



Conservation Status of Amphibian Species in Tāmaki Makaurau / Auckland

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Hochstetter's frog. Photograph by Sabine Melzer.

Karamatura stream, Auckland. Photograph by Jay Farnworth

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Executive summary

The conservation status of all known amphibian taxa in Tāmaki Makaurau / Auckland was assessed, using the New Zealand Threat Classification System (NZTCS) for the first time. We used the draft Department of Conservation regional guidelines and followed the process outlined by the Greater Wellington Regional Council. A total of four amphibian species were identified as present in Tāmaki Makaurau / Auckland. Hochstetter's frog (*Leiopelma hochstetteri*) was assessed as At Risk, northern Great Barrier Island swimming frog (*Incertae cedis* "Northern Great Barrier Island swimming frog") as Data Deficient and southern bell frog (*Ranoidea raniformis*) and green and golden bell frog (*Ranoidea aurea*) as Introduced and Naturalised. Archey's frog (*Leiopelma archeyi*) may have formerly occurred in the region.

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1 Introduction

Completing regional conservation status assessments for amphibians in Tāmaki Makaurau / Auckland is a component of Auckland Council’s Biodiversity Focus Area (BFA) Programme. Under this programme, several projects are being established to deliver on council’s obligations for regional biodiversity management under Te Tahua Pūtea Tau 2021-2031 Long-term Plan (Auckland Council 2021), the Auckland Council Indigenous Biodiversity Strategy (Auckland Council 2012), Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy 2020 (Department of Conservation), the draft National Policy Statement for Indigenous Biodiversity (Ministry for the Environment) and Mahere ā-Rohe Whakahaere Kaupapa Koiora Orotā mō Tāmaki Makaurau Auckland Regional Pest Management Plan 2020-2030 (Auckland Council 2020).

The Department of Conservation regularly (DOC) assesses the national conservation status of many taxa using the New Zealand Threat Classification System (NZTCS; Townsend et al. 2008, Rolfe et al. 2021). National conservation status assessments of New Zealand amphibians, including native and introduced species are published every five years as part of the DOC New Zealand Threat Classification Series (Hitchmough 2002; Hitchmough et al. 2007, Newman et al. 2009; Newman et al. 2013; Burns et al. 2018). While the national assessments are helpful for prioritising conservation management, research, monitoring and natural resource management decisions, regional considerations are not taken into account. In the Tāmaki Makaurau / Auckland context, this is particularly relevant where a species is more threatened in the region than nationally or where the region represents a national stronghold for a species.

Regional threat status of a species is particularly important in the context of consenting processes under the Resource Management Act 1991 (RMA), and in conservation planning where habitat loss as a result of land use changes may occur at a site that supports the type locality or a regionally rare population of a species. Under the RMA, regional and district councils have a statutory obligation to manage threatened species habitats. A key requirement of achieving recovery of threatened species and managing their habitats in Tāmaki Makaurau / Auckland is to have a good understanding of regional population sizes and know where declines are occurring. Furthermore, regional assessments will provide a much stronger foundation for assessing species nationally as they utilize regional expert knowledge and data that may not otherwise be readily available.

Wellington Regional Council has completed threat assessments for lizards and several other taxa groups (Crisp 2020). Methodologies for that work were based on the national NZTCS system (Townsend et al. 2008, Rolfe et al. 2021) and thresholds for area of occupancy/species number adjusted for land area in the region (Appendix A). National strongholds and additional regional qualifiers including natural or historic range limits were also considered (Appendix B).

This report is the first conservation status assessment for amphibians in Tāmaki Makaurau / Auckland.

2 Methods

A panel comprising Auckland Council internal (Sabine Melzer, Melinda Rixon) and external (Rod Hitchmough, Dylan van Winkel, Chris Wedding, Simon Chapman, Virginia Moreno, Jen Germano) experts assessed the status of amphibian species in Tāmaki Makaurau / Auckland in July 2021.

