Introduction to herpetofauna monitoring

Version 1.0

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Department of Conservation
Te Papa Atawhai

Introduction to herpetofauna monitoring

This section of the herpetofauna module describes the different herpetofauna functional groups to help to select the most appropriate method(s) for your study objectives. Herpetofauna is the collective term given to reptiles and amphibians. New Zealand herpetofauna comprises primarily lizards (geckos and skinks), tuatara and frogs (Jewell, 2008). The occasional migrant and vagrant turtles and sea snakes that are found in New Zealand waters are not monitored, and are not covered in this module.

It is not the intention of this introduction to cover all possible methods that may be used to count every herpetofauna population nor is it to prescribe which methods should be chosen over any other (refer to Herpetofauna Module comparative tables and decision tree to assist with this). Rather, the intent is to outline the classes of methods that have been applied to herpetofauna populations and highlight and encourage an understanding of their relative advantages and disadvantages.

New Zealand herpetofauna are generally well hidden or camouflaged and difficult to detect, thus being one of the more difficult taxonomic groups to obtain measures of distribution and population size for. Traditionally, timed searching and pitfall trapping have been the standard techniques for monitoring herpetofauna. However, there has been a recent surge of development of methods for herpetofauna, most notably the use of artificial retreats for inventory and monitoring (e.g. Hoare et al., 2009; Lettink et al., 2011). There is no single method (nor is there ever likely to be) that can be applied to all species or populations given the variety of practical and statistical problems that are encountered in different situations.

Herpetofauna inhabit a range of habitats from the alpine zone, through forests to braided rivers, wetlands and coastlines. Obviously, some monitoring techniques are more suited to particular habitats, and the way in which herpetofauna use their habitats further complicates choice of the most appropriate technique. Even the most robust of methods can be compromised by poor design, inadequate understanding of the assumptions and inappropriate application. For these reasons a series of decision trees and comparative tables have been provided to help users to choose the most suitable and cost effective way in which to answer specific inventory and monitoring questions.

We have attempted to split herpetofauna into (for the want of a better term) ‘functional groups’. These groups broadly reflect a common set of ecologies, behaviours or other features that tend to shape inventory or monitoring programmes.

1. **Native frogs** are small, nocturnal, visually cryptic and, unlike most frogs, don’t call. Three of four native species are entirely terrestrial and the fourth (*Leiopelma hochstetteri*) is semi-aquatic. The primary field technique for inventory and monitoring native frogs is systematic searches at night. Depending on objectives, systematic search data can be used to generate population estimates or indices of relative abundance, and a site occupancy approach can be taken.

2. **Introduced frogs** are small, nocturnal and visually cryptic, but at least they croak! Introduced frogs are usually counted based on calling indices at night (Toolbox method yet to be developed).

3. **Arboreal lizards** are visually cryptic and can live way up in the canopy. They comprise a mixture of diurnal (green geckos, striped skink) and nocturnal (forest geckos) species. Traditionally, systematic searches, either during the day (for diurnal species) or by spotlighting at night (for nocturnal species) have been used. However, recently, artificial retreats have been trialled for inventory and monitoring of arboreal lizards, with some success (Bell 2009). Either technique yields information that can inform indices of relative abundance, but the detection issues must be acknowledged. There is no technique available for inventory or monitoring of lizards in tall forest canopy.

4. **Terrestrial (ground-dwelling) lizards** are usually well hidden and can inhabit difficult habitats such as rocky screes. They comprise a mixture of diurnal (many skinks) and nocturnal (some skinks and geckos) species. Traditionally, pitfall trapping has been the primary technique used for inventory and monitoring of terrestrial lizards, and this remains a useful technique. However, recent development of artificial retreats and funnel traps provide cost-effective alternatives that are useful in some situations.

5. **Tuatara** are nocturnal and burrow-dwelling reptiles. Systematic searching during favourable weather conditions is the technique primarily used for inventory and monitoring of tuatara; however, complete counts may be possible in discrete areas (using a combination of night searching and examining burrow occupancy using scopes).

There are, of course, many useful summaries of count methods to be found outside this Toolbox (e.g. Thompson et al. 1998) and readers are encouraged to consult this material and become familiar with the limitations of count methods as they apply to herpetofauna populations.

