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A TRIAL TRANSLOCATION OF THE CRITICALLY ENDANGERED MANGROVE FINCH: CONSERVATION MANAGEMENT TO PREVENT THE EXTINCTION OF DARWIN'S RAREST FINCH

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Finch habitat at Playa Tortuga Negra, Caleta Negra.

Photograph: Francesca Cunninghame

A trial translocation of the critically endangered mangrove finch: Conservation management to prevent the extinction of Darwin`s rarest finch

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The mangrove finch (*Camarhynchus heliobates*) is the rarest of 13 Darwin's finch species endemic to the Galapagos Islands (Dvorak *et al.*, 2004; Fessl *et al.*, 2010). Currently classified as Critically Endangered by the IUCN, with an estimated population of 100 individuals, ongoing conservation management is essential to prevent extinction. Historically widespread throughout mangroves of Isabela and Fernandina (Dvorak *et al.* 2004), the mangrove finch is now restricted to 30 ha of mangroves in north-west Isabela at Playa Tortuga Negra (PTN) and Caleta Black (CB) (Figure 1). Until 2009 a remnant population was present south of Bahía Cartago; however, recent attempts to locate these birds have failed. Threats to the species include predation from introduced rats (*Rattus rattus*), nestling mortality through parasitism from introduced botflies (*Philornis downsi*), potential inbreeding through small population size, and environmental phenomena (tidal waves, volcanic uplift, etc.) destroying remaining habitat (Dvorak, 2004; Fessl *et al.*, 2010). Effects of other introduced predators such as cats (*Felis catus*) and anis (*Crotophaga ani*) remain unknown (Fessl *et al.*, 2010). Reasons for past declines are likely a combination of those listed (Fessl *et al.*, 2011).

Current conservation management

Artificial-nest trials and nest-success studies showed that rat predation was the biggest threat to nesting success (Fessl *et al.*, 2010; Fessl *et al.*, 2011). As a result, permanent bait-stations, with rat poison, were placed 50 m apart along transects throughout the 30 ha of mangrove forest (Fessl *et al.*, 2010). Pipes were baited with Klerat wax cubes (0.05 g brodifacoum/kg), checked every 1-2 months, and refilled as necessary; unconsumed bait was removed.

As a result of the poison regime, rat numbers have decreased. Over the last four years, twice-yearly monitoring reveals, at worst, very low numbers of rats at the end of the wet season. In the two months following the implementation of rat control, mangrove finch nesting success doubled (Fessl *et al.*, 2010).

Translocation

Based on the restricted range of the mangrove finch and limited natural dispersal through poor breeding success (until recently), one of the most beneficial conservation management tools may be the direct re-establishment of populations within its historic range (Fessl *et al.*, 2010). Captive trials conducted in 2009 on Santa Cruz with the closely related woodpecker finch (*C. pallidus*) highlighted the risk of avian pox infection (all birds became infected, to date pox has not been recorded in mangrove finch habitat) and therefore reintroductions of captive-raised birds could never take place. Thus, a direct translocation of wild-caught birds was proposed (Fessl *et al.*, 2010). Translocation and reintroduction

