experienced severe range contraction, regardless of whether that contraction continues or has been arrested.</p> <p>This qualifier complements the ‘Naturally Uncommon (NU)’ qualifier which can be applied to taxa whose abundance has declined but which continue to occupy a substantial part of their natural range.</p>

Appendix 4: List of categories and statuses from the New Zealand Threat Classification System amended for the Regional Threat Classification System

Full details of the criteria included in Table 1 can be found in Rolfe et al. (2021) and Michel (2021) for the NZTCS and in Appendices 2 and 3 for the qualifiers. Summary definitions for are presented below as amended for the Regional Threat Classification System framework.

Regionally Data Deficient

Taxa that cannot be assessed due to a lack of current information about their distribution and abundance. It is hoped that listing such taxa will stimulate research to find out the true category (for a fuller definition, see Townsend et al. (2008)).

Regionally Threatened

Taxa that meet the criteria specified by Townsend et al. (2008) and Michel (2021) for the categories Nationally Critical, Nationally Endangered, Nationally Vulnerable, and Nationally Increasing.

REGIONALLY CRITICAL

A – very small population (natural or unnatural)

A(1) < 250 mature individuals

A(2) ≤ 2 sub-populations, ≤ 200 mature individuals in the larger sub-population

A(3) Total area of occupancy ≤ 1 ha (0.01 km²)

B – small populations with a high ongoing or forecast decline of 50–70%

B(1) 250–1000 mature individuals

B(2) ≤ 5 sub-populations, ≤ 300 mature individuals in the largest sub-population

B(3) Total area of occupancy ≤ 10 ha (0.1 km²)

C – population (irrespective of size or number of sub-populations) with a very high ongoing or forecast decline of >70%

C Predicted decline > 70%

REGIONALLY ENDANGERED

A – small population that has a low to high ongoing or forecast decline of 10–50%

A(1) 250–1000 mature individuals

A(2) ≤ 5 sub-populations, ≤ 300 mature individuals in the largest sub-population

A(3) Total area of occupancy ≤ 10 ha (0.1 km²)

B – small, stable population (unnatural)

B(1) 250–1000 mature individuals

B(2) ≤ 5 sub-populations, ≤ 300 mature individuals in the largest sub-population

B(3) Total area of occupancy ≤ 10 ha (0.1 km²)

C – moderate population and high ongoing or forecast decline of 50–70%

C(1) 1000–5000 mature individuals

C(2) ≤ 15 sub-populations, ≤ 500 mature individuals in the largest sub-population

C(3) Total area of occupancy ≤ 100 ha (1 km²)

REGIONALLY VULNERABLE

A – small population (unnatural), increasing > 10%

A(1) 250–1000 mature individuals

A(2) ≤ 5 sub-populations, ≤ 300 mature individuals in the largest sub-population

A(3) Total area of occupancy ≤ 10 ha (0.1 km²)

B – moderate population (unnatural), stable $\pm 10\%$

B(1) 1000–5000 mature individuals

B(2) ≤ 15 sub-populations, ≤ 500 mature individuals in the largest sub-population

B(3) Total area of occupancy ≤ 100 ha (1 km²)

C – moderate population and population trend that has a low to high ongoing or forecast decline of 10–50%

C(1) 1000–5000 mature individuals

C(2) ≤ 15 sub-populations, ≤ 500 mature individuals in the largest sub-population

C(3) Total area of occupancy ≤ 100 ha (1 km²)

D – moderate to large population and moderate to high ongoing or forecast decline of 30–70%

D(1) 5000–20 000 mature individuals

D(2) ≤ 15 sub-populations, ≤ 1000 mature individuals in the largest sub-population

D(3) Total area of occupancy ≤ 1000 ha (10 km²)

E – large population and high ongoing or forecast decline of 50–70%

E(1) 20 000–100 000 mature individuals

E(2) Total area of occupancy $\leq 10 000$ ha (100 km²)

REGIONALLY INCREASING

This is a new name and category for At Risk – Recovering A of Townsend et al. (2008).

