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Short Note

Longevity and survival of the Endangered Seychelles Magpie Robin *Copsychus sechellarum*

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The Seychelles Magpie Robin *Copsychus sechellarum* was once one of the most threatened birds in the world, but was downgraded from Critically Endangered to Endangered after a long-term recovery programme was successfully implemented. Comprehensive long-term monitoring of this species was conducted on the islands of Cousin and Cousine over an 18-year period. We report here on the species longevity and annual survival at these two sites. The oldest recorded individual was a male who died on Cousine Island on 28 September 2000 at just under 16 years old. This individual was recorded to have hatched on Frégate Island on 3 January 1985, before being translocated to Cousine Island in 1995. Mean annual survival rates over an 18-year period were 81.6% on Cousin and 77.9% on Cousine islands. A decrease in annual survival was noted with increasing population size on both islands (Cousin: $t = -3.09$, $p < 0.05$; Cousine: $t = -2.71$, $p < 0.05$), which is a likely consequence of increased territory disputes and competition for food.

Keywords: annual survival, *Copsychus sechellarum*, Cousin Island, Cousine Island, longevity, Seychelles Magpie Robin

The Seychelles Magpie Robin *Copsychus sechellarum* (SMR) is endemic to the Seychelles Archipelago in the Indian Ocean (López-Sepulcre et al. 2008). It is a passerine bird that forms small social groups comprised of a dominant pair and up to eight subordinate individuals (López-Sepulcre et al. 2008). Each social group defends a common territory on which they rely for their nesting sites, foraging areas and water provisions (McCulloch 1996; López-Sepulcre et al. 2008). Each territory varies in quality and size causing individuals and social groups to compete for and extend existing territories into higher quality habitat areas (López-Sepulcre et al. 2010). Habitat loss and predator introduction occurred after human settlement in 1770 and were responsible for the dramatic decrease in population numbers, consequently resulting in the extinction of the species from seven of only eight originally occupied islands (Komdeur 1996). In 1990 a total of 23 individuals remained on Frégate Island (201 ha) alone. This prompted BirdLife International and the Royal Society for the Protection of Birds to initiate a recovery programme in 1990 (Norris and McCulloch 2003; López-Sepulcre et al. 2008), which was later taken over by Nature Seychelles in 1998. Nature Seychelles set up and facilitated a local stakeholder group, the Seychelles Magpie Robin Recovery Team (SMART), to assist in decision-making and management. BirdLife International successfully translocated individuals from Frégate Island to the islands of Cousin in 1994 and Cousine in 1995. Nature Seychelles led the translocations to Aride in 2002 and Denis in 2008 (López-Sepulcre et al. 2008; Gerlach and Le Maitre 2009). Due to the conservation efforts to increase the overall population, the International Union for the Conservation of Nature changed the status of the SMR from Critically Endangered to Endangered in 2005 (López-Sepulcre et al. 2009). Despite this conservation success little is known about the longevity and annual survival of this species. Individual SMRs are believed to be long-lived (Komdeur 1996), but no analysis of long-term data has been undertaken.

For this study we considered data from the islands of Cousin (04°33′14″ S, 55°66′31″ E) (27 ha) and Cousine (04°21′41″ S, 55°38′51″ E) (26 ha), for which reliable and consistent data have been collected for 18 years. Cousin and Cousine support an average of 49 and 32 individual SMRs, respectively. Since translocation to both islands the SMR populations have been monitored closely on a daily (sightings), weekly (behavior and breeding) and monthly (movement) basis. All chicks were ringed prior to or shortly after fledging. Each individual wears a metal South African Bird Ringing Unit (SAFRING) and an island-specific colour ring, allowing for early identification of birds that have migrated from another island. The second leg holds two colour rings, the combination of which is unique to that individual allowing for ease of population monitoring. Individuals were identified from several metres away by sight or by further using binoculars. Each individual bird was located and recorded at least once monthly but in most cases weekly, providing rigorous mark and 'recapture' data. A summary of activity was made and individuals that were not seen during that particular month were noted as missing; if they disappeared for three consecutive months

they were assumed dead and removed from the island population list. This assumption of death was valid due to there being no record of missing individuals re-emerging once removed from the respective islands population list. Since 1994 there have been a total of seven confirmed inter-island movements/migrations, six of which involved movement either to or from Cousine or Cousin. The nature of the monitoring of SMR on each island makes it extremely unlikely that a migrated bird would go unnoticed and therefore these figures can be considered robust and hence migration of birds can be considered a negligible factor when calculating annual survival. All breeding attempts were monitored and all individuals have recorded life histories from hatching to death. Longevity results were taken from when the individuals hatched to when they died or went missing (assumed dead), or if they were still living the age is accurate until June 2014. Annual survival was calculated using the same method as Watson et al. (1992) as the percentage of marked adult birds present in year Y and detected in $Y + 1$ (juveniles added after one year). For each year Y there was replenishment of the number of marked birds.