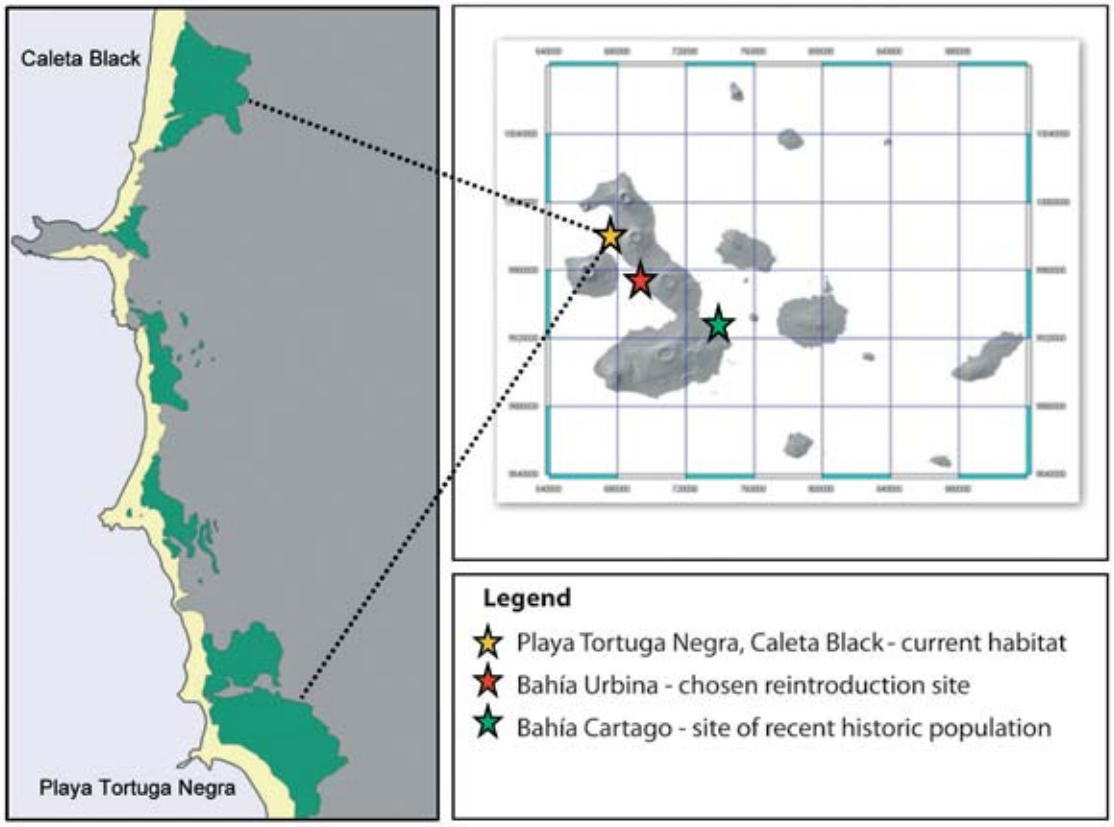

Figure 1. Recent and current distribution of the mangrove finch in the Galapagos Islands.

of endangered species are well-established techniques used worldwide to reduce extinction risk and safeguard threatened populations: the overall goal being to establish additional viable populations within the species' historical range (Seddon *et al.*, 2007). Although studied for several years, the mangrove finch has never been held in captivity; birds have only been handled for ringing, measuring and blood-sampling. Therefore, the first step in developing a translocation program was a trial translocation to determine the best techniques to hold and transport birds, and study their adaptation to a new site.

Reintroduction site selection and management

Mangrove finch habitat at PTN and CB is unique in Galapagos, being the only unmodified tall mangroves protected from the open sea, resulting in the buildup of leaf litter (Dvorak *et al.*, 2004; Fessl *et al.*, 2010). Former finch sites at Cartago and Urbina bays are considered suitable for translocation based on current knowledge (Dvorak *et al.*, 2004). Bahía Cartago contains the largest continuous area of mangroves in the archipelago, providing ample space for population expansion. Logistically, however, predator control and monitoring of released birds are impractical there. After visits in early 2010, Bahía Urbina was selected as the preferred site due to its suitability for rat control and proximity to the source population.

Poza de los Tiburones, a mangrove forest covering 10 ha at Bahía Urbina, was chosen for the re-introduction for the following reasons:

- Small area and distance from other mangroves make it manageable for rat control;
- Accessibility of habitat makes post-release monitoring possible;
- Proximity to the source population (PTN 22 km);
- More feasible logistically and financially.

On-going rat control is essential for the protection of breeding mangrove finches (Fessl *et al.*, 2010). A rat-bait grid identical to those at PTN and CB was set up at the release site. To assess the effectiveness of the bait stations, rat monitoring using live-capture Tomahawk traps was conducted twice-yearly (Table 1). Traps were placed 25 m apart and opened for three consecutive nights using peanut-butter and oats to attract rats. The traps were closed during the day to avoid capturing non-target species. Rat numbers at the release site were reduced following the implementation of baiting in late May 2010.

Capture and transfer

Birds were captured for translocation in late May 2010, once the 2009/2010 breeding season ended. The plan was to capture 10 individuals for transfer, the composition to be determined by ease of capture. Preference was placed on transferring juveniles; however, in order to obtain

Table 1. Percentage rat catch at Poza de los Tiburones (Bahía Urbina) prior to and following implementation of rat control in late May 2010.