This report covers all amphibian species in the region and followed the draft Department of Conservation (DOC) process for assessing regional conservation status (Department of Conservation 2014, pers. comm. Pascale Michel). Taxa that have become naturalised in New Zealand after being deliberately or accidentally introduced by human agency are classified as Introduced and Naturalised. To be considered naturalised, a taxon must have established a self-sustaining population in the wild over at least three generations and must have spread beyond the site of initial establishment.

We used spatial data from the national DOC Herpetofauna database as well as additional recent species records that had not yet been submitted to DOC. Spatial data was viewed in ArcGIS Pro GIS software in conjunction with other map layers, including vegetation cover (Land Cover Database v. 5.0; Manaaki Whenua – Landcare Research 2020) and land water boundaries to inform decisions on area of occupancy and distribution.

All amphibian species from the national NZTCS list (Burns et al. 2018) not observed in the region were removed from consideration. Nationally threatened species that reproduce or are resident for more than half their life cycle in the region where assigned a regional conservation status by applying the NZTCS criteria (Townsend et al. 2008, Rolfe et al. 2021). However, to maintain highest protection of threatened species and for consistency between regional and national assessments, regional status must not be a lower threat category than the national status. For example, a Nationally Endangered taxon cannot be assessed as Regionally Vulnerable or lower, but it could be assessed as Regionally Critical. Population trend criteria are applied based on current knowledge, projecting from recent past into the future.

The process for determining the regional threat status of a species is shown in Appendix 1 and a full list of qualifiers applied in Appendix 2. If more than 20% of the national population is breeding or resident for more than half their life cycle in Tāmaki Makaurau / Auckland, the species was assigned National Stronghold status and the NZTCS criteria applied. Regional thresholds, allowing for differences in land area, were applied as drafted by the Department of Conservation (Department of Conservation 2014). Thresholds are designed to be used universally across a wide range of taxa and allow for using either an area or population size estimate based on the information available for a species. For Tāmaki Makaurau / Auckland, the threshold was set at less than 500 mature individuals present or a habitat occupancy area of less than 250ha. If a species did not meet the threshold, it was assigned a regional conservation status by applying the NZTCS criteria. If it did meet the threshold and the population was $\pm 10\%$ stable or increasing, it was assigned the status regionally not threatened.

3 Results

A total of four amphibian species was identified as present in Tāmaki Makaurau / Auckland (Fig. 1, Table 1).

Hochstetter’s frog (*Leiopelma hochstetteri*) is the only endemic amphibian species known for certain in Tāmaki Makaurau / Auckland and was assessed as being Regionally Declining. The species occupies an area of less than 10,000ha and is declining at an estimated rate of 10-30% over three generations (30+ years).

The region is a stronghold for the northern Great Barrier Island swimming frog (Incertae cedis "Northern Great Barrier Island swimming frog"). However, the species is taxonomically indeterminate and is only known from two sightings at Great Barrier Island / Aotea that were 10 years apart (Whitaker & Hardy 1985; Burns et al. 2018). Attempts by Dylan van Winkel and colleagues to locate the species in 2016 were unsuccessful. As a result, the northern Great Barrier Island swimming frog is Regionally Data Deficient. If this taxon is found to be a New Zealand endemic species it will also be a regional endemic, but it is also possible that it is an introduced and naturalised species.

There are two introduced and naturalised species from Australia, southern bell frog (*Ranoidea raniformis*) and green and golden bell frog (*Ranoidea aurea*).

