Science for Saving Species

Research findings factsheet

Project 3.3.6

Threatened Species Recovery Hub

National Environmental Science Programme

Identifying translocation sites for the Critically Endangered northern corroboree frog

In brief

The chytrid fungus pathogen has driven severe declines of amphibian diversity globally. In Australia, over 40 species have experienced declines.

The Critically Endangered northern corroboree frog is at high risk of extinction, primarily due to chytrid fungus. Corroboree frogs are restricted to high elevation regions of New South Wales and adjacent areas of the Australian Capital Territory. However, in some sites, the frogs appear to be coexisting with chytrid.

Corroboree frogs have been successfully reproducing in captivity, and captive-bred frogs provide a source for experimental translocations into the natural environment, to seed and supplement new wild populations.

We aimed to inform management of the northern corroboree frog by identifying the characteristics of environments that support frog population persistence in the presence of chytrid fungus. We also aimed to locate sites that are potential candidates for translocations.

We found that certain environmental variables and frog maturation rates are strongly related to the frog population's ability to coexist with chytrid fungus. Frogs at lower elevation are mature earlier, meaning that they can recruit faster. We identified habitats that hosted frog species with similar habitat requirements, had low threat levels and low risk of drought-associated reproductive failure. The best candidate site we identified may be used for a translocation trial, and our methods used to identify this site may be useful for other similarly threatened frog species.

Background

The introduced pathogen, chytrid fungus (*Batrachochytrium dendrobatidis*) has caused the most severe, disease-driven loss of vertebrate biodiversity ever recorded. Over 500 amphibian species have been impacted around the globe, and chytrid has caused declines in over 40 Australian frog species. As a result, some species have become extinct. Without conservation interventions, other species like the Critically Endangered northern corroboree frog (*Pseudophryne pengilleyi*) are at high risk of extinction.

Captive breeding programs paired with translocations are common management responses to re-establish and supplement wild populations of frogs at very high risk of extinction. While captive breeding has been generally successful, many translocation projects have failed, in part due to the continued severe impact of chytrid fungus. The limited success of previous projects highlights the clear need for research to help develop new strategies for translocations of frog species impacted by chytrid fungus.

The northern corroboree frog's natural distribution is restricted to high elevation areas of New South Wales and the Australian Capital Territory in south-eastern Australia. Over the past two decades, the species has experienced severe declines due to chytrid fungus and it has become locally extinct across large areas of its historical range. While the general decline trend is continuing, two sites are maintaining larger populations. The long-term viability of these populations remains unclear but their persistence indicates that the species has some capacity to coexist with chytrid fungus.

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LEFT: The Critically Endangered northern corroboree frog has rapidly declined in recent decades and is highly threatened by chytrid fungus. Image: Adam Parsons

Background (continued)

Along with a range of conservation actions for the species, a comprehensive, multi-institutional captive breeding program has been developed. The corroboree frog has been successfully bred in captivity with a consistent and high reproductive output, securing captive populations. Captive-bred populations now provide an opportunity for experimental translocations, with the objective of creating self-sustaining wild populations.

Past reintroductions of captive-bred northern corroboree frogs have focused on returning species to areas where they have become locally extinct. This approach has seen limited success, with severe impacts from chytrid fungus appearing to contribute to low survival of the translocated frogs.

We urgently need to develop, trial and evaluate new translocation strategies to establish self-sustaining wild populations of the northern corroboree frog and many other chytrid-impacted species.

Research aims

This project aimed to directly inform the management of the northern corroboree frog in the Australian Capital Territory, with the goal of re-establishing self-sustaining wild populations.

We aimed to do this by:

1. Improving our understanding of the characteristics of refuges that support northern corroboree frog populations persisting with chytrid fungus;
2. Developing new approaches to re-establishing wild populations from the captive breeding program; and
3. Identifying and evaluating suitable candidate sites for translocations of northern corroboree frogs.

What we did

This research was conducted in sub-alpine and montane ecosystems in the Australian Capital Territory and southern New South Wales, including in Namadgi and Kosciuszko National Parks. The project ran from early 2018 to mid-2021.

Understanding refugia

To improve our understanding of the characteristics of refuge habitats, we conducted a literature review on the environmental context of frog declines associated with chytrid fungus. This helped us to identify the mechanisms that enable northern corroboree frogs to coexist with chytrid fungus.