Since translocation to present, a total of 201 individuals have resided on Cousin and 143 individuals on Cousine. Longevity was determined using this data set of 344 individuals over an 18-year period. A total of 11 (3.2%) individuals from both Cousin and Cousine surpassed a 10-year survival period. The oldest recorded individual was a male who died on Cousine Island on 28 September 2000 at just under 16 years old. This individual was recorded to have hatched on Frégate Island on 3 January 1985 and was translocated to Cousine Island in 1995. The mean age at death on both islands is 3 (SD 2.6) years old, with no significant difference between the sexes (two-sample t-test: $t = -1.257$, df = 46, $p = 0.947$). Annual survival rates over this 18-year period were recorded as 81.6% on Cousin and 77.9% on Cousine (Figure 1). Both islands showed a significant relationship in annual survivorship with population increase (linear regression; Cousin $b = -0.348$, $t = -3.09$, $p < 0.05$, df = 18; Cousine: $b = -0.639$, $t = -2.71$, $p < 0.05$, df = 17). No significant difference was found in annual survival between the islands overall (two-sample t-test: $t = 0.869$, df = 17, $p = 0.397$).

Watson et al. (1992) reported on the low reproductive rate for this species with an average 1.1 chicks per pair annually and reproductive maturity being reached by 12–14 months. In addition, only the dominant pair in each territory breed. With populations fully saturated on Cousin and Cousine there are 10–11 and 7–9 territories, respectively, and therefore population recruitment is restricted to and dependent on 10–11 and 7–9 breeding pairs, respectively. The long lifespan that is here recorded is a likely benefit to population survival and growth of this species; by having the same dominant breeder for several years the number of disputes within territorial groups is likely reduced. There also appears to be an increase in reproductive output with age once a breeding pair is established (unpublished data), which would suggest that there is an optimum breeding age, though further study here is required. Longevity of the SMR is of further interest considering its endangered status and its recent history involving several translocations. By understanding the lifespan we are better able to make conservation management plans for this species, such as improving output by removing unproductive, older dominant individuals to alternative territories or by ensuring the successful translocation and establishment of a population by selecting the most favourable individuals according to life stage. All applications of management are aimed at improving the conservation status from Endangered to Threatened. The thorough data collected on this species on both Cousin and Cousine since translocation has provided long-term insight into the species annual survival. Both islands demonstrate similar levels of annual survival with no significant difference found overall ($t = 0.869$, df = 17, $p = 0.397$). Most notably, an overall decrease in annual survival overtime on both islands was linked to population increase. It has been reported that aggressive defense of territorial

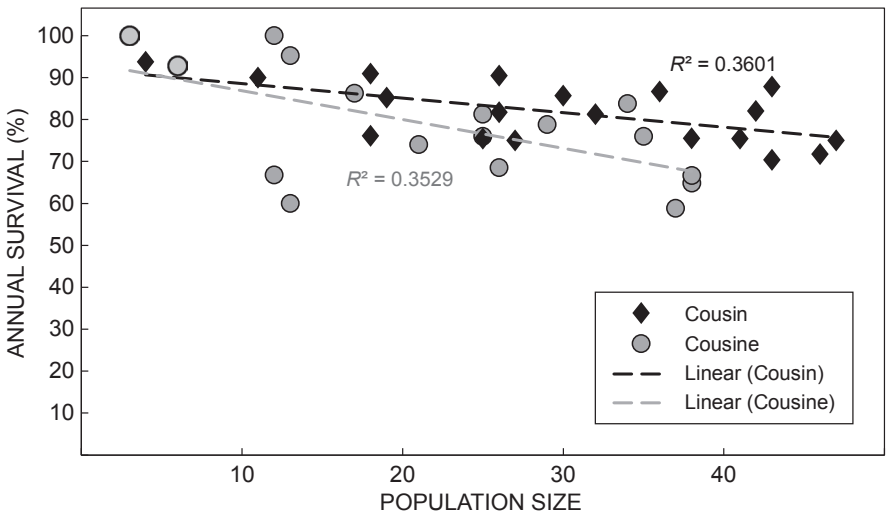

Figure 1: Significant linear regression of Seychelles Magpie Robin annual survival and population size with associated R^2 values for Cousin and Cousine Islands, Seychelles

boundaries operate as a limiting factor within populations of this species (Watson et al. 1992), likewise density-dependent effects on reproduction can also be caused by competition for food as recorded for the Seychelles Warbler *Acrocephalus sechellensis* (Brouwer et al. 2009). It is likely that both increased territory disputes and competition for food are limiting factors for this species' population growth, particularly given its geographic constraints.

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