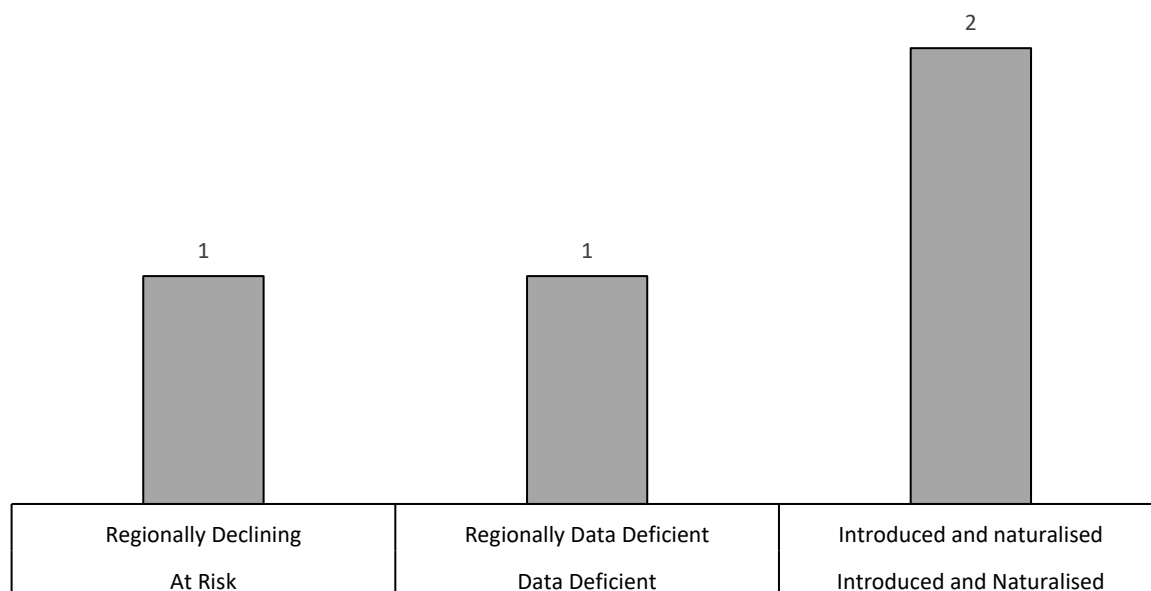


Figure 1. Summary of the regional conservation status of amphibians in the Auckland region.

Table 1: Regional conservation status of Tāmaki Makaurau / Auckland amphibians.

Common Name	Name and Authority	National Cons. Status (2017)	Regional Cons. Status	Regional Criteria	National Stronghold	Regional Population	Regional Area	Regional Trend	Regional Confidence Population	Regional Confidence Trend	Regional Qualifiers	Regional Threat Assessment Notes
Hochstetter's frog	<i>Leiopelma hochstetteri</i> Fitzinger, 1861	Declining	Regionally Declining	B (2/1)	No		2000-10000 ha		Quantitative	10-30% decline	DPT, CI, CD, CR	Based on pop. size, region not a stronghold. Overall populations likely declining with habitat loss occurring (eg forestry, expanding quarries), impacts from climate change and introduced mammalian predators. Over 3 generations (30+ years), populations have likely declined. None are known to be increasing. Significant portions of some Hochstetter ESUs are within region and may be at risk, posing a threat to the overall genetic diversity of the species.
northern Great Barrier Island swimming frog	<i>Incertae cedis</i> "Northern Great Barrier Island swimming frog"	Data Deficient	Regionally Data Deficient		Yes						DPR, DPS, DPT, IE, OL, RE	2 sightings 10 years apart
green and golden bell frog	<i>Ranoidea aurea</i> (Lesson, 1829)	Introduced and Naturalised	Introduced and naturalised									
southern bell frog	<i>Ranoidea raniformis</i> (Keferstein, 1867)	Introduced and Naturalised	Introduced and naturalised									

Table 2: Species that have become extinct or may have formerly occurred in Tāmaki Makaurau / Auckland.

Species	Status	Justification
<i>Leiopelma archeyi</i>	Fairly Confident	DNA from subfossil Archey's frog material from Northland has demonstrated that they were distinct from extant Archey's frog populations. The evidence also suggests that Archey's frog would have occurred in Tāmaki Makaurau / Auckland historically.

