Science for Saving Species

Research findings factsheet

Project 1.2

Threatened Species Recovery Hub

National Environmental Science Programme

Use of artificial habitat in herpetofauna (reptile and amphibian) monitoring

In brief

Wildlife conservation managers need effective survey methods to be able to detect and understand species population trends over time. Common methods of surveying both ground based and arboreal herpetofauna (reptiles and amphibians) include active searches and checking around and under artificially placed habitat, such as railway sleepers, corrugated iron and roofing tiles.

This research tested and compared herpetofauna detection rates from active searches with the detection rates at common types of terrestrial artificial habitat and at novel arboreal artificial habitat across the Endangered box gum grassy woodlands of temperate south-eastern Australia.

Our findings demonstrate that combining active searches with the use of a range of artificial habitat (timber railway sleepers, corrugated iron and artificial bark) yielded the highest detection rates for herpetofauna.

Using artificial habitat can also address common survey issues of standardisation of methodologies for landscapes that do not contain the same range of habitat elements.

Background

Effective wildlife management depends on a detailed knowledge of where species are to be found, their preferences for habitat and if their populations are going up, down or are stable. Determining this depends on selecting an appropriate survey technique that can provide robust information on the presence and abundance of species.

There are well established methods for surveying reptile and amphibian abundance and movement patterns in terrestrial environments. However, they are often labour-intensive methods such as installing pitfall and funnel traps, or time-consuming active searches.

Active searching is a method of searching available habitat for herpetofauna by, for example, peeling back bark, lifting slabs or fragments of rock, turning logs, or raking through leaf litter. These methods can damage these fragile parts of the landscape if care is not taken, and repeat-visit, long-term monitoring of the same sites may eventually destroy critical microhabitat and reduce the overall quality of habitat for fauna. For example, damaged bark may take a tree years to replace. Such damage can also effectively reduce the amount of available searchable habitat in future surveys, and negatively influence the results of long-term monitoring programs as a consequence.

Another concern with active searches, particularly on large spatial studies in modified landscapes, is how to ensure the standardisation of survey methodology across study sites with different habitat elements. A lack of standardisation can make the meaningful comparison of sites difficult.

One solution to the issue of standardising the survey of herpetofauna is to deploy artificial habitat. In the past, the most commonly deployed artificial habitat has been terrestrial (ground based), resulting in low detection rates for arboreal (tree-dwelling) species. Our recent research also deployed a new technique – artificial bark habitats to assist detection of arboreal herpetofauna.

Bark study - artificial bark. Image: Daniel Florance

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Christinus marmoratus *on artificial bark.*
Image: Daniel Florance

What the research looked like

This research set out to test and compare the efficacy of using artificial habitat – terrestrial and arboreal – and active searches to detect herpetofauna (frogs and reptiles). There had been very little previous research focussed on this topic, so we were keen to address the knowledge gap with field testing and surveys. We consider that our results are relevant to any long-term ecological monitoring programs that include herpetofauna.

We compared long-term results for detecting herpetofauna species in artificial terrestrial and arboreal habitat with the results of active searches of natural habitat. The research was conducted in the Endangered box gum grassy woodlands of temperate south-eastern Australia, but has relevance to herpetological surveys more broadly.

What we did

We established survey sites within box gum grassy woodland in New South Wales and Victoria. Sites were located on private land and stock reserves, and in conservation reserves and state forests. Each site consisted of a 200 m x 50 m search area.

At each site we placed two arrays of artificial habitat 100m apart, which consisted of:

Terrestrial habitat - four 1.2m timber railway sleepers, four terracotta or concrete roofing tiles and two stacked sheets of corrugated roofing iron.

In a separate study we also investigated the efficacy of artificial bark at a subset of survey sites.

Arboreal bark habitat - non-toxic, closed-cell foam attached to the trunks of the dominant eucalypt species in these woodlands, yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*E. blakelyi*).