Date	Season	No. rats over three nights	No. trap nights	% catch
May 2010	Wet	26	69	37,7
Nov 2010	Dry	4	114	3,5
Apr 2011	Wet	15	114	13,2
Nov 2011	Dry	1	90	1,1
Mar 2012	Wet	5	90	5,5

enough birds, adults were included. The ability of the field team to catch 10 individuals was unknown so three days were planned for the effort. All birds would be transferred on the same day as their capture.

Birds were captured using mist-nets set up in early morning at low-tide across six sites throughout the forest at PTN. Ten finches were caught, five adults and five juveniles from the 2009/2010 breeding season. Only nine were chosen for transfer (Table 2). One adult male was not transferred to avoid removing a significant number of breeding adults from the source population.

Table 2. Individuals transferred from PTN to Poza de los Tiburones on each of the three days of transfer; all nine birds were identified by their individual color-ring combinations.

Date	Adult Males	Adult Females	Juveniles
23/05/10			Orange/Green
			Red/Yellow
24/05/10	Gold/Purple	Pink/Blue	Blue/Blue
	Red		Purple/Green
25/05/10		Pink/Yellow	Red/Orange

Birds were removed from nets, weighed, measured, photographed, fitted with metal and color rings, and blood samples taken for DNA sexing. A veterinarian (WildCare Institute, CDF) was present to assess the birds for any apparent health problems. All nine birds were healthy and ready for transfer. Transmitters with external aerials (Holohil Systems Ltd., Ontario, Canada) weighing 0.41 g were fitted to the interscapular region of all transferred birds (Figure 2a).

Transport boxes (Figure 2b) were built and all materials used complied with Galapagos National Park Service (GNPS) quarantine regulations. In order to provide food for the finches, the field team caught local invertebrates to release in the boxes. Travel by speedboat between PTN and Bahía Urbina lasted one hour. This was the first time mangrove finches had been held in cages and the duration between capture and release varied from 2-7 hours. Birds reacted very well during their time in confinement and all arrived at the release site in excellent health.

Post-release monitoring

1. Telemetry

Telemetry monitoring was carried out following release, with the battery life of the transmitters allowing a maximum monitoring period of 22 days. Birds were radio-tracked daily on foot and by kayak using a R1000 receiver (Communications Specialists Inc., Orange, California) and a 3-element yagi aerial (Sirtrack Electronics, Havelock North, New Zealand) to attain a minimum of one fix per bird/per day.

Telemetry monitoring was cut short for six birds by the premature detachment of the transmitters resulting in individuals being monitored for 2-16 days (Table 3). The 200-300 m range of the transmitters within the forest was sufficient to confirm the presence or absence of a bird within any patch of mangroves. All birds were found to be alive and close to the reintroduction site 48 hours after release. While one juvenile returned to PTN within the first week following release, the other eight remained near the release site until signals were lost, transmitters fell off or batteries ran out. One juvenile was found dead in the arid zone vegetation 500 m from the release site seven days after release.

2. Observational monitoring

Once the transmitters stopped functioning, monitoring was continued through direct observation and listening. Playback was used to elicit response from any mangrove finch in the search area from the mangrove forest at the release site extending up the coast to PTN. Searches were conducted monthly following the end of telemetry monitoring for 4-17 days until May 2011. Observations of ringed birds during fortnightly trips to PTN each month from October to May have continued through the 2011/12 breeding season to May 2012.

Figure 2. *a)* Adult mangrove finch fitted with radio transmitter and ready for transfer; *b)* transport boxes with birds inside. Photos: B. Barrett

Table 3. Number of days that each bird was monitored and number of fixes obtained using telemetry, whether transmitter was recovered, last date observed with or without telemetry and fate (* successful breeding confirmed).

