Captive Propagation and Reintroduction of the Puaiohi *(Myadestes palmeri)*: Seventeen Years of Conservation Action

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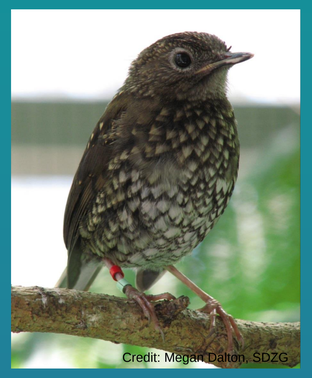
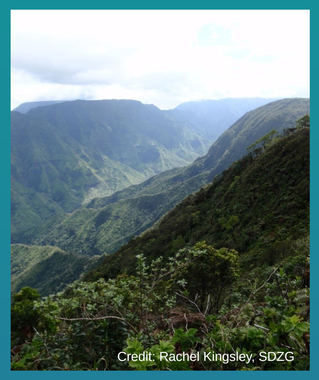
HAWAI`I ENDANGERED BIRD CONSERVATION PROGRAM

The Hawai`i Endangered Bird Conservation Program (HEBCP) is a unique collaboration between the San Diego Zoo Institute for Conservation Research, the U.S. Fish and Wildlife Service (USFWS), and the State of Hawai`i's Division of Forestry and Wildlife (DOFAW).

The HEBCP uses captive propagation and reintroduction as crucial tools in the recovery of Hawai`i's threatened avifauna.


Credit: Megan Dalton, SDZG


Credit: Rachel Kingsley, SDZG

INTRODUCTION

The Puaiohi, *Myadestes palmeri,* is a federally listed endangered thrush, endemic to the island of Kaua`i. It is listed as critically endangered by the IUCN. Historically, the Puaiohi was uncommon and by the mid-1990s the Puaiohi population faced a wide range of threats, including introduced predators (cats, rats and mongoose) and the degradation of its habitat by ungulates and invasive plants. The altitudinal rise in the elevation limit up to which the *Culex* mosquito and the avian malaria parasite *Plasmodium relictum* can reproduce is an ever-increasing concern for native birds including the Puaiohi.

The Puaiohi is now restricted to upland, wet forest and ravines of Kauai's Alaka`i Plateau. Although the ecosystem of the Alaka`i is degraded in parts, it still contains native fruiting plants as well as invertebrates – the two major food types in the wild Puaiohi diet. Territoriality of the species may limit the availability of nest-sites, which are primarily niches in cliff faces along streams.

The Puaiohi is shy and secretive, making it a challenge to survey and evaluate the impact of threats. Population estimates in the 1980's and 1990's ranged between virtually extinct to more than 200 birds. These surveys also showed a distinct retraction in the species' range, to approximately 20km^2. Consequently, a captive breeding program was initiated. By 2004, survey results indicates that 300-500 Puaiohi existed and the range may have been slightly larger than previously thought.

ESTABLISHING THE BREEDING PROGRAM

During 1996-1997, 19 Puaiohi eggs were collected from wild nests and transferred to a temporary incubation and rearing facility on Kaua`i. Fifteen eggs were viable and resulted in the hatching of 15 chicks. When strong enough, the chicks were transferred to the Keauhou Bird Conservation Center (KBCC), as the founders for the captive breeding program. A second captive population was established at Maui Bird Conservation Center (MBCC) on Maui in 2000.


Credit: Sharon Belcher, SDZG


Credit: Sara Bebus, SDZG

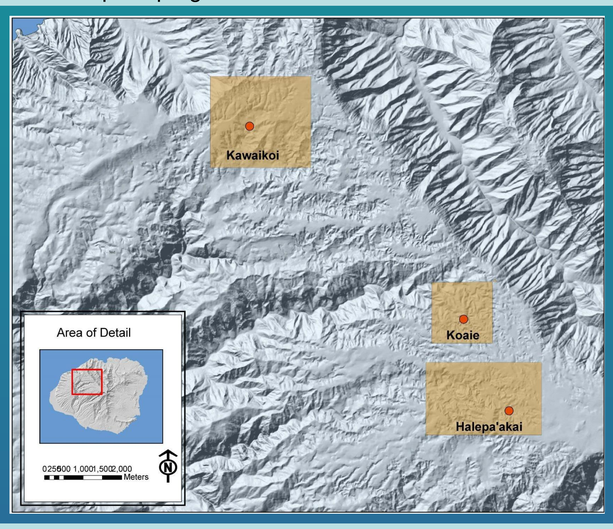
CAPTIVE PROPAGATION OF PUAIOHI

The Puaiohi at KBCC and MBCC are maintained year round with a captive diet comprised of a variety of fruits (including native ones, when available), scrambled egg, proprietary soft bill pellets and a range of insects. Veterinary care is coordinated by the San Diego Zoo's Veterinary Services and Wildlife Diseases Labs.

Being primarily solitary, male and female Puaiohi are kept separately in adjoining aviaries except during the breeding season (March to July). Pairs are then socialized and monitored. Females are provided with a variety of nest sites around the sheltered walls of the aviary.