Decision tree

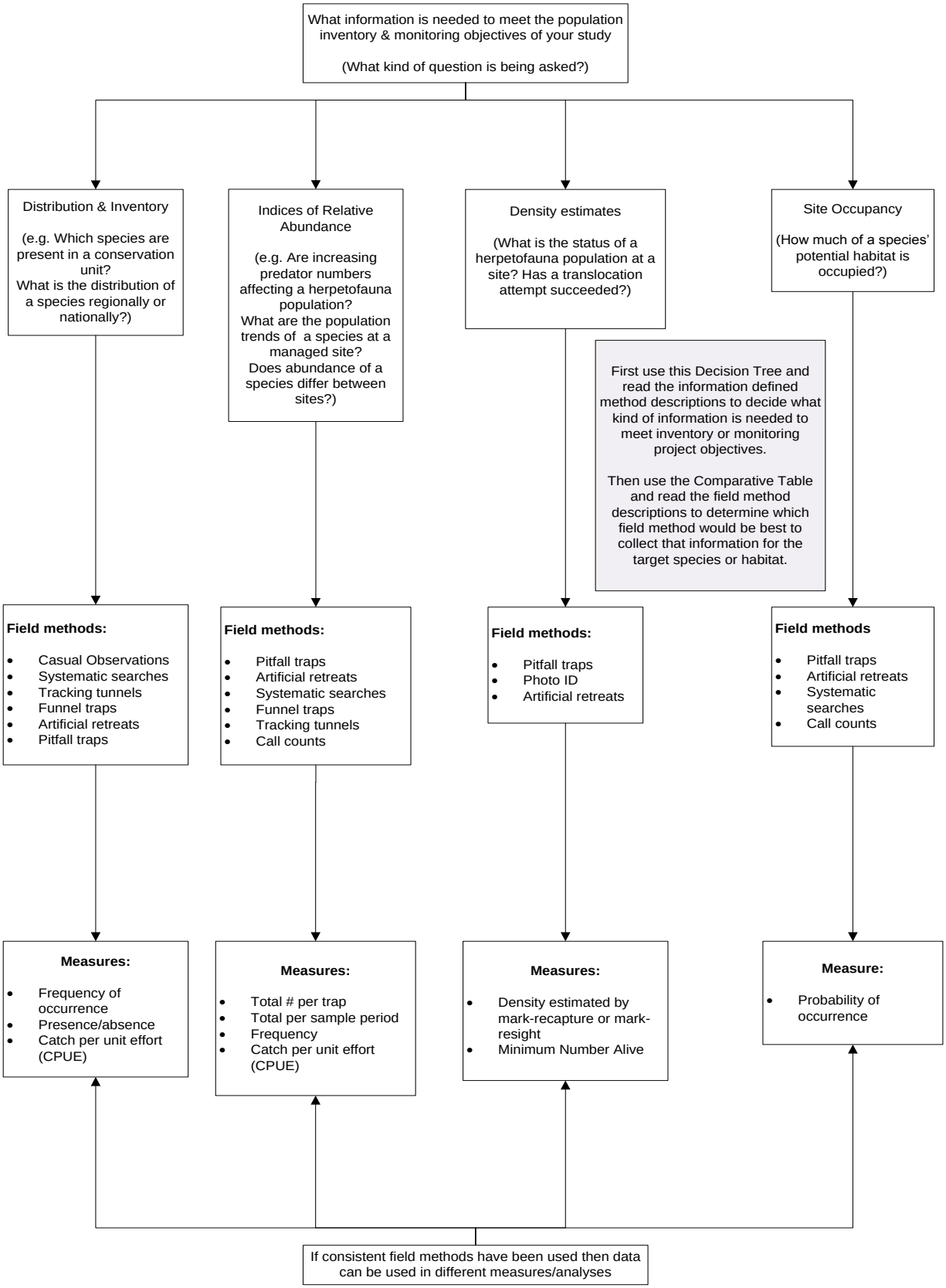

Figure 1. Herpetofauna monitoring decision tree.

Comparative tables

Terrestrial (ground-dwelling) lizards

Table 1. Recommended techniques for the inventory and monitoring of terrestrial (ground-dwelling) lizards. **Method precision** (relative to objectives): ✓✓✓ Good; ✓✓ Medium; ✓ Poor; ✗ Not Recommended; **–** Not Applicable. **Resources:** L = Low; M = Medium; H = High. Methods that are blacked out are under development.

