

Translocation of the Seychelles warbler *Acrocephalus sechellensis* to establish a new population on Frégate Island, Seychelles

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SUMMARY

In December 2011, 59 adult Seychelles warblers *Acrocephalus sechellensis* were translocated between two islands in the Seychelles. Birds were captured on Cousin Island and translocated to Frégate Island using a hard release method, with minimum time in captivity. Frégate had been previously identified as a suitable host for a substantial population of Seychelles warblers, although the presence of the species had never been confirmed on this island. It was estimated that Frégate currently has the potential to support about 500 Seychelles warblers, rising to over 2,000 after habitat regeneration. All birds survived the translocation and were released unharmed at the new site within 24 hours of capture. Close monitoring of both the new and source population was undertaken over a period of 18 months. By June 2013, the Frégate population had increased to 80 individuals, which included 38 of the original translocated birds and 42 birds which had hatched on Frégate. There was also evidence that multiple generations had already hatched on the island. This shows that the Seychelles warbler responded well to a hard release translocation, with observed population growth on Frégate comparable to previous warbler translocations. The source population on Cousin recovered to carrying capacity within a single breeding season. This is the fourth translocation of this species, fulfilling the species action plan requirement of five populations of this endemic island passerine.

BACKGROUND

The Seychelles warbler *Acrocephalus sechellensis* is a small, insectivorous passerine endemic to the granitic islands of the Republic of Seychelles. Due to habitat destruction for intensive coconut *Cocos nucifera* cultivation and the introduction of invasive predators (e.g. rats *Rattus spp.*), the Seychelles warbler was extirpated from all islands except Cousin Island (4°20'S, 55°40'E, 0.29 km²) where the population may have fallen to as low as 26 individuals by the mid 20th century (Crook 1960, Spurgin *et al.* 2014). The warbler has since been the focus of intensive conservation action that commenced with the purchase of Cousin in 1968 by a consortium led by the International Committee for Bird Protection (now BirdLife International). Since then the island has been managed solely for conservation and research. Careful habitat management, including the regeneration of native forest, enabled the population to recover and the population of Seychelles warblers has remained stable at about 320 individuals since 1982 (Brouwer *et al.* 2006).

Seychelles warbler has not, so far, naturally re-colonised the other islands with suitable habitat (Komdeur *et al.* 2004). To increase the species range, translocations of 29 individuals were undertaken from Cousin to Aride Island (4°12'S, 55°40'E, 0.68 km²) in 1988 and from Cousin to Cousine Island (4°21'S, 55°39'E, 0.25 km²) in 1990 (Komdeur 1994). In 2001, Nature Seychelles commissioned a species conservation action plan for the Seychelles warbler. This plan outlined the objective of increasing the species range to five populations, with a total exceeding 3,000 individuals, to further enhance long term survival prospects and potentially allow a

downgrade in its conservation status from Vulnerable to Near Threatened (Richardson 2001). It was agreed that twice the number of individuals should be moved in future translocations, to ensure increased representation of the genetic variation present on Cousin within the new populations. Subsequently, a third translocation of 58 individuals from Cousin to Denis Island (3°48'S, 55°40'E, 1.42 km²) was undertaken (Richardson *et al.* 2006). The present work details the fourth translocation undertaken, from Cousin to Frégate Island (4°35'S, 55°56'E, 2.19 km²), to fulfil the conservation action plan.

ACTION

Study site assessment: From 1999 to 2002, 10 islands in the Seychelles were surveyed by Nature Seychelles to assess their suitability for sustaining translocated populations of endangered endemic bird species, including the Seychelles warbler (Hill 2002). Three islands were selected as potentially suitable for Seychelles warbler, and were surveyed in more detail (D'Arros: Van de Crommenacker *et al.* 2009; North: Richardson & van der Woude 2010; Frégate: Richardson & Hammers 2011). Whole island surveys were conducted during which native and exotic vegetation was identified and its distribution mapped. Seychelles warbler prey availability was determined using standardised insect counts following the protocols outlined by Komdeur (1992) and Brouwer *et al.* (2009). These data were used to estimate the quantity and quality of warbler habitat across each island. The absence of introduced predator species and the presence of ongoing measures to minimise the possibility of their accidental introduction, such as culling and island landing controls, were also confirmed.