We conducted field research investigating the underlying causes of varying population declines for corroboree frogs. We also examined the relationship between frog persistence and site elevation.

Identifying translocation sites

We evaluated potential candidate translocations sites, within or immediately adjacent to the historical range of the northern corroboree frog, which encompass cool, temperate, upland areas.

Using satellite imagery, we assessed potential candidate sites for translocations. For each site, we considered a range of factors, including site elevation. We then conducted on-ground surveys at candidate sites. During field surveys, we evaluated site habitat suitability and quality and identified characteristics that were comparable with those of sites where northern corroboree frogs persist.

We also surveyed other frog species at each site, focusing on locating a key surrogate species, Bibron's toadlet (*Pseudophryne bibronii*). Bibron's toadlet is closely related to, and shares similar habitat requirements with, corroboree frogs.

Evaluation of candidate sites

At sites where habitat extent and quality appeared suitable and Bibron's toadlet was present, we then evaluated the suitability of the local environment. We compared environmental variables between the shortlisted candidate sites, historically occupied sites and sites where the species persists.

The final step in evaluating candidate sites involved detailed hydrological monitoring at shortlisted candidate sites. Corroboree frogs rely on ponds to breed. We took photographs daily throughout the 2019 breeding season at both refuge sites and candidate sites, to track the duration of time that the essential pond habitats endured.

LEFT: At some sites at lower elevation, the northern corroboree frog appears to be persisting while chytrid is also present in the environment. Image: Damian Esquerre.

RIGHT: Northern corroboree frog habitat. Image: Ben Scheele

Key findings

Refugia from chytrid fungus

We found that environmental conditions and frog maturation rates can strongly mediate the impact of chytrid fungus and the ability of frog populations to coexist with the pathogen.

Northern corroboree frogs no longer persist at elevations higher than 1500 m above seal level. This indicates that population dynamics such as earlier maturation at lower elevations play an important role in allowing frogs to persist in the presence of chytrid fungus.

Identification and evaluation of translocation sites

We identified candidate sites immediately adjacent to the species' historical range. Field surveys confirmed that these sites had suitable habitat and Bibron's toadlet was present (a species with similar habitat requirements to the northern corroboree frog).

Chytrid fungus was detected at all sites.

Comparing the environmental attributes of sites revealed that the candidate sites are nested within the historically occupied niche and overlap with sites where northern corroboree frogs are persisting. Candidate sites have similar temperature and elevation profiles to the persistent sites but receive lower rainfall. Lower rainfall could potentially benefit corroboree frogs by reducing environmental suitability for chytrid fungus. To be beneficial, however, the site must maintain ponds for long enough to enable frog breeding.

We identified sites with suitable pond durations during the 2019 breeding season, despite monitoring coinciding with a severe drought period. The continued presence of water at these sites suggested that the sites have some resilience to drought and climate change.

The key site-level considerations we identified to increase translocation success of northern corroboree frogs include:

1. Habitat suitability:

- Suitable habitat requirements, including appropriate habitat extent
- Absence, or mitigation of threats, such as the impact of feral horses, which can degrade northern corroboree frog-breeding habitat through grazing and trampling
- Maintenance of suitable ponds during drought conditions, to provide suitable breeding habitat in years with both high and low rainfall.

2. Suitability for pathogens, and/or species resilience:

- Environmental conditions that support the coexistence of northern corroboree frogs with chytrid fungus
- Favourable population dynamics, e.g., lower-elevation sites where frogs can reach maturity earlier and recruit faster.

