Population decline in the endangered grassland earless dragon in Australia: Identification, causes and management

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Abstract

Identifying species under threat from extinction and what is driving their decline is vital to biodiversity conservation. Currently, lizard populations worldwide are under serious threat with widespread declines and predictions of multiple extinctions through climate change. No reptile extinction has been recorded in Australia since European settlement. Yet, emerging signs indicate that Australian reptiles are facing major threats from habitat fragmentation and other extinction forces. Contractions in the distribution of Australian reptiles are well documented with 25 percent of the country's reptile fauna nominated by conservation agencies and individuals as warranting threatened status and requiring management. One of the most highly endangered lizards in the Australian Capital Territory (ACT), *Tympanocryptis pinguicolla* (grassland earless dragon), is facing range contraction from habitat loss and fragmentation, caused by agricultural and urban development. *Tympanocryptis pinguicolla* are of particular concern because they are native temperate grassland specialists, a habitat type of which only 0.5% of the pre-1770 area in southeastern Australia remains in a semi-natural condition. It is currently unclear if the remaining populations of *T. pinguicolla* are stable or if contraction is continuing.

In this thesis I report on the ecology of *T. pinguicolla* using long term mark recapture sampling at two locations: Jerrabomberra West and Majura, and re-sampling of ten former survey sites across the ACT. I compare historic population survey data to that collected for this thesis using a one-tailed sign test to estimate declines in population sizes across the ACT. I also used an exponential growth state space model to estimate population trends at Jerrabomberra West and Majura. In addition multistage mark recapture (MSMR) models were used to estimate population sizes and survival rates of *T. pinguicolla* at these two locations. A gradual non-significant decline in population sizes of *T. pinguicolla* was observed across all sites from 1995 followed by a dramatic reduction (88%) from 2006 at the most densely populated site (Jerrabomberra West). Annual survival at that site was estimated to be low (0.017 to one year of age and 0.024 to adulthood) over the three years of the study. Of the ten sites at which *T. pinguicolla* were previously known to be present, four (40%) contained no trace of the lizards, despite extensive survey.

To further understand what was driving these declines I conducted a Population Viability Analysis (PVA). Reproductive parameters for the PVA were informed using past survey data combined with data collected as part of this thesis work. Based on four discovered nests, clutch size was considered comparable to closely related agamids (5–7), with small (24 mm snout–vent length, 0.62 g) hatchlings and single clutches per year. In addition *T. pinguicolla* diet was examined using Schoener's overlap index for differences between sites and electivity. *Tympanocryptis pinguicolla* feed on invertebrate prey, selecting for a small number of orders such as Coleoptera (beetles) and Lepidoptera (butterflies and moths, including larvae). Using this survival and reproductive data to build the PVA, I showed that the Jerrabomberra population had a very high probability (100%) of extinction within ten years and that the parameters most likely to be driving this decline were juvenile survival and fecundity. Taken together, these data suggest a regional decline in *T. pinguicolla* that places the species in grave jeopardy of extinction. The key extinction factors for *T. pinguicolla* are likely to include extreme drought conditions, coincident with over grazing and habitat fragmentation.

The power of monitoring grids (each comprised of 56 artificial shelter burrows) to detect *T. pinguicolla* was also assessed. I combined the use of zero inflated models with the proportion of traps occupied at a location to determine the number of shelter burrows required to have a given probability of detecting the species if it is present. Three-visit detection probabilities for *T. pinguicolla* were low at the beginning of the six week sampling period (February – March) (0.12-0.22) but reached levels (up to 0.5) comparable with the few other lizards for which detection probability have been estimated. In the situation where population density was at its lowest, 26 artificial burrows are needed to be checked for six weeks (18 checks) from February into March to have a 50% confidence of detecting the species if it is present. This rises to 167 burrows checked over the same time period for 99% confidence of detection. Once the established confidence rises above 60%, surveying over a longer time period results in a decrease in the trap days (number of artificial burrows multiplied by the number of checks). Given that the timing of the sampling period is one of the most important factors when trying to increase detection, moving the trapping to later in the summer may increase detection success.

Overall, these data suggest that this is a species for which the effects of habitat fragmentation and destruction and drought are a real threat. They are clearly still declining within the Canberra region, and if nothing changes, the effects of low fecundity and juvenile survival will drive the populations to extinction within ten years. With low population densities a large effort survey is required but this will be necessary if we want to inform the life history parameters around fecundity for which we currently have little data and we need most to focus on if we are to better model these populations.

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