4 Discussion

Completing regional conservation status assessments for amphibians in Tāmaki Makaurau / Auckland is a component of Auckland Council’s Biodiversity Focus Area (BFA) Programme. BFAs represent the minimum set of sites requiring targeted management of critical pressures to ensure regional viability of indigenous ecosystems, sequences and species is maintained in the region over the long-term (>50 years). Under this programme, several projects are being established to deliver on council’s obligations for regional biodiversity management.

Regional conservation status assessments will help guide the prioritisation of species for targeted management, survey, monitoring and research to ensure regional viability of indigenous species is maintained in the region over the long-term. Auckland Council staff have recently completed several workshops to identify BFAs and key pressures for herpetofauna prior to the regional conservation assessment. This work helped collate information on species’ spatial distribution, population trends and identify key pressures and research needs.

Hochstetter’s frog is present throughout the region and the taxon has undergone several changes based on genetic and morphological research. Fouquet et al. (2010) identified 13 evolutionarily significant units (ESU) for Hochstetter’s frog based on phylogenetic analysis of frog populations that was consistent with previously published variation in chromosome numbers and isozyme data (Green et al. 1993, Green 1994). ESU’s represent historically isolated, genetically distinct groupings that warrant treating them independently for conservation management purposes (Fouquet et al. 2010). In the 2013 national conservation assessment for amphibians, 11 highly distinctive genetic groups within *L. hochstetteri* were assessed (Newman et al. 2013). While these 11 ESUs were synonymised again in the latest national threat assessment, it was argued that there is enough genetic differentiation and biogeographic evidence to manage them as separate ESUs (Burns et al. 2018, Easton 2018). Therefore, Auckland Council is managing four major genetic groups of *L. hochstetteri* in the Auckland region, including Great Barrier Island / Aotea, Waitākere, Hunua, and Northland. This approach will be reviewed and adapted as new evidence arises from future research.

While work under the different projects is being shaped to improve outcomes for threatened species in the region, there is already ongoing work for herpetofauna. This includes pest animal control, survey and monitoring. Auckland Council has been supporting monitoring of Hochstetter’s frog in the Waitākere and Hunua Ranges by EcoQuest and at Te Paparahi on Great Barrier Island / Aotea by Wildlands (Wildlands 2021). At Te Paparahi, 15 100-metre transects were first established in 2012 (Herbert et al. 2014) and subsequently monitored in 2015 (Herbert and Gilbert 2015). Preliminary results suggest the population is stable but the latest monitoring round of the transects in 2021 will provide the basis for a more in-depth analysis of population trends for Hochstetter’s frog at Te Paparahi. This work will be completed as part of a MSc student project at Massey University.

A comprehensive framework and plan for management needs for threatened amphibians as well as species-led outcome monitoring are being developed under the BFA programme. This will provide more reliable population trend data, allow for adaptive management and improve outcomes for frogs in the region.