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As a result, Frégate was selected to host the fifth Seychelles warbler population. The island is outside the confirmed historic range of the species, although during the last glacial maximum the inner Seychelles islands would have been a single land mass. Furthermore a reconstruction of the species historic effective population size, estimated at 2,500, suggests that Seychelles warbler was formerly abundant and widespread across these inner islands (Spurigin *et al.* 2014).

Frégate currently possesses 0.37 km² of suitable habitat and this is predicted to increase to 0.42 km² by 2016 as a result of ongoing regeneration work. Prey availability within this habitat was higher than on Cousin (Richardson & Hammers 2011). Importantly, after the successful eradication of common myna *Acridotheres tristis*, Frégate was free of non-native predators (Millet & Shah 2001, Canning 2011). The survey estimated that Frégate could currently sustain about 500 Seychelles warblers, with an eventual population exceeding 2,000 once the regeneration of habitat is completed (Richardson & Hammers 2011). An area of native pisonia *Pisonia grandis* woodland was identified as a suitable release site based on its close similarity to the species' preferred habitat on Cousin.

Pre-translocation census: As part of the ongoing research undertaken by the Seychelles Warbler Study Group, there is detailed information on nearly all individuals in the Cousin Seychelles warbler population (Komdeur 1992, Richardson *et al.* 2005, Barrett *et al.* 2013). Prior to the translocation, a complete island census was conducted from 25 November 2011 to 7 December 2011, to locate and check the suitability of individuals for translocation. The translocation was planned for December, prior to the minor breeding season (December-February, Komdeur 1991), when individuals are in peak condition (Richardson *et al.* 2006). A small percentage of pairs may breed at any time of year and so the census enabled identification of individuals exhibiting breeding behaviour that were subsequently excluded from catching effort. As with all

previous Seychelles warbler translocations, Cousin was used as the single source population. This was because: 1) over 97% of adult birds on Cousin are ringed and of known age and sex (Richardson *et al.* 2001), 2) the population was at carrying capacity and so many territories contained surplus, subordinate individuals (Brouwer *et al.* 2006), and 3) as the last remaining natural population, Cousin is the most genetically diverse, and has not suffered any loss of variation as a result of earlier translocations (Wright *et al.* 2014).

Capture: Based on previous experience and logistical feasibility, the translocation was split into two transfers; the first took place on 7 December 2011 and the second on 14 December 2011. For each transfer, four teams of 2-3 people were distributed around the island in allocated catching zones, where they were already familiar with the territory structure and the status of the occupying birds. These teams then relayed captured birds to a central processing team. Birds were caught using mist nets (5-6 nets of 9-12 m/team) and audio lures between 15:00 h and 18:00 h on the evening before, and from 06:30 h until 13:00 h on the day of transfer; at 13:00 h they were translocated. This timing was designed to allow the birds time (daylight hours) to feed both before capture, to ensure they were in the best condition for translocation, and after release on Frégate, to allow quick subsequent recovery of body weight. Individuals caught in the evening prior to the translocation were kept overnight in individual cardboard boxes (approximately 35 x 25 x 25 cm) furnished with a perch, pisonia leaves sprinkled with water and fresh termite *Nasutitermes spp.* eggs for food (Figure 1).

We attempted to catch individuals from across the entire island with only two restrictions: 1) avoid possible breeding territories, and 2) avoid taking both dominant and subadults/subordinates/recent fledglings from the same territory where they may be first order relatives. Subordinate individuals were particularly targeted as they were surplus,



Figure 1. Individual Seychelles warbler translocation boxes. Note small air hole punctures and pisonia leaf lining. Image: D. Gilroy.

adult birds that were normally relatively young (but see Richardson *et al.* 2007), but often had breeding experience from helping the dominants in their natal territory (Komdeur 1996a). This makes them ideal founders for establishing a new population.

