Western spotted frogs in the Wheatbelt

In the wheat and sheep farming country of WA's Wheatbelt, a noisy little frog is defying the odds and providing a soundtrack to the night from small, isolated temporary ponds made possible by autumn rains.

by Robert Davis and Cheryl Lohr

If you're lucky enough to find yourself in the semi-arid parts of WA's south-west from March to April and there's been some rain, you should go out at night and listen carefully. If you're even luckier, you may hear a shrill 'whoop, whoop' call that doesn't stop all night. If you brave the darkness and track down the source of this strange call, you'll likely end up at a dry small wetland, roadside ditch, dam, salinity drain or old quarry.

Looking around on the ground may reveal a large mound of freshly turned up sand with no obvious entrance hole. The calling has probably stopped by now, so stand still, turn off your torch and look at the stunning southern skies and enjoy the stars and soon enough, the calls will start up again, one at first and then one by one, adding to a symphony until the air around you is pulsing. Congratulations, you have found yourself a thriving breeding population of western spotted frogs!

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Main Western spotted frogs.
Photo – Jiri Lochman

Above Western spotted frog emerge to forage on warm wet nights outside the breeding season.

Above right A granite outcrop breeding site near Kellerberrin. The larger salt river in the foreground separates this site from populations in the north.
Photos – Robert Davis

GOOD CALL

This species has a unique breeding biology. Males arrive shortly after the first autumn rains between March and May. They excavate a burrow in a sandy depression and begin calling. If successful in attracting a mate, a foamy egg mass is deposited in the base of the burrow in the moist soil.

At this stage, the frogs leave the burrow. The eggs develop to some degree within the protection of the jelly-like foam surrounding the eggs. If all goes well, the season breaks, and rains fill the breeding sites with water. The flooded burrows collapse, the eggs hatch and complete their development as free-swimming tadpoles.

THE FIGHT FOR SURVIVAL

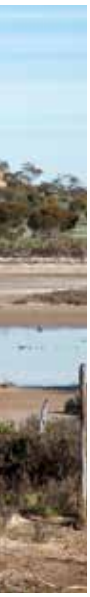
The western spotted frog is distributed widely throughout the semi-arid region of Western Australia from near Kalbarri in the north-west to Esperance in the south-east. Much of this distribution coincides with the wheat-sheep farming region of Western Australia, and accordingly, much of the range of this species has been subject to habitat loss, fragmentation and salinisation as European settlers cleared 140,000 square kilometres in less than 150 years.

In most areas of the Wheatbelt, less than 10 per cent of the native vegetation now remains, mostly as small, isolated remnants. The value of the approximately 1000 small nature reserves, parks, reserves and private property bush cannot be underestimated as they provide valuable protection for animals like frogs and areas from which they can recolonise when conditions are favourable. Such rapid and widespread landscape change has had a significant impact on local fauna and flora.

Amphibians are the world's most threatened class of vertebrate and there has been great concern about both the cause and scale of declines of amphibians globally. The most significant causes of decline are the chytrid fungus, climate change and habitat loss. Habitat loss is the leading cause for the decline of Australian frogs, yet we have a very limited understanding of how frogs persist in fragmented landscapes, or even if they do.

PREDICTING THE FUTURE

To understand the impact of a drying climate and habitat loss, a comprehensive dataset is needed that can be used to model population processes and predict the future survival of frogs on a landscape scale. Over six years, starting during his PhD at the University of Western Australia in 1999, Robert Davis studied 30 populations of the western spotted frog *Heleioporus albopunctatus* in the Central Wheatbelt region of WA near Kellerberrin.



He installed pitfall traps to capture migrating adults during the autumn breeding season. Adults were marked so he knew which adults survived from year to year. Egg clutches were collected, and the number of eggs counted. He followed the metamorphosis of tadpoles into frogs from May to September.

