FAUNA

HOW WELL DO YOU KNOW YOUR NEIGHBOURS? (THE WESTERN SPOTTED FROG STORY)

Robert Davis

FOR the last two hours, I have been driving through brown and parched agricultural land, an endless sea of sheep and wheat broken only occasionally by a small remnant of deliciously pink salmon gums and thick, scrubby Acacias. The sun had been shining brightly on my trip from Perth, but now that I have reached Kellerberrin, it's a different story. Standing in a remnant patch of *Banksia prionotes* all ablaze with fiery orange and pink flowers, and seething with Spiny-cheeked Honeyeaters, I watch nervously as dark storm clouds scud towards me, the sky painted with lightning. The wild winds wail around me, sweeping through the She-oaks and blasting through the Banksias. The distant paddocks become obscured in a blanket of rain and I begin to shudder as cold drops run down my neck. I race to my vehicle and shelter in its warmth, listening to the vicious torrents of rain beating a rhythm on the roof.

Now, fast-forward one year. I am sitting under the old tin verandah of a rambling farmhouse waiting for rain. It's hot and dry and I watch as warm winds sweep across the parched paddocks, whipping up small clouds of red dust. Galahs suddenly burst into the blue sky, thundering past me in a whir of wings as a passing car disturbs them from their quiet solitude. I notice dark thunderclouds building on the horizon again, another bluff! Yesterday I had raced along the Great Eastern Highway from Perth through a gigantic front. It rained solidly for the entire two-hour journey, with water streaming across the road in a tumultuous torrent. But alas, as soon as I got towards Kellerberrin, the heavens cleared and the fiery sun burnt away the rain clouds. By the time I arrived in the town it looked like a desert dustbowl. The drought still had not broken, sheep lay dead in fields, the historical buildings were coated in a layer of red dust and I presumed that the frogs were still holed up in their cool, moist, below-ground retreats.

These two frustrating climactic extremes are just some of the many challenges I faced during my four year PhD study on frogs at UWA. You may be asking yourself why anyone would study frogs in this dry area receiving an average of less than 350 mm of annual rainfall? The answer is that the central wheatbelt encompasses much of the range of a species of large burrowing frog called the Western Spotted Frog *Heleioporus albopunctatus*.

This species is found throughout the semi-arid region of WA from near Kalbarri in the north-west to Esperance in the south-east. Western Spotted Frogs have a unique breeding system. Males excavate burrows up to 1 m deep in sandy areas surrounding ephemeral waterbodies and start calling from burrows in autumn (March/April). Mating occurs in the burrow and females deposit a foamy egg clutch of up to 800 eggs in a chamber at the base of the burrow. Development to early-stage tadpoles takes place within the eggs, but final hatching is dependent on winter rains filling the waterbody and flooding burrows. Tadpoles then hatch and complete development in the pond.

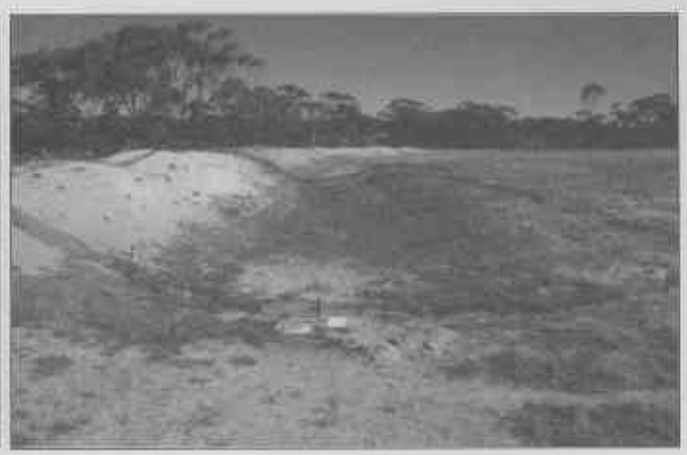
So why did I choose Kellerberrin? The Kellerberrin region is an old and extensively cleared shire with only 7% of its native vegetation remaining, primarily as small fragments and roadside corridors. Kellerberrin thus unites my two passions, namely metapopulation ecology and frogs.

Western Spotted Frog.

No longer a tadpole, not quite a frog!

FAUNA

Burrows.



Study site.

"Meta *what*?" I hear you say. Put simply, a metapopulation is an ecological concept describing the structure of populations in a landscape. Frog populations can be found at suitable locations all across the landscape. A single population does not have much chance of indefinite survival on its own. It all comes down to how well you know your neighbours! The long-term survival of a population may be ensured if it is linked to other nearby populations. In the same way that people might move house to another town or city, frogs often disperse to neighbouring populations. This can have a number of benefits for their neighbours. Dispersers bring in new genes that increase the genetic variation of their new population and decrease its chances of becoming inbred due to a decline in genetic variation. They may also bolster populations that are in decline (known as the rescue effect) due to an ageing population and finally in the same way as a person moving to a new town, they may bring new skills or attributes. In a frog's case this may be being a good breeder and therefore bolstering the recruitment rate of very small populations.

