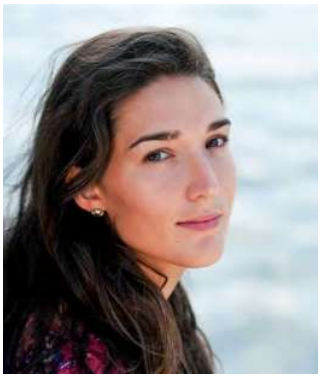


Assisted Colonisation of the Western Swamp Turtle into Cooler Southern Wetlands

BETHANY NORDSTROM
School of Biological Sciences, University of Western Australia

One of the greatest threats to biodiversity is climate change, affecting various taxa through shifts in distribution, range contractions, and extinctions. These consequences of climate change are particularly concerning for reptiles, as many rely on specific temperature regimes for optimum physiological performance. Species with low reproductive rates, long generation times, and restricted ranges are particularly susceptible to climate change due to their limited capacity to adapt or move. One proposed solution for these species is assisted colonisation – the intentional translocation of species outside their Indigenous range to mitigate a threat.

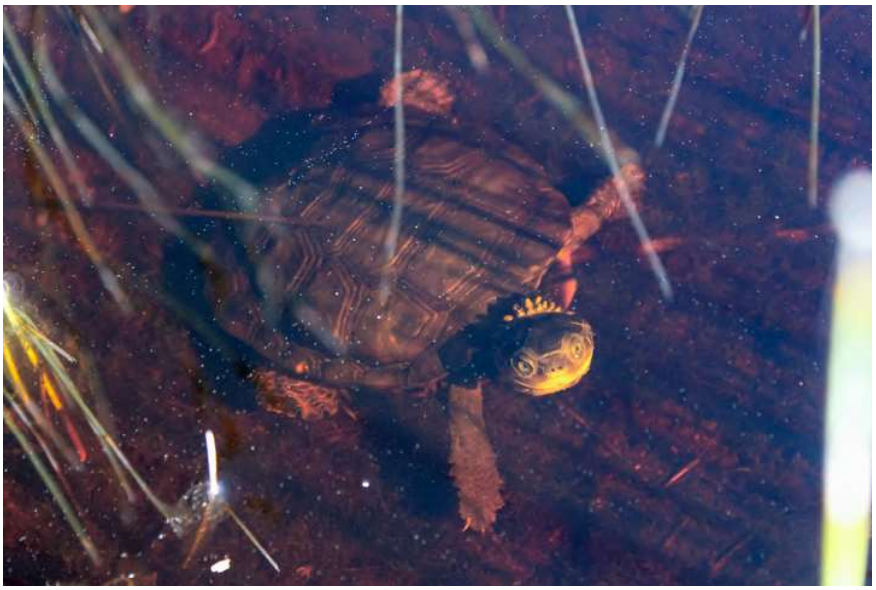
The Critically Endangered western swamp turtle (*Pseudemydura umbrina*), a long-lived species endemic to south-west Australia, is a strong candidate for assisted colonisation. It has experienced extensive habitat loss and fragmentation and now only naturally persists in one small, fenced nature reserve north of Perth. Western swamp turtles rely on seasonal swamps for survival, where they feed and reproduce during the wet winter period (hydroperiod) and aestivate in upland areas for the dry summer and autumn months.

Over the last fifty years, mean rainfall during the hydroperiod has declined by approximately twenty-five percent. Further declines in winter rainfall, hotter summers, and fewer rainfall events are expected in south-west Australia under projected climate scenarios. These factors result in shorter critical wet periods in seasonal wetland ecosystems and uncertain future habitat suitability in the western swamp turtle's small natural range. If critical wet periods become too short, turtles will grow very slowly and may be unable to reproduce. The future success of the western swamp turtle depends on conservation tactics such as drought-proofing habitat in the western swamp turtle's natural range and exploring options that account for future climate change – such as assisted colonisation.

