Science for Saving Species

Research findings factsheet

Project 4.1.4.1

Threatened Species Recovery Hub

National Environmental Science Programme

Assisted colonisation trials for the western swamp turtle to cooler southern wetlands

In brief

This study is a world-first trial of assisted colonisation of a vertebrate species in response to the threat of climate change.

The Critically Endangered western swamp turtle (*Pseudemydura umbrina*) naturally occurs in one small, now isolated, ephemeral and seasonal clay swamp complex near Perth, Western Australia. The species relies on a wet winter and spring period to eat, grow and reproduce within the wetlands, and is then dormant (in aestivation) when the wetlands dry out. The critical wet period was formerly up to seven months long, but without remedial intervention reduced rainfall due to climate change has reduced the wet period to three to four months. Shortened wet periods coupled with extensive habitat loss on privately owned land and changes in adjacent land usage threaten the persistence of the species within its natural range.

Seasonal swamps further south of the species' natural range may provide suitable habitat for the turtle now and into the future. In 2016, we trialled assisted colonisation of juvenile western swamp turtles to two wetlands approximately 300 km south of the species' natural range and compared their survival and growth rates over six months to individuals released at an existing northern translocation site.

We found that growth rates at the two southern sites were different – only at one of the southern sites did juveniles grow as much as they did in the north. While the positive result at one site was encouraging, further trials over longer periods were needed, especially as the south-west of Western Australia was unusually cool throughout the winter and spring of 2016.

Consequently, in 2018, a second year-long trial of assisted colonisation commenced. In this trial, we released juveniles across three wetland sites that spanned a 350 km latitudinal gradient, and focused more closely on post-release behaviour and growth. Growth rates at the northern and southern extremes of this gradient were very similar between the first and second trials, and it became clearer that factors limiting growth in the south included both lower environmental temperatures and food availability. We conclude that assisted colonisation to southern coastal regions of Western Australia could be considered in the near future, provided that release areas have wetlands with high food availability and longer wet periods than those in the natural range near Perth.

Swamp turtles forage exclusively in water on macroinvertebrates and tadpoles. Image: Nick Rodriguez

The University of Western Australia

Department of Biodiversity, Conservation and Attractions

Biodiversity and Conservation Science

Perth Zoo Saving Wildlife

Background

Climate change is one of the most significant threats to biodiversity this century, and is rapidly altering ecosystem conditions. One of the most recognised of its impacts is a systematic shift of species' range limits towards the poles, at an average of 17 km and 72 km per decade for terrestrial and marine species, respectively. Species that have restricted ranges and breed at slow rates are particularly vulnerable to these effects of climate change, as they have limited opportunities to disperse or to adapt in evolutionary ways. Many of these species may well become extinct as a direct result of climate change.

Worldwide, reptile species are experiencing significant declines, with an estimated 25% of species at risk of extinction. Turtles are especially imperilled, with just over half (52%) of all species at risk. Climate change will have particularly severe impacts on freshwater turtles, as they rely on specific temperature ranges for optimal biological functioning, and because wetland habitats are already among the most altered and degraded habitats globally.

The western swamp turtle is Australia's rarest reptile and has a lifespan similar to humans. In the turtle's habitat in a small, seasonal swamp near Perth, climate change has reduced winter rainfall by approximately 26% in recent decades, shortening the time that swamps hold water, and has brought hotter summers and fewer rainfall events. Together these changes have lengthened the period that the swamp is dry each summer, and so eventually the critical wet periods may be too short to allow turtles to adequately grow and reproduce.

The current habitat of the western swamp turtle is likely to become marginal for the species under future climate change, unless a greater area of habitat can be protected, and major drought-proofing actions can be implemented. Wetlands near the south coast of Western Australia are cooler than the swamp turtle's current habitat, but they have longer wet periods, and predictive models suggest they are likely to provide ideal microclimates within 30 to 50 years, due to climate change.

Assisted colonisation is the intentional introduction of a species of conservation concern to an area outside its natural range, and is carried out to avoid the impacts of a threatening process such as disease, predation or climate change. This study reports on the outcomes of trials of assisted colonisation for the western swamp turtle to wetlands of the south coast of Western Australia.

Turtles were released in 2018 into a newly acquired wetland within Ellen Brook Nature Reserve to allow comparisons of their behaviour with turtles released outside the natural range. Image: Nick Rodriguez

Temperate loggers were installed in both terrestrial and aquatic habitats. Image: Nick Rodriguez

Main aim of the research

The aim of the assisted colonisation trials was to assess the current suitability of habitats more than 300 km south of the natural range of the western swamp turtle for supporting growth and survival of juveniles of the species.

We used growth rates over their winter–spring activity period as an indicator of the turtles' ability to persist long-term in the new southern sites. We therefore set out to compare the growth of turtles released in southern wetlands to the growth of turtles released in an existing northern translocation site, and within the natural range.

We also sought to determine if there were behavioural differences in released individuals that related to the different microclimatic conditions at each release site.

A longer-term goal of the species' recovery team and recovery plan is the establishment of new populations in habitats that will remain suitable as the climate changes.

What we did

In partnership with the Western Swamp Turtle Recovery team we selected two wetlands near the townships of East Augusta and Northcliffe as trial sites for assisted colonisation. We used an existing northern translocation site at Moore River Nature Reserve to provide a comparison. These northern and southern sites were approximately 350 km apart, and so offered different freshwater and terrestrial microclimates.