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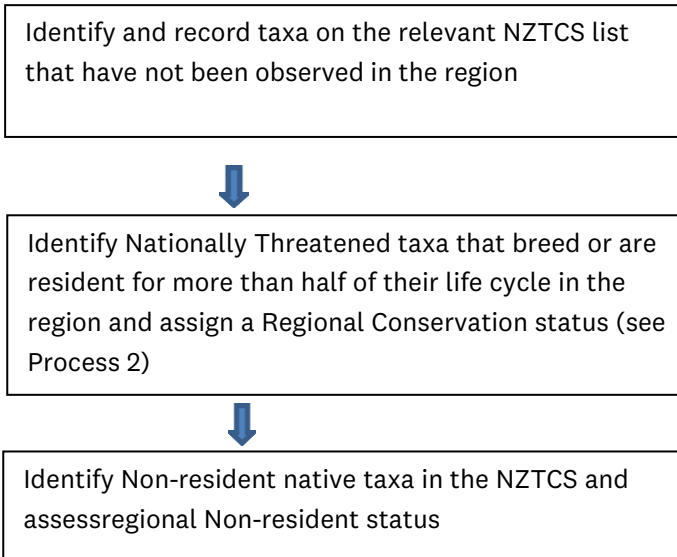
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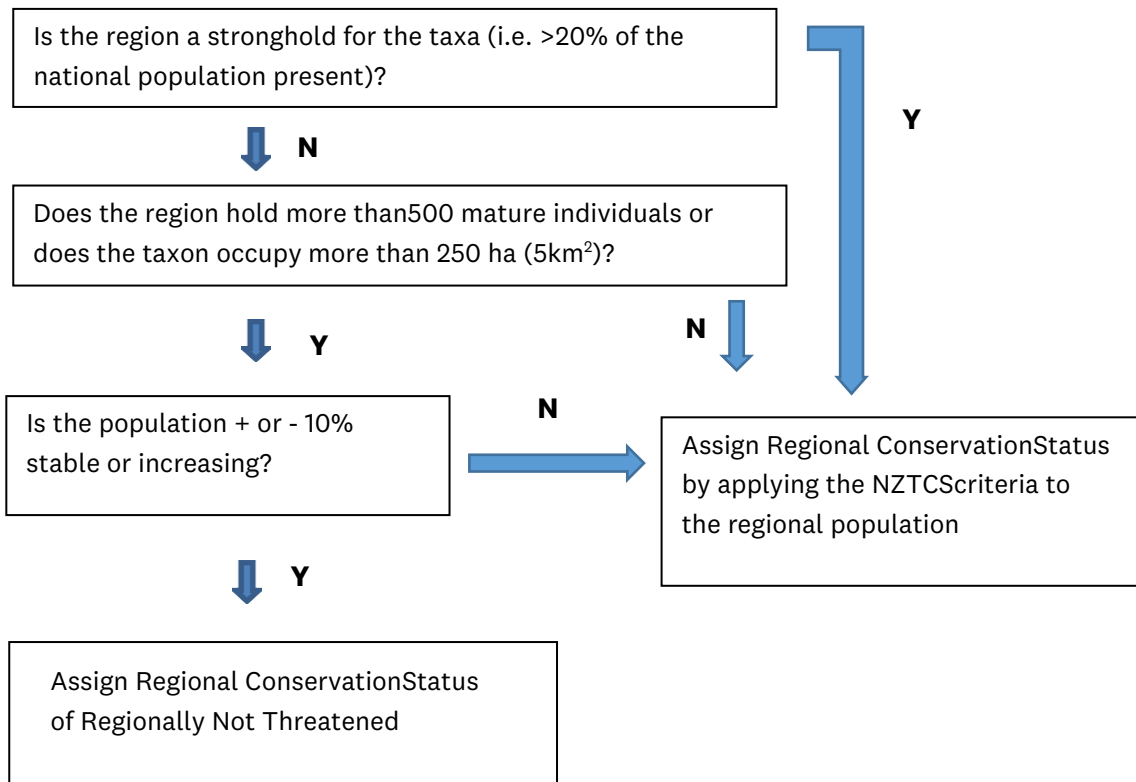
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Appendix 1: Process for determining the regional threat status of a species

Process 1: Determination of regional threat status



Process 2: Determination of strongholds and Regionally Not Threatened species



Appendix 2: List of national and regional qualifiers

Code	Qualifier	Qualifier Type	National/Regional	Description
DPR	Data Poor: Recognition	Assessment Process Qualifier	National	Confidence in the assessment is low because of difficulties in determining the identity of the 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	National	Confidence in the assessment is low because of a lack of data on population size.
DPT	Data Poor: Trend	Assessment Process Qualifier	National	Confidence in the assessment is low because of a lack of data on population trend.
DE	Designated	Assessment Process Qualifier	National	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 stock 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	National	A taxon whose natural distribution is restricted to one island archipelago (e.g. Auckland Islands) and is not part of the North or South Islands or Stewart Island/Rakiura. This qualifier is equivalent to the 'Natural' Population State value in the database.
NS	Natural State	Biological Attribute Qualifier	National	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	National	A taxon naturally confined to specific substrates, habitats or geographic areas of less than 1000 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).

