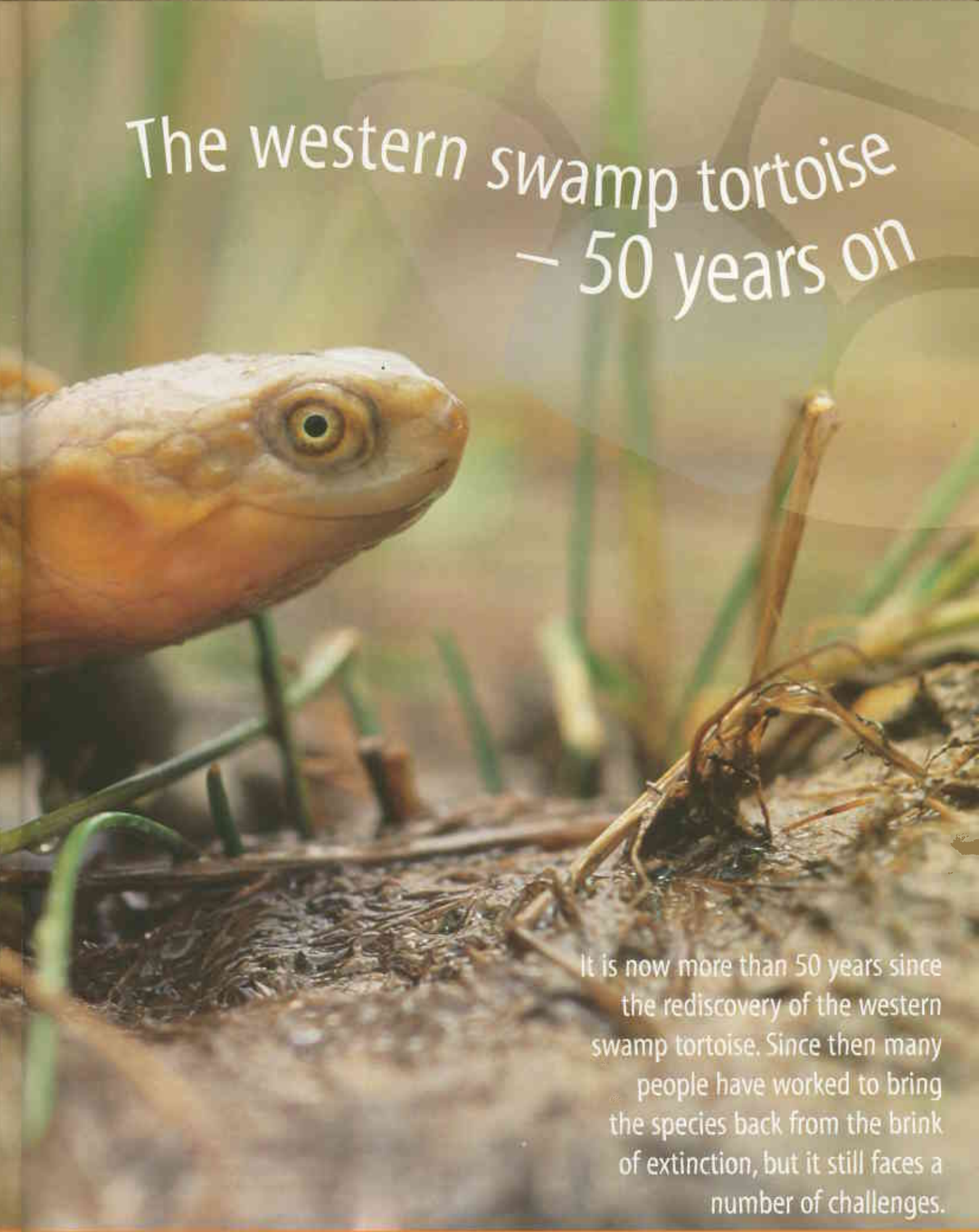
The western swamp tortoise – 50 years on



It is now more than 50 years since the rediscovery of the western swamp tortoise. Since then many people have worked to bring the species back from the brink of extinction, but it still faces a number of challenges.

By Andrew Burbidge and Gerald Kuchling

The 1953 rediscovery of the western swamp tortoise (*Pseudemydura umbrina)* close to Perth triggered an increase in public interest in nature conservation in Western Australia. Interest in the species has remained high and governments, conservation agencies, scientists, companies, societies and individuals have supported the necessary scientific research and on-ground conservation work. But all this work has yet to result in the species being reclassified from 'critically endangered' to 'endangered' or a lower category of threat. Why?

Threats to the western swamp tortoise

The conservation of critically endangered plants and animals is rarely easy. In the case of the western swamp tortoise there are several factors that have made the task particularly difficult. Firstly, the tortoises' biology prevents a rapid increase in numbers, even if conditions were ideal. They grow slowly and maturity is not reached until they are about 10 to 15 years of age. Females lay only one clutch of three to five eggs yearly, while other Australian freshwater turtles may lay several clutches each of more than 10 eggs. And in years with limited food due to low rainfall, the western swamp tortoise may lay no eggs at all. Eggs are laid from late October to early December and hatchlings emerge the following May or June. Being very small (about 25 millimetres long and weighing only three to five grams), the hatchlings are susceptible to predation.