This is all well and good, but what if you can't migrate between populations? This is the problem facing the Western Spotted Frog. A large-bodied species endowed with white spots and big soulful eyes, it is facing a tough existence in a highly modified landscape. Most of the species' former breeding sites have been lost due to rising salinity, and it is now largely found in man-made breeding sites such as roadside ditches. Its breeding sites are few and scattered, and individuals have to walk (or hop!) up to 2 km across cleared paddocks to get to neighbouring populations. From an ecological perspective it is important to know if this landscape (in this case the wheat paddocks of Kellerberrin) is hostile to species and if individuals can form metapopulations with other nearby populations. Most individual Western Spotted Frog populations are now facing an array of problems including high soil and water salinity, early pond drying and predation. Ultimately, however, the long-term survival of this appealing frog may depend on how well it gets on with its neighbours.

To investigate if these frogs knew their neighbours, genetic studies were undertaken in a transect from the most easterly range of this species, near Southern Cross, to their westerly range in the Darling Scarp near Perth. The results revealed that although there was generally a low level of genetic differentiation (consistent with gene flow and therefore dispersal, across the range), a number of populations suffered from apparently high levels of inbreeding (some of the highest recorded in any other frog studies). This indicated that gene flow between some populations was being restricted. What factors might have caused this restriction of gene flow? Traditionally, gene flow can be obstructed by large natural barriers such as mountains and drainage systems or by human modifications such as roads that are barriers to dispersal. I was unable to pinpoint the exact cause of these high levels of genetic subdivision, but investigated several possible causes including large-scale salinity and cleared land (paddocks) acting as barriers to dispersal. I found no obvious clue as to why some populations were suffering from restricted gene flow, but it didn't appear to be related to isolation by paddocks. Further studies in this area may shed some light on this.

Isolation is not the only issue Western Spotted Frogs face. There are a number of other threats arising from man-modified landscapes, including poor reproductive success resulting from increased salinity, breeding ponds that hold water for only short periods of time and the impacts of sustained drought on populations. Studies of recruitment success (basically how many offspring are produced each year) showed that over 87% of 45 breeding ponds studied failed to recruit juvenile frogs over a three year period! I measured many aspects of water quality, including salinity, but

continued on page 8

FAUNA

The Western Spotted Frog continued from page 7

the majority of recruitment failures were due to ponds never filling with water (especially in the drought of 2001) or ponds drying too early, leading to mass tadpole deaths. It seems that the problem might lie in the Western Spotted Frog's switch to human-modified landscapes. It now breeds in ditches, salinity-interceptor banks and dams which do not hold water for long enough. The cues for breeding sites (possibly the ability to sense below-ground water) often lead to ludicrous situations like frogs calling in the damp sections of a paddock that is never likely to form a pond! It wasn't all bad news though. Some populations did recruit each year and these were the ones with the deepest ponds that held water for more than 3 months. Ongoing studies to identify these important breeding ponds will assist in managing this species.

Anyway, there is much more to tell, so stay tuned for more on this topic in future issues of *Western Wildlife*! Meanwhile if you are lucky enough to have Western Spotted Frogs in your area, listen out for their mournful calls drifting across the landscape on a still moonlit evening in autumn. Spare a thought for these amphibian battlers adapting to a human-modified landscape ... and hope that they are well acquainted with their next-door neighbours!

Robert Davis is in the process of finalising his PhD thesis in Zoology at the School of Animal Biology, UWA. He has studied Western Spotted Frogs and other frog species for the past 5 years.
Rob can be contacted at rob@graduate.uwa.edu.au and would love to hear of any Western Spotted Frog sightings. An electronic copy of the Western Spotted Frog call is available on request, to aid identification. The best time to look and listen for these frogs is during the autumn breeding season from March to late June.

BUSH DETECTIVE

This cone was found beneath Slender Banksia, *B. attenuata*, trees at Yanchep last November. It has been stripped right back to show the rather beautiful pattern made by the inside of the seed follicles. Can you guess how this was done?

Ans: Quite right! It was done by our noisy friends with the immensely powerful beaks, Carnaby's Cockatoos. They open the cones so that they can eat the seeds. (Thank you to David Lamont for this puzzle.)

Implementing a Biodiversity Revegetation Project continued from page 3

that are contributing to a rising watertable. High recharge areas are in the upper catchment and commonly form undulating landforms. Low recharge or discharge areas occur in the drainage lines or valley floor. A network of piezometers is located across the catchment and indicates the watertable rise after long term monitoring. This map was used to identify areas of high potential recharge that could be revegetated to prevent the further spread of salinity in the Wallatin Creek catchment.

Local provenance seed was collected each year from Nature Reserves and some private remnants in the catchment. This seed was used for both tube stock and direct seeding. In the second year of the project each farmer who had a revegetation site was invited to come and help collect seed for a couple of hours. This enabled them to understand the techniques in seed collection and appreciate the importance of local provenance seed.

The tube stock was grown in selected nurseries. These nurseries were visited during the growing season to ensure that seedlings were produced to specified standards.

The site preparation included ripping to a suitable depth and controlling weeds by herbicide application. Planting each revegetation site took place in partnership with the farmers, Revegetation Officer, other CALM staff and local volunteers.

A debriefing meeting and dinner was organised after the planting season with the farmers who had revegetation designs implemented. The debriefing questionnaire results were compiled to improve the adoption and implementation of the project and associated revegetation techniques. It was also used to document the decision-making process used by landholders.

These biodiversity revegetation sites have been written up as case studies and can be found on the Nature Base website along with other tools and tips for revegetation. http://www.calm.wa.gov.au/projects/habitat/revegetation.html

For further information contact: Susie Murphy White, Revegetation Officer CALM Merredin susiem@calm.wa.gov.au