A 20-minute active search of natural habitat was undertaken at each site, which included raking through leaf litter, lifting logs and surface rocks, and inspecting exfoliating bark of mature trees. An additional 5 minutes was spent at each site inspecting artificial terrestrial refuge arrays.

To test terrestrial artificial habitat, each site was surveyed every two years, for between four years and 19 years. We conducted 5808 site visits during the study.

To test arboreal artificial habitat, each site was surveyed annually for 4 years.

We compared the herpetofauna detection and abundance survey results from the artificial habitat arrays with the results of the active searches of natural habitat at these sites.

Bark study site. Image: Daniel Florance

Key findings

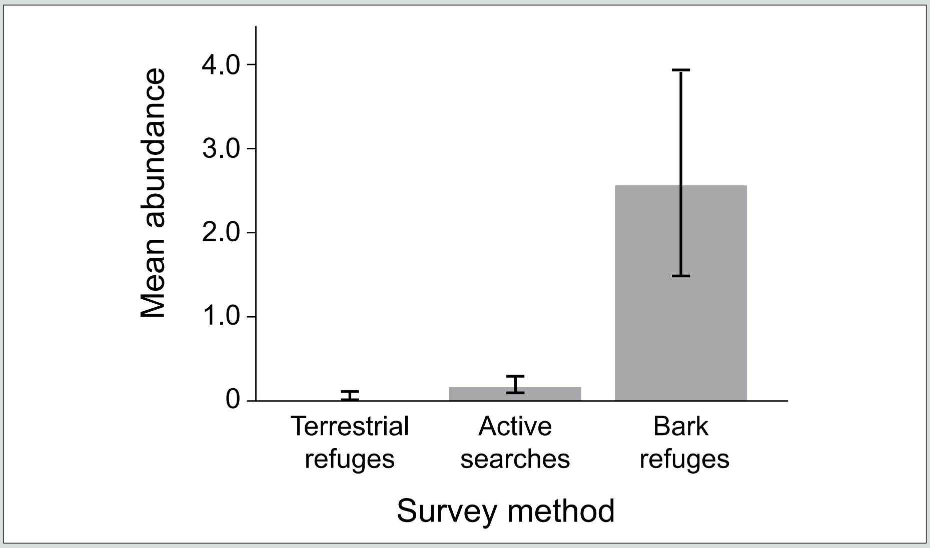
The results show that artificial habitat is effective for the detection of many species of herpetofauna. Our key finding was that active searches combined with terrestrial artificial refuges detected the highest diversity of herpetofauna species. However, both methods detected supplementary species.

Of all artificial habitat, timber railway sleepers were the most effective for detecting frog species while roofing tiles were the least effective. In particular timber refuges were effective for detecting several burrowing species, whereas active searches were effective for detecting habitat generalists. Combining active searches with surveys at the terrestrial timber railway sleepers yielded the highest detection of amphibians across sites.

Over the study period we detected 3970 individuals from 18 frog species. The spotted marsh frog (*Limnodynastes tasmaniensis)* was the most abundant species, accounting for 67.75% of all observations. Frog detection rates were also positively associated with above average rainfall.

Corrugated iron was up to five times more effective for detection of reptile species than tiles or timber, and a combination of active searching and corrugated iron provided supplementary species detections, yielding the highest species richness.

Terrestrial artificial habitat and active searches were not effective for detecting arboreal species, such as the southern marbled gecko (*Christinus marmoratus*).



Mean abundance (95% credible interval) of the southern marbled gecko, Christinus marmoratus, *using three different survey methods between 2013 and 2016*

The most effective detection method for this species was artificial bark. Artificial bark habitat detected an average of 132 times more individuals of the gecko than did terrestrial artificial refuges, and 20 times more individuals than were found during active searches.

The closed-cell foam material used as artificial bark in this research was weather-resistant in field conditions. Damage caused by birds and invertebrates was evident on some foam, but this did not prevent reptiles from using it. The foam remained viable throughout the four-year deployment period.