Secondly, the species has a very small geographic range. All records come from a narrow strip of the Swan Coastal Plain, just west of the Darling Range from Pearce south to Perth Airport. The Swan Valley was the first part of WA developed for intensive agriculture and by the 1950s most had been cleared, urbanised or mined for clay. That trend continues today.

In 1962, two small nature reserves—Ellen Brook and Twin Swamps—were declared to protect the tortoises' habitat. Both have since been enlarged by the purchase of adjacent areas, but both remain very small in terms of the tortoises' requirements. Some good-quality habitat remains adjacent to one of the reserves and negotiations to acquire it are underway. Urbanisation is creeping ever closer and the Environmental Protection Authority has developed an environmental protection policy on the tortoise to limit development in surrounding areas. This was an important step in protecting the tortoises' habitat, but caused antagonism from some nearby landowners who were hoping to get permission to subdivide their land.

Climate change looms as the third major challenge facing the western swamp tortoise. Winter rainfall has already declined significantly in Perth and it is predicted that this trend will continue. Western swamp tortoises live in temporary swamps that have standing water from around June to November in most years. During the winter and spring, they feed on aquatic invertebrates and grow and lay down fat for the coming summer. Adult females need plenty of food for egg development. The clay-based swamps at Ellen Brook Nature Reserve in Upper Swan fill even in dry winters such as that of 2006, but the sand over

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Main A western swamp tortoise.
Photo – Jiri Lochman

Above A western swamp tortoise in a puddle at Ellen Brook Nature Reserve adjacent to Great Northern Highway.

Left Captive-bred western swamp tortoises.
Photos – Gerald Kuchling

Above Gerald Kuchling holds a western swamp tortoise next to the predator-proof fence in Ellen Brook Nature Reserve.
Photo – Jiri Lochman

Left Large waterbirds, including the white-necked heron, predate on western swamp tortoise hatchlings.
Photo – Ken Stepnell/DEC

clay swamps at Twin Swamps Nature Reserve in Warbrook has been greatly affected by Perth's increasingly dry winters. A bore was drilled in 1994 so water could be pumped into one of the swamps in dry years. Recently the winter rains have been so low that it has had to be used almost every winter and spring. In some years, the only one of the six major swamps at Twin Swamps Nature Reserve with water in it has been the one that is being augmented with groundwater. Because of increasing concern about the ability of Twin Swamps Nature Reserve to maintain a viable western swamp tortoise population, the Department of Environment and Conservation (DEC) recently called in hydrological consultants to advise on surface and groundwater management.

Predation is the fourth major factor affecting the species' recovery. As hatchlings, western swamp tortoises are easily predated by large waterbirds such as herons, as well as by goannas. Recently, predation of juveniles by ravens (*Corvus coronoides*), which have become more numerous in metropolitan Perth, has been recorded. Introduced laughing kookaburras (*Dacelo gigas*) may be an added threat.

European red foxes (*Vulpes vulpes*) are a well-known threat to many of our native animals. Foxes prey on tortoises during the winter and spring, but it is during the summer, when the tortoises aestivate (sleep) while the swamps are dry, that they are most susceptible. Aestivation sites vary—at Ellen Brook Nature Reserve they are usually in naturally occurring tunnels in the clay soil but at Twin Swamps Nature Reserve they are often on the surface under leaf litter. In the mid-1960s there were more than 200 western swamp tortoises at Twin Swamps, but by the late 1980s there were less than five and, while declining rainfall had some effect, fox predation is thought to have been the major cause of the fall in numbers. To prevent this unnatural predation, both nature reserves now have fox-proof fences around them. Introduced black rats (*Rattus rattus*) also predate western swamp tortoises, especially juveniles, and rat control is now a necessary management activity.

Recovery efforts

Planning for recovery began decades ago and was first formalised in a recovery plan published in 1990 (see 'What the tortoise taught us', *LANDSCOPE*, Winter 1991). Two later versions have been published with the next one, for 2008-2013, in preparation. A recovery team, comprising scientists and managers from DEC, Perth Zoo, The University of Western Australia (UWA), WWF-Australia and The Friends of the Western Swamp Tortoise, coordinates the implementation of the recovery plan. Gerald Kuchling is employed part-time through UWA as the team's Chief Investigator.

Habitat management is critical. Wanneroo-based DEC staff intensively manage all three nature reserves where the species now occurs. They build and maintain fox-proof fences, bait for foxes, cats and rats, manage fires, liaise with neighbours and rehabilitate degraded habitat. Their work is often

Left Gerald Kuchling and Andrew Burbidge at the official release of captive bred tortoises at Twin Swamps Nature Reserve, which attracted significant media attention.
Photo – Jiri Lochman

Below left Members of The Friends of the Western Swamp Tortoise group releasing tortoises.
Photo – Gerald Kuchling

aided by volunteers from The Friends of the Western Swamp Tortoise, who are also involved in education and information dissemination.