Transport: 59 birds (23 females, 36 males) were translocated to Frégate. Of these, 22 were transferred on 7 December and 37 on 14 December 2011, with 25 kept overnight and 34 caught on the day of transfer. The birds were transferred by helicopter; a journey time of 15 minutes.

All individuals were checked for injuries and general body condition and their age and sex were checked in a central electronic database in order to select individuals fit for translocation, and to balance the sex ratio in the new population as much as possible. Any unringed birds were given a unique identifying combination of coloured leg rings and a metal British Trust for Ornithology ring. Any faded or damaged rings were replaced. Standard measurements of wing and tarsus length and mass were recorded. A 25 µl blood sample was taken from the wing vein of each bird and stored in absolute ethanol. All birds were then placed individually into customised cardboard boxes (as above) ready for transportation (Figure 1).

Release: Prior to the translocated birds' arrival, water was sprayed on the trees at the release site to provide drinking water. All birds were released immediately after arrival, within a five minute period. There was no mortality during the translocation and all individuals readily flew into the vegetation canopy.

Post-release monitoring: The Frégate population was monitored for one week immediately after each release day. Cousin was monitored after five weeks (25 January 2012 to 28 February 2012) and Frégate was monitored again after eight weeks (15 to 28 February 2012). Extended monitoring of Cousin was undertaken from June to October 2012 and of Frégate from March to June 2013. All monitoring was undertaken by teams of 2-3 people.

Censuses were conducted using transects across the islands in which birds were located by a variety of methods: "phishing" (blowing harshly through closed lips to create a scolding-type vocalisation), whistling and/or using song playback; listening for the song, the distinctive bill-snap produced when the warbler is feeding, or the begging calls of chicks and dependant fledglings. Once located, individuals were followed for a minimum of 15 minutes to determine territory ownership and boundaries, breeding status and any interactions with other warblers. We attempted to catch all unringed birds using mist nets and song playback on both islands. Any unringed individuals were given a unique identifying combination of coloured leg rings and a metal British Trust for Ornithology ring. All birds were processed as described previously.

CONSEQUENCES

Frégate population: A total of 50 translocated individuals (85%, 20 female, 30 male) were resighted during February 2012 (eight weeks post-release) in 28 established territories. Nineteen pairings were confirmed and two breeding attempts

were recorded. The birds had colonised many areas across the island, with individuals sighted on the opposite side of the island to the release site (Wright & Richardson 2012).

A census in June 2013 recorded 80 warblers with 33 defined territories, an overall population growth of 36%, although a small number of unringed individuals hatched on Frégate makes an exact figure difficult to ascertain. Of the 59 founders, 38 were resighted during this census, four of which were not seen in the initial census. Both sexes showed high annual survival in 2012 (males 0.92 ± 0.04 , females 0.95 ± 0.03 , Teunissen 2013), and a lower annual survival in 2013 (males 0.85 ± 0.07 , females 0.77 ± 0.07 , Teunissen 2013). A minimum of 42 individuals had hatched on Frégate, six of which were the begging offspring of birds that had hatched on Frégate themselves, indicating at least two generations since translocation.

The highest density of territories was around the release site, in the areas of habitat considered highest quality for warblers. However, the warblers were often observed using habitat consisting of mostly introduced tree species such as cinnamon *Cinnamomum spp.*, cashew *Anacardium spp.* and coco plum *Chrysobalanus spp.* (Wright & Richardson 2012) which was considered to be unsuitable breeding habitat (Richardson & Hammers 2011). As expected, no territories were found within areas dominated by coconut.

Cousin population: The post-translocation census of Cousin (January – February 2012) revealed a total of approximately 290 ringed individuals (Figure 2). Around 25% of all territories were engaged in breeding activity during the minor breeding season (December – February). Twenty-three territories had one or more dominant individuals removed during the translocation. By February 2012, 14 of these had acquired a new dominant breeder, three contained a single individual in a reduced size territory, three had ceased to exist and a further three could not be determined. By October 2012, the population census was again about 320 ringed birds (Figure 2).