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Sp	Sparse	Biological Attribute Qualifier	National	The taxon naturally occurs within typically small and widely scattered subpopulations. This qualifier can apply to any 'Threatened' or 'At Risk' taxon.
NO	Naturalized Overseas	Population State Qualifier	National	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 traversiorum</i> in the Republic of Ireland.
OL	One Location	Population State Qualifier	National	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 Island 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 subpopulations 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	National	The taxon is secure in the parts of its natural range outside New Zealand.
SO?	Secure Overseas?	Population State Qualifier	National	It is uncertain whether a taxon of the same name 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	National	It is uncertain whether the taxon is secure in the parts of its natural range outside New Zealand.
TO	Threatened Overseas	Population State Qualifier	National	The taxon is threatened in the parts of its natural range outside New Zealand.
TO?	Threatened Overseas?	Population State Qualifier	National	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	National	It is uncertain whether the taxon is threatened in the parts of its natural range outside New Zealand.

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CI	Climate Impact	Pressure Management Qualifier	National	<p>The taxon is adversely affected by long-term climate trends and/or extreme climatic events. The following questions provide a guide to using the CI Qualifier:</p> <p>Is the taxon adversely affected by long-term changes in the climate, such as an increase in average temperature or sea-level rise?</p> <p>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.</p> <p>If YES = CI Qualifier</p> <p>Is the taxon adversely affected by extreme climate events, such as a drought, storm or heatwave?</p> <p>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.</p> <p>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	National	<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. 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). Taxa qualified CD may also be PD because of the benefits of management.</p>
CR	Conservation Research Needed	Pressure Management Qualifier	National	<p>Causes of decline and/or solutions for recovery are poorly understood and research is required.</p>

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EW	Extinct In The Wild	Pressure Management Qualifier	National	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	National	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	National	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	National	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, for which the Relict qualifier may be appropriate.
PF	Population Fragmentation	Pressure Management Qualifier	National	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	National	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.

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RF	Recruitment Failure	Pressure Management Qualifier	National	<p>The age structure of the current population is such that a catastrophic decline is likely in the future.</p> <p>Failure to produce new progeny or failure of progeny to reach maturity can be masked by apparently healthy populations of mature specimens.</p> <p>Population trend qualifiers</p>
Rel	Relict	Pressure Management Qualifier	National	<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>
FR	Former Resident		Regional	<p>Breeding population (existed for more than 50 years) extirpated from region but continues to arrive as a regional vagrant or migrant. FR and RN are mutually exclusive.</p>
HR	Historical Range		Regional	<p>The inferred range (extending in any direction) of the taxon in pre-human times meets its natural limit in the region.</p>
IN	Introduced Native		Regional	<p>Introduced to the region, though not known to have previously occurred in it.</p>
NS	National Stronghold		Regional	<p>More than 20% of the national population breeding or resident for more than half their life cycle in the region.</p>
NR	Natural Range		Regional	<p>The known range (extending in any direction) of the taxon meets its natural limit in the region</p>

Conservation status of amphibian species in Tāmaki Makaurau / Auckland

RE	Regional Endemic		Regional	Known to breed only in the region.
RN	Restored Native		Regional	Reintroduced to the region after having previously gone extinct there.
TL	Type Locality		Regional	The type locality of the taxon is within the region. Ignore if the taxon is or has ever been regionally extinct.

Find out more: biodiversity@aucklandcouncil.govt.nz
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aucklandcouncil.govt.nz