Because of the slow reproductive rate and high natural juvenile mortality, captive breeding has been very important to produce animals that can be translocated to develop self-sustaining wild populations. Some tortoises were taken into captivity in the 1950s and some breeding occurred, but few of the young tortoises survived to adulthood. In 1987 a captive breeding project was developed at Perth Zoo under the guidance of Gerald Kuchling. Over succeeding years, better husbandry, improved facilities and the dedication of staff have led to captive breeding becoming almost routine with 40 or more hatchlings being added to the colony each year. The growing season in captivity is longer than in the wild and three years after hatching most young tortoises have grown to more than 100 grams, the size at which the recovery team considers them large enough to be released.

Early in the captive breeding program, the tortoises were translocated to Twin Swamps Nature Reserve, to augment the very small surviving wild population. Some of these tortoises have now attained reproductive size and some females are known to have developed eggs, but no hatchlings have yet been found.

In species conservation you should not have 'all your eggs in one basket'. Only one small nature reserve, Ellen Brook, seems to have a secure, viable western swamp tortoise population. The recovery team's aim is to have four or five. If the Twin Swamps Nature Reserve population becomes self-sustaining, that would be two. In 2000 a very valuable area of bush was purchased and added to Mogumber Nature Reserve, 100 kilometres north of Perth. The new area includes three clay-based swamps that the recovery team considered to be suitable western swamp tortoise habitats. Concerns that regional groundwater changes might cause the swamps to become saline have been investigated and seem unfounded. Introductions of the tortoises to Mogumber started in 2000, but have not gone entirely to plan. In December 2002, a very hot wildfire swept through the reserve, killing all the western swamp tortoises aestivating under vegetation on the surface. Most animals sheltering underground, including three tortoises in artificial tunnels installed to provide aestivating habitat, survived. However, as there was now no shade or shelter, these tortoises were returned to Perth Zoo. Introductions got underway again the following winter, but a further set back in 2006, when extreme drought meant that there was no water in any of the swamps, prevented the programmed release that year. Whether the 2006 drought will lead to lower survival remains to be seen.

Two other prospective translocation sites are being investigated. The first is within one of Perth Airport's conservation zones and the recovery team continues to negotiate with the airport's owners, Westralia Airports Corporation, to gain access to this land. The other is within Moore River Nature Reserve, 85 kilometres north of Perth, where hydrological and other investigations are underway to properly

Right Western swamp tortoise.
Photo – Jiri Lochman

evaluate this area. The recovery team is now looking for suitable areas south of Perth.

From critically endangered to endangered?

The western swamp tortoise currently meets the World Conservation Union (IUCN) Red List criteria 'A2' and 'D' for critically endangered species (see www.redlist.org). To qualify for 'endangered' under criterion D, there must have been more than 50 adult tortoises in the wild for five years. At the end of 2006, population estimates suggested that there were still fewer than 50 adult animals in the wild, but that the number was slowly increasing. If all goes well, wild adult numbers could pass 50 within five years. Criterion A2 is more difficult. It is defined as:

> "Reduction in population size based on an observed, estimated, inferred or suspected population size reduction of ≥80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible..."

In the case of the western swamp tortoise, the causes of population reduction are fairly well understood, but they have not ceased and some, such as habitat loss and climate change, may not be reversible. So, how long is three generations? The IUCN Red List criteria define generation length as the average age of parents of newborn individuals in the population. Reproductively active adult western swamp tortoises may be from 12 to 100 years old and the average age of parents is thought to be around 30 to 40 years. So three generations is about 100 years.

We don't know how many western swamp tortoises there were 100 years ago, but we do have population estimates from the early 1960s when there were probably more than 300 individuals within Twin Swamps and Ellen Brook nature reserves, plus an unknown number outside. We know that in the 1960s, western swamp tortoises still occurred near Midland, at Perth Airport, near Caversham and near Pearce, so it is likely that they also occurred at other localities between these points and that 100 years ago there were many more of the tortoises alive than in 1960. If we assume that 100 years ago there were 1000 western swamp tortoises, for the decline to be less than 80 per cent in the past 100 years, there must now be more than 200 tortoises in the wild. Currently, we think there are between 150 and 200, but most of these are sub-adult. Because of the uncertainty about criterion A2, the recovery team is concentrating on criterion D and once we know that there have been more than 50 adults in the wild for more than five years, we will seek to have the species upgraded from critically endangered to endangered.

The western swamp tortoise is a classic example of a long-lived, but slow-reproducing species, with highly specialised habitat requirements. Scientists and land managers often find the conservation of such species, when faced with habitat loss, predation and other threats, very difficult and slow to bring back from the edge of extinction. The tortoises' status has improved considerably during the past 20 years, but there are still many challenges for it and us to face and overcome.

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