Bird ID	Sex	No. days radio tracked	No. telemetry fixes	Transmitter recovered	Last date observed	Fate
orange/green	J	5	13	yes	28/05/2010	unknown
red/yellow	J	2	6	no	27/05/2010	unknown
pink/blue	F	9	15	yes	15/04/2011	PTN
gold/purple	M	8	6	no	03/05/2012*	PTN
blue/blue	J	3	5	no	26/05/2011	unknown
red	M	16	35	no	16/02/2012	PTN
purple/green	J	7	9	yes	27/05/2010	dead
pink/yellow	F	6	15	yes	28/05/2010	unknown
red/orange	J	8	5	no	21/04/2012	PTN

For four months following termination of telemetry monitoring, no finches were located at Urbina, despite 232 hours of searching by trained personnel over three separate field trips. In November 2010, however, an adult male at the release site responded to playback and a month later, in December, this bird, along with another adult male, was observed singing back at PTN. These individuals were observed at PTN throughout the breeding seasons of 2010/2011 and 2011/2012, and successful breeding was confirmed for one in 2012. In early 2011 and 2012 the juvenile that returned to PTN soon after translocation was observed, and during May 2011 one of the adult females was found at PTN. All sightings of known transferred individuals were confirmed by reading their color-rings in the field.

Conclusions

The ability to reduce rat numbers at the release site (Bahía Urbina) over a short period of time demonstrates that a site can be managed for the protection of mangrove finch. The increase in rat numbers seen between November 2010 to April 2011 and November 2011 to March 2012 most likely resulted from the increase in food supply during the wet season. The increase in the rat population during these periods was also evident at PTN where rats were caught for the first time in two years. With the maintenance of poison-bait stations, rat numbers at the release site can be kept significantly lower than without control, even during a wet season.

Radio-tracking of mangrove finches following their translocation was successful providing that devices remained attached. Premature detachment of six transmitters resulted in valuable data being lost. The rapid loss of transmitters was likely caused by the prevalence of blood-feathers on the juveniles and adults being in molt.

Monitoring by observation and listening surveys was challenging. It took several months following the radio-tracking before any birds were re-sighted. No calls were heard until the onset of the breeding season four months

Figure 3. The mangrove finch (*Camarhynchus heliobates*). Photograph: Michael Dvorak

later though birds may have been present. No mangrove finch has been detected at the release site since November 2010.

Only one juvenile bird was confirmed returning to the source population immediately following release; this was surprising as it was predicted that adult birds with established territories would be more inclined to return. The presence of three more adult birds at PTN detected in December 2010 indicates that mangrove finches exhibit strong site fidelity and are capable of making relatively long-distance flights over expanses of exposed lava fields. It is known that one of these individuals that had been observed calling and exhibiting mate searching behavior at the release site did return to PTN at the beginning of the breeding season. It is possible that it returned to search for a mate. It is unknown when the other two adults returned.

The persistence of at least one bird at the release site for six months and the fact that it was in good enough condition to return to PTN, suggests that the habitat at Bahía Urbina provides sufficient food and shelter for mangrove finches. It is imperative to continue to develop more effective methods based on the lessons learned in this study to re-establish mangrove finch populations outside of the 30 ha in which they currently persist. Until then they will continue to be one of the most threatened birds in the world.

Recommendations

The trial translocation reported here was successful in advancing the development of translocation techniques for conservation of the mangrove finch. At least four of the birds removed from the source population are once again part of that population. Knowing the fate of over 50% of the translocated birds highlights the ability of dedicated field teams to work with this species. However, the trial translocation was unsuccessful in terms of increasing the range of the species. Additional translocations are needed to re-establish mangrove finch populations across its historic range. We recommend the following actions:

- Improve methodologies to increase chances of permanent establishment of new populations;
- Conduct a translocation in early 2013 using first clutches at PTN from accessible nests (therefore inducing double-clutching in the source pair) to avoid translocated individuals returning to the source population. Incubate these eggs *in situ* to avoid disease risk and hand-raise nestlings; aviaries should be constructed at the release site and fledglings held for a month before soft release;
- Continue rat control in all mangrove finch sites to protect current and future populations although

the isolation of both the source population and new release site makes both regular monitoring and predator control expensive;

- Carry out research to establish methods for control of *P. downsi* (this work should be done in collaboration with the mangrove finch project); with rats significantly reduced through the poison-bait program, *P. downsi* represents the biggest threat to nesting success;

- Continue capacity building in the Galapagos National Park and with other local personnel to ensure that the project continues once international funding expires in 1-3 years;

- Continue the outreach program; although the mangrove finch is the rarest bird in Galápagos, its plight is relatively unknown. Education activities conducted in Puerto Villamil in support of the project have been well received.

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