This demonstrates the suitability of the material for short- to medium-term use. Longer-term studies may require a more robust material, and this needs further testing.

More marbled geckos were detected on larger trees (mean diameter = 78cm). Therefore, larger trees with thick bark located in timbered areas, regardless of the tree species investigated (Blakely's red gum and yellow box), may be the best trees to target for artificial-bark installation.

Marbled geckos took some time to initially colonise artificial bark, but by 12 months after installation the detection rates were stable.

RIGHT: Artificial substrates - terrestrial array. Image: Daniel Florance

Further Information

Michael, D.R., Blanchard, W., Scheele, B.C. and Lindenmayer, D.B. (2019). Comparative use of active searches and artificial refuges to detect amphibians in terrestrial environments. *Austral Ecology*, 44, 327-338. https://doi.org/10.1111/aec.12677

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Michael, D.R., Cunningham, R.B., Donnelly, C.F. and Lindenmayer, D.B. (2012). Comparative use of active searches and artificial refuges to survey reptiles in temperate eucalypt woodlands. *Wildlife Research*, 39, 149-162. https://doi.org/10.1071/WR11118

Recommendations

Herpetofauna detection and census surveys can be improved by the addition of artificial habitat. Artificial habitats have the following advantages:

- Detection of the highest diversity of herpetofauna species when combined with active searches.
- Provides a standardised survey technique across sites that may not contain the same habitat elements.
- Easily repeatable.
- Non-destructive of habitat - an important consideration for long-term, repeat-visit study sites.
- Presents little risk of injury to the species surveyed.
- Cost effective and low-labour compared to techniques such as trapping (e.g., pitfall trapping, which requires installation, maintenance, opening, closing and regular checking of traps).

Depending on the target species, certain combinations of the different artificial habitats will yield better detections. The particular ones deployed should be tailored to reflect the needs of the study.

If standardisation of the survey method and minimisation of habitat damage are important considerations, then timber railway sleepers on their own are generally the most appropriate method for amphibians, corrugated iron for terrestrial reptiles and artificial bark for arboreal species.

The artificial habitats need to be maintained for long-term studies, and may need to be regularly replaced or repositioned as they can be disturbed by livestock or wildlife poachers, or damaged by strong winds. There is also establishment and colonisation time required for artificial habitat that needs to be considered.

Arboreal herpetofauna

For studies targeting arboreal species, artificial bark is the best survey method. This study was conducted in south-east temperate woodlands where the diversity of arboreal herpetofauna species is limited, but the technique is likely to be of high value in habitats that have a richer species diversity, such as northern Australia.

Our results suggest that it takes approximately 12 months before detection of arboreal species remains stable under artificial bark, so survey schedules should factor in that herpetofauna may take some time to colonise artificial habitat.

Amphibians

Detection of terrestrial amphibians is maximised when active searches are used in conjunction with surveys at timber railway sleepers.

Timber refuges may prove to be more cost-effective in the long-term for detecting frogs in any given area as the time required to inspect refuges is considerably less than the time required to search for frogs in their terrestrial habitat, an important consideration in environmental assessments.

Reptiles

Complementary methods of corrugated iron and active searches detects the most reptile species. Corrugated iron is a good option for longer-term surveys, as it can be cheaply sourced, and is not as susceptible to livestock damage or decay as other materials. However, corrugated iron can be disturbed by wind or livestock and may require periodic resetting.

Artificial bark in habitat restoration

This research has indicated that artificial bark may be suitable as temporary habitat in restoration activities for arboreal herpetofauna species, especially in regrowth woodland sites where stem density is high but tree diameter is small and bark thickness is low.

The targeted installation of artificial bark in areas lacking large trees with suitable bark habitat could improve habitat connectivity and aid species dispersal through fragmented landscapes.

The closed-cell foam material used as artificial bark in this research remained viable throughout a four-year deployment period, but longer-term deployment may require a more robust material.

Further Information Daniel Florance – Daniel.florance@anu.edu.au

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