Taxa that have undergone a documented decline within the last 1000 years to a population size of 1000–5000 mature individuals or a total area of occupancy of ≤ 100 ha (1 km²) and now have an ongoing or predicted increase of $> 10\%$ in the total population or area of occupancy, taken over the longer of the next 10 years or three generations.

Taxa that are increasing but have a population size of < 1000 mature individuals (or a total area of occupancy of < 10 ha) are listed in one of the other Threatened categories, depending on their population size (for more details, see Townsend et al. 2008).

Regionally At Risk

REGIONALLY DECLINING

A – moderate to large population and low ongoing or forecast decline of 10–30%

A(1) 5000–20 000 mature individuals

A(2) Total area of occupancy ≤ 1000 ha (10 km²)

B – large population and low to moderate ongoing or forecast decline of 10–50%

B(1) 20 000–100 000 mature individuals

B(2) Total area of occupancy $\leq 10 000$ ha (100 km²)

C – very large population and low to high ongoing or forecast decline of 10–70%

C(1) $> 100 000$ mature individuals

C(2) Total area of occupancy > 10 000 ha (100 km²)

REGIONALLY RELICT

Taxa that have undergone a documented decline within the last 1000 years and now <10% of their former range and meet one of the following criteria:

A 5000–20 000 mature individuals; population stable (\pm 10%)

B > 20 000 mature individuals; population stable or increasing at > 10%

The range of a relictual taxon takes into account the area currently occupied as a ratio of its former extent. Relict can also include taxa that exist as reintroduced and self-sustaining populations within or outside their former known range (for more details, see Townsend et al. (2008)).

REGIONALLY NATURALLY UNCOMMON

Taxa whose distributions are confined to a specific geographical area or which occur within naturally small and widely scattered populations, where these distributions are not the result of human disturbance.

Regionally Not Threatened

Resident native taxa that have large, stable populations.

Regionally Introduced and Naturalised

Taxa that have become naturalised in the wild after being deliberately or accidentally introduced into Otago by human agency.

Regional Non-resident Native

Taxa whose natural presence in Otago is either discontinuous (Migrant) or sporadic or temporary (Vagrant), or which have succeeded in recently (since 1950) establishing a resident breeding population (Coloniser).

REGIONAL MIGRANT

Taxa that predictably and cyclically visit Otago as part of their normal life cycle (a minimum of 15 individuals known or presumed to visit per annum) but do not breed here.

REGIONAL VAGRANT

Taxa whose occurrences, though natural, are sporadic and typically transitory, or migrants with fewer than 15 individuals visiting Otago per annum.

REGIONAL COLONISER

Taxa that would otherwise trigger Threatened or At Risk categories because of their small population sizes, have arrived in Otago without help from humans and have been successfully reproducing in the wild only since 1950.

Appendix 5: Changes affecting reptile taxa found in the Otago region between the publication of Hitchmough et al. (2021) and this report

Name and authority in Hitchmough et al. 2021	Name and authority in this report	Notes	Change in distribution of taxa as relates to Otago
<i>Hoplodactylus duvaucelii</i> "southern" Dumeril & Bibron, 1836	<i>Hoplodactylus tohu</i> Scarsbrook et al. 2023		
<i>Oligosoma</i> aff. <i>polychroma</i> Clade 5	<i>Oligosoma chionochloescens</i> Jewell 2022c	New split from <i>O. aff. polychroma</i> Clade 5	Contact zone between <i>O. chionochloescens</i> and <i>O. aff. polychroma</i> Clade 5 as proposed by Jewell 2022c is across much of the width of the eastern South Island. See Jewell 2022c for more details.
<i>Oligosoma</i> aff. <i>inconspicuum</i> "herbfield"	<i>Oligosoma murihiku</i> Jewell 2022b		
<i>Oligosoma</i> . aff. <i>inconspicuum</i> "pallid"	<i>Oligosoma pluvialis</i> Jewell 2022a	Otago populations previously tag-named <i>O. aff. inconspicuum</i> "pallid" form part of this more broadly-distributed species, which also includes Fiordland and Westland populations.	