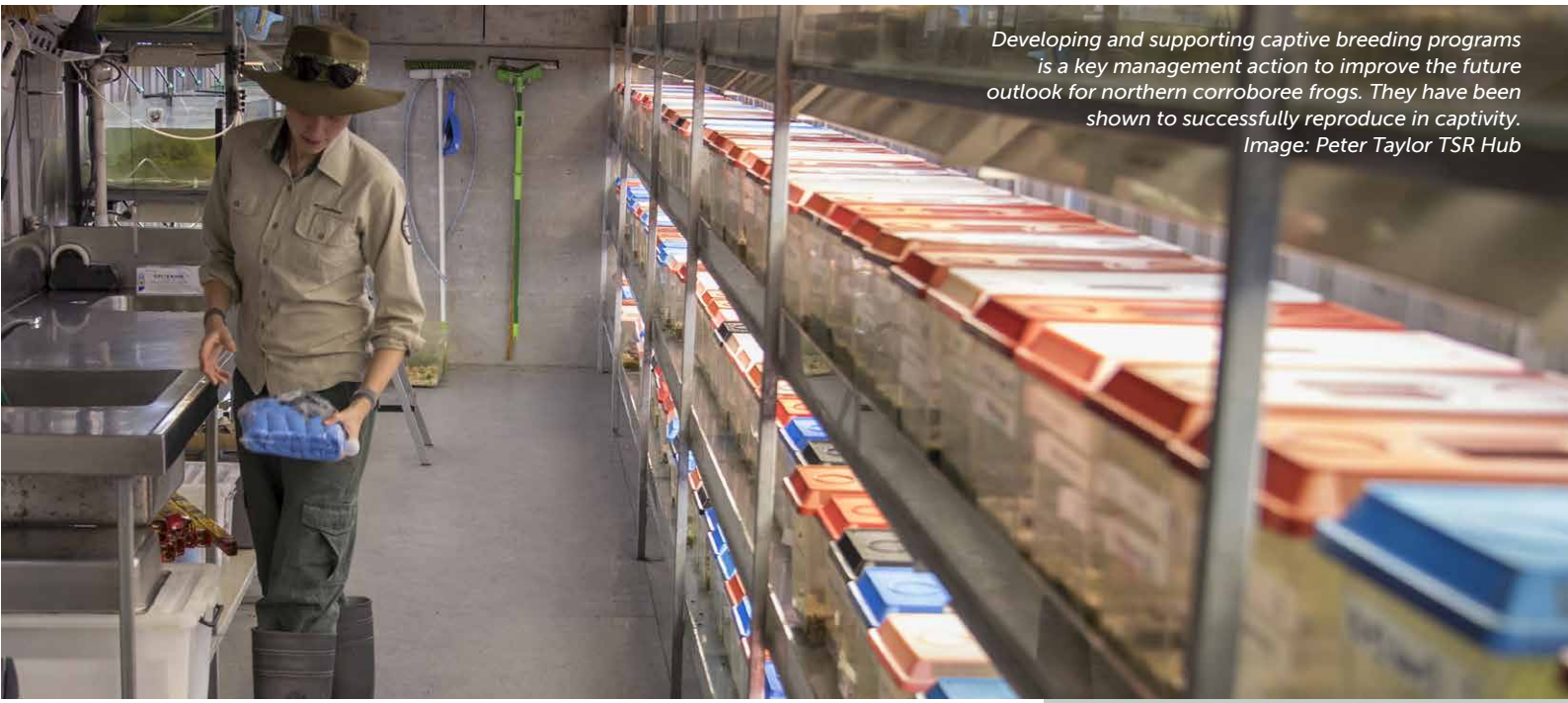
LEFT: A remote camera set up to monitor pond water levels. Ponds must be maintained for long enough to support frog breeding and need to persist in drying climatic conditions. Image: Ben Scheele

Implications and recommendations

Our screening process identified a highly suitable candidate site. This site has high habitat suitability with conditions that will promote persistence of the species in the presence of chytrid fungus, as well as the ability to maintain ponds during drought conditions.

The next step is to design and undertake an experimental translocation to the top-ranked candidate site with careful consideration of release tactics (e.g., timing and number of individuals) and monitoring. A successful translocation could increase the likelihood of achieving additional, self-sustaining wild populations of the northern corroboree frog and improve the outlook for the species' long-term persistence.

Re-establishing wild populations of frogs that are threatened by chytrid fungus is a global conservation management challenge. The process and factors explored here are common to other frog species that are threatened by chytrid fungus. Therefore, our research may be applicable for other chytrid threatened frog species, in particular those with established or planned captive breeding and reintroduction programs such as the Baw Baw frog (*Philoria frosti*). Incorporating research on understanding refugia, including habitat suitability and the suitability for pathogens, and species resilience to pathogens can be used to strategically search for and evaluate potential translocations sites for threatened frogs.



Developing and supporting captive breeding programs is a key management action to improve the future outlook for northern corroboree frogs. They have been shown to successfully reproduce in captivity. Image: Peter Taylor TSR Hub

Cited material

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Further Information

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National Environmental Science Programme

Cite this publication as NESP Threatened Species Recovery Hub. 2021. Identifying translocation sites for the Critically Endangered northern corroboree frog, Project 3.3.6 research findings factsheet.

This project is supported through funding from the Australian Government's National Environmental Science Program.