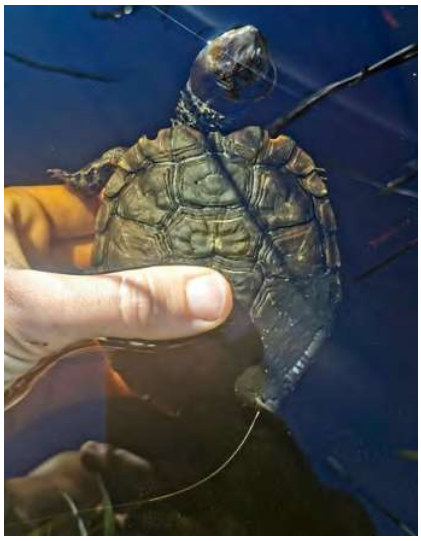
Assisted colonisation trials exploring growth rates of turtles in cooler climates began in 2016, with captive-bred juveniles released to two locations approximately three hundred kilometres south of their historic range. These wetlands were cooler, had longer hydroperiods, and were predicted to offer ideal microclimates for western swamp turtles in twenty years. They performed well in one of the southern sites in 2016, with comparable growth rates to those in a warmer wetland much further north. It is thought that ideal growth rates were achieved, partly due to the timing and abundance of aquatic food resources such as tadpoles and longer wet periods resulting in extended foraging opportunities. As foraging rates and body temperatures are often synergistic in reptiles, it is critical to understand whether cooler environments (and therefore reduced activity of western swamp turtles) can be offset by high prey abundance and extended periods of prey availability.

The project builds on the recent assisted colonisation trials and aims to understand whether western swamp turtle energy requirements can be met in cooler climates over both the short- and long-term. As

Top: Bethany Nordstrom is a PhD candidate at the University of Western Australia



A juvenile western swamp turtle (*Pseudemydura umbrina*). Image: Bethany Nordstrom.



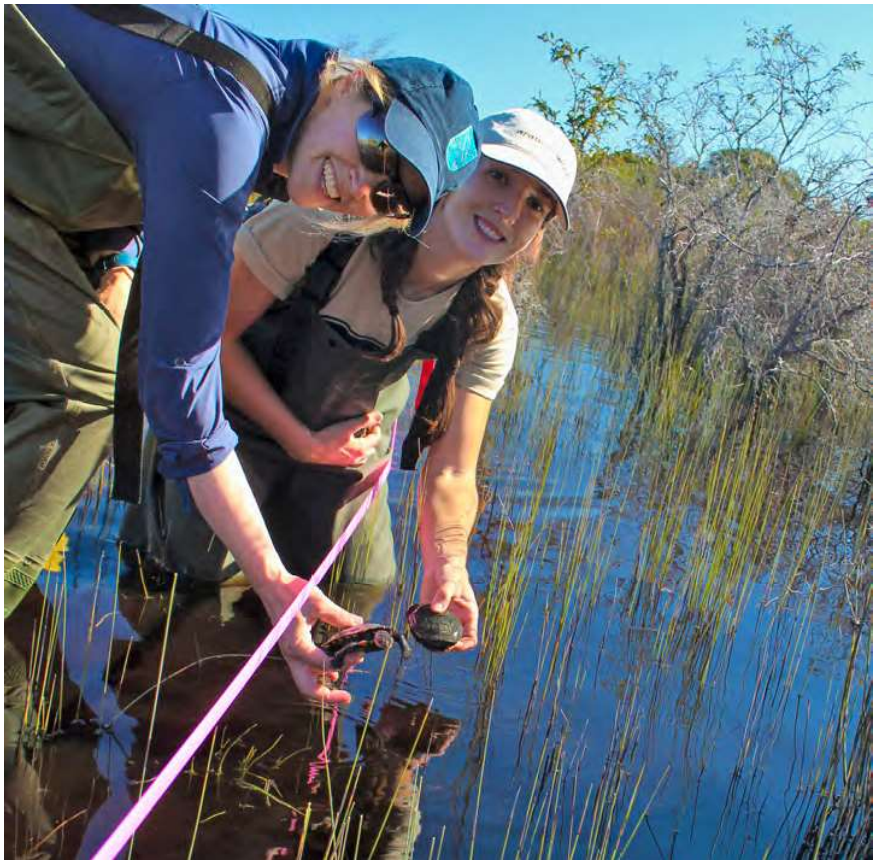
A juvenile western swamp turtle fitted with a radio transmitter tag with inbuilt activity and temperature sensors. Image: Bethany Nordstrom.

part of this project, a third assisted colonisation trial commenced in mid-August 2021, where individuals are closely monitored. Western swamp turtles have been fitted with a radio transmitter with inbuilt temperature and activity sensors to help determine when turtles are capable of foraging. Data from the sensors is transmitted to a stationary receiver set up in the wetland. Tadpole and macroinvertebrates surveys will also be conducted to determine prey availability throughout the hydroperiod. The growth of turtles will be assessed through morphological measurements and the calculation of specific growth rates.