	Inventory objectives*	Resources			Monitoring objectives†			Resources		
Method	Suitability for inventory	Equipment costs	Personnel costs	Skills required	Surveillance[1]	Status & trend[2]	Management[3]	Equipment costs	Personnel costs	Skills required
Pitfall traps	✓✓	L	M	M	✓	✓✓✓	✓✓✓	L	M	M
Systematic searches	✓✓✓	L	M	H	✓✓	✓✓	✓✓	L	M	H
Artificial retreats	✓✓	L	L	H	✓✓	✓✓✓	✓✓	L	L	H
Funnel traps	✓✓	M	M	M	✓	✓	✓	M	M	M
Tracking tunnels										
Photo ID										
Call counts										

* Inventory is a one-off survey or assessment with no intention to re-measure. If inventory of a site is repeated in the future this can be considered monitoring. Typical inventory objectives include: What species are present at a site and how are they distributed over a landscape? What are the species habitat relationships? What is the wildlife value/significance of an area (SSWI, etc)? Is this a baseline survey? Interpretation of results must be based on the understanding that these are single surveys.

†Monitoring assesses change or trend over time and requires re-measurement of parameters at some pre-determined frequency. Typical monitoring objectives include:

1. What species have moved into an area? Have range extensions occurred for a species of interest (e.g. monitoring for biosecurity risk—spread of rainbow skinks and red-eared slider turtles)?
2. What is the population abundance or density of a species or community? Is this stable over time? What are the population trends? Does this relate to habitat use?
3. Do population estimates of density and abundance change as a result of management action? Over what time-scale does this occur? Has a species translocation succeeded? Has management been effective? Has species composition altered as a result of management? What are the visitor impacts?

Arboreal lizards

Table 2. Recommended techniques for the inventory and monitoring of arboreal lizards. **Method precision** (relative to objectives): ✓✓✓ Good; ✓✓ Medium; ✓ Poor; ✗ Not Recommended; **–** Not Applicable. **Resources:** L = Low; M = Medium; H = High. Methods that are blacked out are under development.

	Inventory objectives*	Resources			Monitoring objectives†			Resources		
Method	Suitability for inventory	Equipment costs	Personnel costs	Skills required	Surveillance[1]	Status & trend[2]	Management[3]	Equipment costs	Personnel costs	Skills required
Pitfall traps	×	L	M	M	×	×	×	L	M	M
Systematic searches	✓✓✓	L	M	H	✓✓	✓✓	✓✓	L	M	H
Artificial retreats	✓✓	L	L	H	✓✓	✓✓	✓✓	L	L	H
Funnel traps	✓✓	M	M	M	✓	✓	✓	M	M	M
Tracking tunnels										
Photo ID										
Call counts										

* Inventory is a one-off survey or assessment with no intention to re-measure. If inventory of a site is repeated in the future this can be considered monitoring. Typical inventory objectives include: What species are present at a site and how are they distributed over a landscape? What are the species habitat relationships? What is the wildlife value/significance of an area (SSWI, etc)? Is this a baseline survey? Interpretation of results must be based on the understanding that these are single surveys.

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3. Do population estimates of density and abundance change as a result of management action? Over what time-scale does this occur? Has a species translocation succeeded? Has management been effective? Has species composition altered as a result of management? What are the visitor impacts?

Tuatara

Table 3. Recommended techniques for the inventory and monitoring of tuatara. **Method precision** (relative to objectives): ✓✓✓ Good; ✓✓ Medium; ✓ Poor; ✗ Not Recommended; **–** Not Applicable. **Resources:** L = Low; M = Medium; H = High. Methods that are blacked out are under development.

	Inventory objectives*	Resources			Monitoring objectives†			Resources		
Method	Suitability for inventory	Equipment costs	Personnel costs	Skills required	Surveillance[1]	Status & trend[2]	Management[3]	Equipment costs	Personnel costs	Skills required
Pitfall traps	×	L	M	M	×	×	×	L	M	M
Systematic searches	✓✓✓	L	M	M	✓✓✓	✓✓✓	✓✓✓	L	M	M
Artificial retreats	×	L	L	M	×	×	×	L	L	M
Funnel traps	×	M	M	M	×	×	×	M	M	M
Tracking tunnels										
Photo ID										
Call counts										

* Inventory is a one-off survey or assessment with no intention to re-measure. If inventory of a site is repeated in the future this can be considered monitoring. Typical inventory objectives include: What species are present at a site and how are they distributed over a landscape? What are the species habitat relationships? What is the wildlife value/significance of an area (SSWI, etc)? Is this a baseline survey? Interpretation of results must be based on the understanding that these are single surveys.