In August 2016 we released 35 juvenile turtles at three sites: 11 at Moore River and 12 each at East Augusta and Meerup (the wetland site near Northcliffe). Our 2018 trial was slightly larger, with 18 juveniles each released at Moore River and Meerup, and 12 in the natural habitat at Ellen Brook Nature Reserve near Perth.

In both years, individuals were sourced from a captive breeding program at Perth Zoo, were mostly two to five years old, and had an average mass of 130 g. We ensured a similar distribution of age and mass in each release group.

Before releasing the turtles, we fitted each one with a small radio transmitter and data logger that recorded temperature (2016 trial) or temperature and pressure (2018 trial). These were attached to the rear of the carapace (shell) using epoxy resin and covered with black plastic to minimise the visibility of the turtles to aerial predators.

After release, we monitored the turtles regularly – about every two weeks until the end of the hydroperiod, and thereafter approximately monthly. In addition to measuring changes in body size and weight of turtles at each site, we assessed thermal variation in the swamp microclimates, soil microclimates and analysed the factors that most influenced juvenile growth. We expected that the individuals released at the southern sites would grow more slowly than turtles in northern sites, but that their slower rates of growth would be offset by the longer wet periods that the southern sites offered for foraging and gaining weight.

Key findings

Our key finding was that growth rates similar to those at warmer northern translocation sites can be achieved in a southern wetland, even in an unusually cool spring, as occurred in 2016. The total growth achieved at East Augusta in 2016 was similar to that at the northern Moore River site.

The microclimates at southern wetlands were most suitable for foraging and growth in late spring and early summer, as turtles did not begin to gain weight until mid-September. However, individuals released at Meerup in 2016 and 2018 did not consistently gain weight in either trial. This was likely due to Meerup having limited prey biomass (particularly tadpoles) when water temperatures were most suitable for foraging in the latter part of spring. This is problematic for that site, as reptiles forage when temperatures are suitable for their activity, rather than solely when prey is available.

Encouragingly, captive-reared juveniles found suitable sites for their terrestrial aestivation periods in the novel southern habitats. However, at the East Augusta trial site, which is bounded by private property, several individuals moved onto private land to aestivate. This means that the trial wetland at East Augusta is unlikely to be the best option for establishing a permanent assisted colonisation site in the region. Fortunately, the nearby Scott River National Park may offer a suitable alternative to the trial wetland, as it contains similar wetlands with good prey availability, provides a much larger area, and has little connectivity to farmland or private properties.

Overall, our findings show that western swamp turtles can grow in southern wetlands where the current microclimate temperatures are near to the lower limit that allow turtles to forage. The long-term suitability of southern sites for juvenile turtles to reach maturity will depend on juveniles being able to survive their annual period of summer aestivation, which in turn depends on the energy they can accumulate during spring when foraging on high-energy prey items such as tadpoles.

Turtles move overland when wetlands dry. Image: Nick Rodriguez

References

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Limitations

Although our study revealed clear differences in the current and future suitability of translocation sites for the western swamp turtle, some limitations need to be acknowledged.

Our sample sizes were small, and in 2016 this was compounded by radio transmitters and temperature loggers occasionally detaching from turtles throughout the trial. Because the trial ended earlier than was intended (partly due to transmitter loss), we could not compare aestivation behaviours across the sites, but this was remedied in the 2018 trial, where turtles better retained transmitters and loggers and so monitoring could continue until September 2019.

Several turtles were killed by predators (likely foxes) during the trial, which further reduced sample sizes, but survival did not depend on the release site (some juveniles also died inside the fenced natural site near Perth).

A condition of both translocation trials (approved by the Western Australian Department of Biodiversity, Conservation and Attractions) was that animals were returned to Perth Zoo after their final size and weight measurement. This was possible in most instances, but as many turtles shed transmitters between monitoring trips, some were lost and are unlikely to be reencountered as western swamp turtles cannot be caught in traps. However, one juvenile released at Meerup in 2016 was fortuitously encountered in the wetland in 2018, indicating it had survived for two years.

Implications and recommendations

Our study shows that assisted colonisation of the western swamp turtle to seasonal wetlands near the south coast of Western Australia could be considered in the immediate future as part of the overall conservation strategy for the species.

The specific southern wetlands trialled in this study are not currently suitable for an attempt to establish a new population, although other wetlands in Scott River National Park may be. Site-specific factors must be taken into account when choosing sites, in particular:

1. Prey species (invertebrates and tadpoles) should be abundant when water temperatures are suitable for foraging, that is, in late spring.
2. The release site should be on an appropriate land tenure, ideally conservation estate so that predator management can occur.
3. There must be suitable microclimates for basking, nesting and embryonic development.
4. The site must be accessible for both short-term and longer-term monitoring.

Other biological factors also need to be taken into account in assessing the suitability of each site. These include time to maturity, hatchling survival, movement patterns, and, eventually, population growth rates, which will require decades of monitoring.

These factors are currently being evaluated in a new PhD project, as is the possible impact of the western swamp turtle on the recipient ecosystems, which supports other threatened species such as the salamanderfish and black-stripe minnow.

We recommend that assessment of alternative sites in East Augusta followed by translocation trials should occur without delay, as assisted colonisations may be the best option to reduce the risk of extinction of the western swamp turtle by trying to establish a new self-sustaining wild population, as the climate in south-west Western Australia rapidly transitions to a drier, hotter state.

Further Information Nicola Mitchell – nicola.mitchell@uwa.edu.au

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