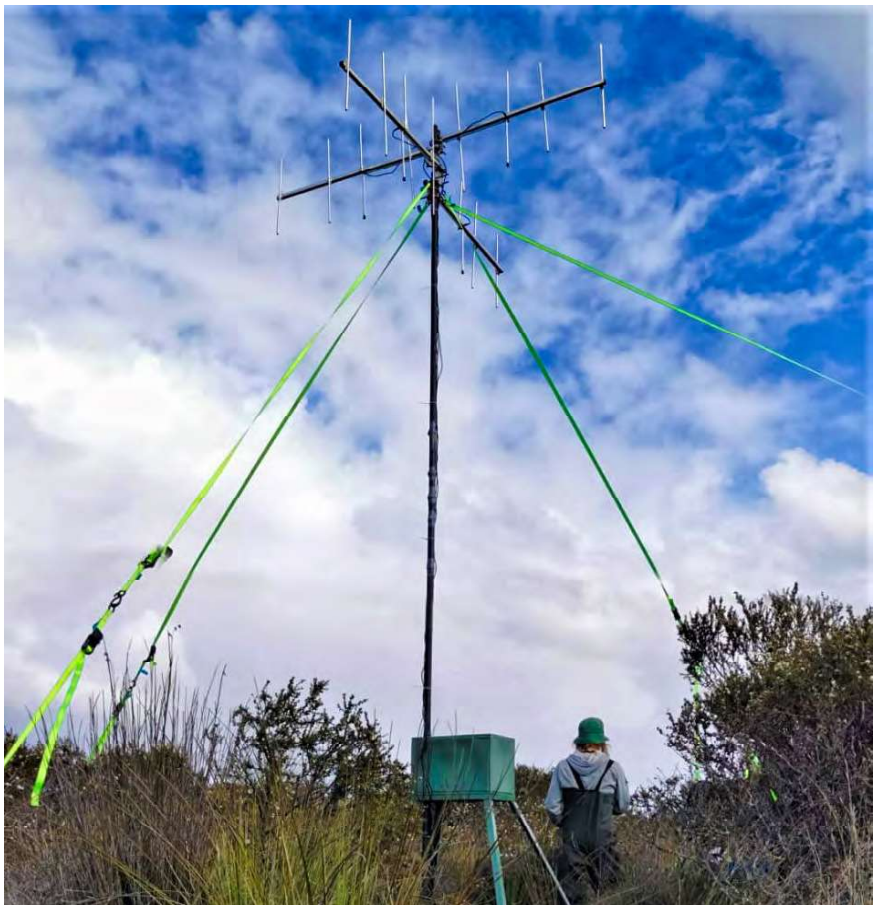
Environmental DNA methods will help detect the species using a species-specific primer/probe. This method will assess the western swamp turtle's immediate food web and ecosystem impacts in novel environments via DNA metabarcoding of faecal samples. The project will also incorporate western swamp turtle food intake in the novel environment into a dynamic energy budget model to study how food availability at translocation sites interacts with body temperature to drive individual growth and reproduction. Growth and reproduction across the turtle population will also be investigated. Understanding the capacity of turtle foraging in cooler climates will help inform practical conservation management outcomes for the swamp turtle, including whether southern wetlands can provide viable habitats for one of Australia's rarest reptiles.

The western swamp turtle is thought to be the first vertebrate species to undergo trials of assisted colonisation in response to the threat of climate change. The project presents a unique opportunity to study assisted colonisation from several applied angles (eDNA, food-web dynamics, and mechanistic energy budget models). The research benefits are not limited to the western swamp turtle, as findings from this case study will provide insights on assisted colonisation as a conservation option for other species unable to adapt *in situ* or migrate in response to rapid climate change.

FUNDS PROVIDED BY THE AUSTRALIAN WILDLIFE SOCIETY will be used to purchase materials to build the stationary receiver tower, iButtons to monitor the carapace temperature of turtles when they go into aestivation, and accommodation costs.



Doctor Nicola Mitchell and Bethany Nordstrom are releasing two juvenile swamp turtles, commencing the 2021 assisted colonisation trial. Image: Alan Harvey.



A stationary receiver tower was set up at the assisted colonisation site to collect data from transmitters attached to the turtles. Image: Bethany Nordstrom.