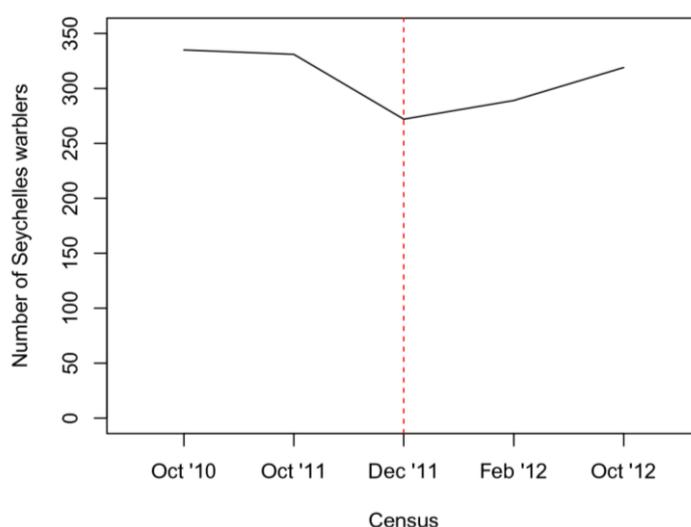


Figure 2. The Cousin Seychelles warbler population size (ringed individuals) at the end of each main breeding season (October), immediately following translocation (December 2011, shown by dashed line) and during two post-release monitoring periods.

DISCUSSION

The translocation of warblers to Frégate completes the requirement for the establishment of five populations of Seychelles warblers. Three of these populations (Cousin, Aride and Cousine) are already at carrying capacity (Brouwer *et al.* 2009). The Frégate population is showing growth similar to previous translocations (Richardson *et al.* 2006). It is encouraging that Seychelles warblers on Frégate were readily utilising habitat that was previously considered unsuitable for them. This suggests that the upper population size estimate of over 2,000 may be realised.

Unusually for an avian translocation programme, no mortality occurred during this or any of the preceding translocations of Seychelles warblers, and survivorship in the establishing populations was high (Teunissen 2013). A study by Taylor (2006) found that time in captivity affected the probability of mortality in translocations of saddlebacks *Philesturnus carunculatus*; our use of a 'hard release' approach, with minimum time in captivity, appears to have been successful for the Seychelles warbler. This species may be particularly resilient to stress and thus suited to a hard release method. We emphasise the invaluable contribution of several years of comprehensive planning and surveying prior to the translocation, which informed the selection of the best new island, release site and founder individuals.

The translocation of 59 Seychelles warblers from Cousin reduced its population size by about 20%. The population recovered to its previous population size by October 2012, less than one year after the translocation. The percentage of territories at which breeding took place during the minor breeding season (25%) is similar to that expected based on long term monitoring of this population (Komdeur 1996b). The rapid re-population of Cousin is, therefore, more likely due to increased survival of offspring than an increase in breeding *per se*. Overall the impact on the source population has been minimal.

Although the last two populations established on Frégate and Denis are not yet near reaching saturation, all five populations of the Seychelles warbler appear to be well established. The total population of Seychelles warblers is now estimated at about 2,800 adults: Cousin = 320 (Brouwer *et al.* 2006), Cousine = 210 (Van de Crommenacker & Richardson 2007), Aride = 1,850 (Orchard 2004), Denis = 300 (J. van der Woude, unpub. data) and Frégate = 80 (Teunissen 2013). As the newer populations reach capacity we expect the total population to exceed 7,000 birds. These numbers, spread across five separate islands, may justify the status of this species being downgraded to Near Threatened (BirdLife International 2014). The monitoring of all Seychelles warbler populations will continue into the foreseeable future, hand-in-hand with research on this species that has become a model for conservation, evolutionary and ecological research.

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