The majority of eggs have been artificially incubated and chicks hand-reared. Hand-rearing initially involves feeding 15 times per day, and becomes less frequent as the chicks develop. Chicks are maintained in brooders, whenever possible with a nest-buddy to reduce the chances of imprinting.

Parent-rearing has been attempted with variable success and continues to be a focus of the captive program's efforts.



RELEASE METHODS

Between 1999 and 2012, 222 Puaiohi were transferred to the Koaie, Kawaikoi or Halepa`akai river drainages within the Alaka`i, constituting 14 release efforts.

Before leaving MBCC or KBCC, each bird was given a full veterinary exam to ensure they were fit for release and then color banded. Birds were transported to Kaua`i by inter-island plane and then transferred to the release sites by helicopter or on foot. Birds were installed in 2.4m x 2.4m x 2.4m pre-release aviaries. Up to 6 birds were held in each aviary for a pre-release acclimation period of 7-15 days.

Several days prior to release each bird was captured, examined, weighed, and if appropriate, fitted with a radio-transmitter. Any birds presenting concerns at this point were not released.

Throughout releases, a soft release strategy was applied. Supplemental food was provided in and around the open release aviaries for up to 1 month, to facilitate the birds' transition to wild foraging.


Credit: Rachel Kingsley, SDZG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POST-RELEASE MONITORING

Bird dispersal and survivorship post-release were monitored frequently by a team using radio-telemetry. The weight and size of the transmitter and battery made it feasible to monitor birds for up to 28 days post-release. The monitoring effort varied according to the evolving release methods and the availability of personnel. In some years, helicopter surveys were used to detect birds which had dispersed to distances where hand-held telemetry units could not detect them. After radio transmitter batteries failed, efforts were made to re-sight color bands of released individuals.

RESULTS

Between 1996 and 2012, the captive breeding program produced 460 viable/fertile eggs and hatched 366 chicks (79.6% hatchability), of which 284 chicks were raised to independence (77.6% chick survivability). This makes it one of the world's most productive propagation programs for an endangered passerine.

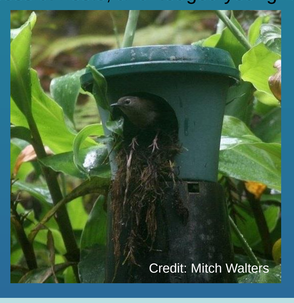
During the initial 1999 release at Kawaikoi, all 14 birds were monitored to assess survival, dispersal, and home-range establishment – all 14 birds survived up to 56 days post-release. Based on this success, a more extensive release effort was instigated.

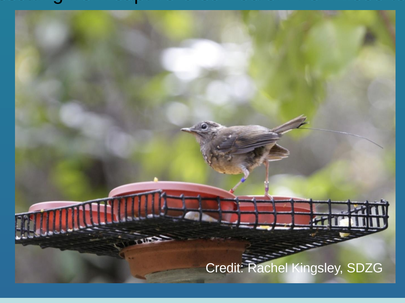
Of the 222 birds released, 122 (55.0%) had confirmed status at 28 days post-release. Of those 122 birds, 80 (65.6%) were recorded as alive and 42 (34.4%) were confirmed dead. The remaining 100 birds' status was unknown at 28 days. The mean age at release was 445 days and 176 (79.1%) were released at under 1 year of age.

The demanding and precipitous terrain of the Alaka`i has made it challenging to acquire long-term post-release survival and reproduction data, but we have observed a few released birds paired up, nesting and raising chicks, usually in the first season post-release.

	Individuals Detected	Individuals Known to Breed	Nesting Attempts	Successful Nests	Young Fledged
2005-2012	10	6	11	6	10
2002-2003	4	4	4	?	?
1999-2001	12	12	28	10	14
Total	**26**	**22**	**43**	**16**	**24**

Table 1: Number of captive-bred Puaiohi individuals detected and number of nesting attempts, successful nests, and fledged young resulting from captive-bred Puaiohi from 1999 to 2012.


Credit: Mitch Walters


Credit: Rachel Kingsley, SDZG

CURRENT STATUS OF PUAIOHI RECOVERY

Data collected between 2003 and 2007 suggested that the Puaiohi population numbered between 300 and 800 birds. Any increase over earlier figures likely reflects a) improved survey effort and techniques for this cryptic species, b) possible natural recovery post-hurricanes, and c) the contribution of captive-bred, released individuals that have survived and bred in the wild. In comparison, populations of several other Kaua`i endemics, residing in similar habitat and facing comparable threats, have declined over the same time frame.

FUTURE MANAGEMENT

Due to the increased population estimates, the reintroduction effort was halted in 2012. This enables the evaluation of wild population trends in the absence of any contribution from newly-released, captive-bred birds. Ongoing studies aim to refine wild population estimates, accounting for other management measures that target limiting factors *in situ*. The captive breeding program will maintain a small breeding population with the aim of producing parent-reared chicks.

ACKNOWLEDGEMENTS

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