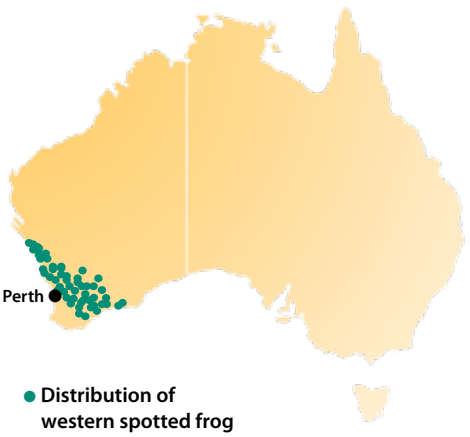
While the western spotted frog may appear to be widespread and secure, Rob's detailed studies of genetics and adult, tadpole and egg survival, suggest that western spotted frog populations are small and isolated, with low tadpole and juvenile frog survival.

So, he teamed up with research scientist Cheryl Lohr from DBCA to predict the probability of persistence for this species.

"We used population viability analysis (PVA) to model the sensitivity of populations to a decline in breeding-season rainfall and the length of time that breeding ponds held water," said Rob. "We wanted to predict the likely persistence of this species in a highly modified agricultural landscape that still has opportunities for successful breeding."

The analysis showed the western spotted frog still occurs across all of its known range and uses a wide range of water bodies such as livestock dams for breeding. Regular dispersal among small breeding populations (metapopulations) increased the probability of persistence for this species.

That is to say that populations that became extinct or were declining could be saved by new individuals moving in. Several similar studies on frogs and other animals have come to the same conclusion. In Rob and Cheryl's study, the metapopulation facilitated population persistence, despite increases in the frequency of drought.



Distribution of western spotted frog

A DRYING CLIMATE

Atmospheric research predicts a drying climate for the south-west of WA. But western spotted frogs are a long-lived dryland frog that may be resilient to some dry years because they don't try to breed every year.

Top left Western spotted frog burrow.

Top Western spotted frog tadpole.

Above Western spotted frog.
Photos – Jiri Lochman

" ...western spotted frog still occurs across all its known range and uses a wide range of water bodies for breeding such as livestock dams."

"Consequently, we assumed drought did not have a catastrophic effect on juvenile frog survival," said Rob.

However, as the drying climate worsens, the reduction in rainfall and runoff will further reduce the size and duration of temporary ponds which may result in widespread failure of recruitment (the successful development of tadpoles into juvenile frogs), which requires the pond to be full of water for at least six weeks.

If this happens, the maintenance of a well-connected metapopulation may be even more critical to the species viability. Another major finding was that the survival rate of juvenile frogs was a key to populations persisting in the long-term. If there was an increased death rate of juvenile frogs e.g. by predation or car strike, then the model suggested that populations would be driven to extinction sooner. To increase the accuracy and resolution of future models, more research on the survival of juveniles is required.

LOCATION, LOCATION

"A fascinating observation during our work is the attraction of breeding adults to sub-surface water and sandy substrates such as in salinity interceptor banks and small pastoral soaks," said Rob.

"Some frogs are choosing breeding sites based on cues such as soil moisture or the presence of a depression, but these sites do not tend to hold water long enough for tadpoles to develop and breeding attempts fail when sites do not fill with water during winter.

"In the future, consideration may need to be given to designing breeding wetlands to ensure the presence of core breeding sites that continually succeed, even in a series of low rainfall years."

WHAT'S NEXT

Juvenile and adult survival is critical to the long-term persistence of western spotted frogs and this may be the case for many amphibians with similar life histories. Finding that a metapopulation with as few as five sub-populations reduced the extinction risk for western spotted frogs gives cause for hope that WA's frogs may have the adaptive capacity required to survive drying climates, particularly if connectivity is maintained or enhanced.

"Our work highlights the importance of furthering our fundamental knowledge of amphibian species. While recent efforts have focused considerable resources on understanding and preventing the spread of chytrid fungus and determining the impact of climate change on amphibians, sound baseline population demographic data is essential to inform the complex models required to understand these threats. With baseline life history data lacking for most species of amphibian, it is critical that such studies are resourced and continued," said Rob.

Above left Western spotted frog habitat, Eagle Rock.

Top Western spotted frog.
Photos – Ann Storrie

Above A newly metamorphosed western spotted frog emerges from a breeding pond. Its tail will be slowly reabsorbed.
Photo – Robert Davis

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