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2. What is the population abundance or density of a species or community? Is this stable over time? What are the population trends? Does this relate to habitat use?
3. Do population estimates of density and abundance change as a result of management action? Over what time-scale does this occur? Has a species translocation succeeded? Has management been effective? Has species composition altered as a result of management? What are the visitor impacts?

Native frogs

Table 4. Recommended techniques for the inventory and monitoring of native frogs. **Method precision** (relative to objectives): ✓✓✓ Good; ✓✓ Medium; ✓ Poor; ✗ Not Recommended; **–** Not Applicable. **Resources:** L = Low; M = Medium; H = High. Methods that are blacked out are under development.

	Inventory objectives*	Resources			Monitoring objectives†			Resources		
Method	Suitability for inventory	Equipment costs	Personnel costs	Skills required	Surveillance[1]	Status & trend[2]	Management[3]	Equipment costs	Personnel costs	Skills required
Pitfall traps	×	L	M	M	×	×	×	M	M	M
Systematic searches	✓✓✓	L	M	H	✓✓✓	✓✓✓	✓✓✓	L	M	H
Artificial retreats	×	L	L	M	×	×	×	L	L	H
Funnel traps	×	M	M	M	×	×	×	M	M	M
Tracking tunnels										
Photo ID										
Call counts										

* Inventory is a one-off survey or assessment with no intention to re-measure. If inventory of a site is repeated in the future this can be considered monitoring. Typical inventory objectives include: What species are present at a site and how are they distributed over a landscape? What are the species habitat relationships? What is the wildlife value/significance of an area (SSWI, etc)? Is this a baseline survey? Interpretation of results must be based on the understanding that these are single surveys.

†Monitoring assesses change or trend over time and requires re-measurement of parameters at some pre-determined frequency. Typical monitoring objectives include:

1. What species have moved into an area? Have range extensions occurred for a species of interest (e.g. monitoring for biosecurity risk—spread of rainbow skinks and red-eared slider turtles)?
2. What is the population abundance or density of a species or community? Is this stable over time? What are the population trends? Does this relate to habitat use?
3. Do population estimates of density and abundance change as a result of management action? Over what time-scale does this occur? Has a species translocation succeeded? Has management been effective? Has species composition altered as a result of management? What are the visitor impacts?

Introduced frogs

Table 5. Recommended techniques for the inventory and monitoring of introduced frogs. **Method precision** (relative to objectives): ✓✓✓ Good; ✓✓ Medium; ✓ Poor; ✗ Not Recommended; **–** Not Applicable. **Resources:** L = Low; M = Medium; H = High. Methods that are blacked out are under development.

	Inventory objectives*	Resources			Monitoring objectives†			Resources		
Method	Suitability for inventory	Equipment costs	Personnel costs	Skills required	Surveillance[1]	Status & trend[2]	Management[3]	Equipment costs	Personnel costs	Skills required
Pitfall traps	×	M	M	M	×	×	×	M	M	M
Systematic searches	✓✓	L	M	H	✓✓	✓✓	✓✓	L	M	H
Artificial retreats	×	L	L	M	×	×	×	L	L	M
Funnel traps	×	M	M	M	×	×	×	M	M	M
Tracking tunnels										
Photo ID										
Call counts[4]										

* Inventory is a one-off survey or assessment with no intention to re-measure. If inventory of a site is repeated in the future this can be considered monitoring. Typical inventory objectives include: What species are present at a site and how are they distributed over a landscape? What are the species habitat relationships? What is the wildlife value/significance of an area (SSWI, etc)? Is this a baseline survey? Interpretation of results must be based on the understanding that these are single surveys.

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2. What is the population abundance or density of a species or community? Is this stable over time? What are the population trends? Does this relate to habitat use?
3. Do population estimates of density and abundance change as a result of management action? Over what time-scale does this occur? Has a species translocation succeeded? Has management been effective? Has species composition altered as a result of management? What are the visitor impacts?
4. Note that call counts is the standard method for inventory and monitoring of introduced frogs. This is a well-established method, but not yet developed for the I & M Toolbox.

References and further reading

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