## SHORT COMMUNICATION

# Relocation of Puerto Rican cave dwelling frogs *Eleutherodactylus cooki* into natural and artificial habitats

Alberto L. López-Torres[1]*, Carlos A. Rodríguez-Gómez[1] & José A. Salguero-Faría[2]

[1] *Proyecto Coquí, San Juan, Puerto Rico*

[2] *Puerto Rico Department of Natural and Environmental Resources, San Juan, Puerto Rico*

**SUMMARY: We report the results of capturing and relocating 403 *Eleutherodactylus cooki* frogs. The frequency of recovery of translocated individuals was similar in natural and artificial habitats.**

**BACKGROUND:** The Puerto Rican cave dwelling frog *Eleutherodactylus cooki* is a threatened species protected by the US Endangered Species Act. It is a habitat specialist that depends on caves and grottoes formed by large granite boulders along streams and rivers, and is only found in southeastern Puerto Rico. The Puerto Rico Aqueduct and Sewer Authority has begun constructing a new water supply system for the east central region of Puerto Rico (the Valenciano Dam and Reservoir Project). The proposed project will affect 3.0 ha of federally designated critical habitat and 1.3 ha of non-designated habitat for this species. This study documents the effects of translocating *E. cooki* individuals, and compares the recovery rate of those released in natural habitat with those released in artificial habitat.

**ACTION:** Habitat creation and enhancement of existing habitat for *E. cooki* were completed in December 2011. This involved the creation of a habitat corridor with six new areas of artificial habitats, to mitigate the proposed impact to existing habitats and enhance the remaining habitat through reforestation. The construction of these corridors included excavation of a trench, 340 m from the original habitat, filled with boulders from the impact area (when feasible) in combination with concrete pipes of different sizes (30-183 cm), to simulate the intermittent creeks the species prefers, and create artificial cavities. The artificial habitats were monitored for temperature, moisture and light incidence using HOBO® sensors before *E. cooki* individuals were released, to ensure that they resembled the existing climate conditions of the natural habitat. Relocated animals were also released in natural habitat sites, selected on the basis of the following parameters: 1) similarities to the original habitat of the relocated animals (size, cavity complexity), 2) presence of other *E. cooki* individuals and 3) distance between the original habitat and the new natural habitat (394 m) (since we wanted to prevent the animals from returning to their original habitat).

In January 2014 we initiated the relocation of resident *E. cooki* from two of the four natural habitats that were going to be impacted. We visited both areas on ten nights between 20 January 2014 and 3 February 2014, capturing a total of 134 individuals. A second relocation effort took place at the two remaining locations between 3 March 2014 and 24 April 2014 (19 visits) capturing a total of 269 individuals. In addition to measuring and weighing all the animals, captured adult frogs were also marked by toe-clipping, with each animal having a specific codification. Before release, all individuals were externally covered with thermoplastic fluorescent dyes (Day-Glo Color Corp. Eco Pigment), allowing the initial movement of released individuals to be determined.

Monitoring efforts started when the frogs were released and continued for a 60-day period, ending on 4 April for the first group of relocated individuals, and 22 June for the second group.

**CONSEQUENCES & DISCUSSION:** Individuals were released the same night they were captured in both natural (n = 294) and artificial (n = 109) habitats at the same adult/juvenile and male/female ratios that we observed in their original habitat. Recapture data suggest that released individuals dispersed rapidly from their new habitat towards the edges and explored the surrounding vegetation, as evidenced by the fluorescent powder trails. Relocated frogs moved further during the first 24 hrs in natural habitats (3.73 ± 3.19 m, n = 49) than in artificial habitats (2.34 ± 3.34 m, n = 22), although these differences were not statistically significant (t = 1.67, d.f. = 69, p = 0.09). Juveniles and sub-adults appeared to be more sedentary and remained closer to their relocation habitats, staying in vegetation on rocks near their release points.

In this initial assessment, the recapture rate of individuals was similar at artificial and natural relocation sites (Figure 1) (linear regression (habitat type): $\beta$ = -0.004, t = -0.30, p = 0.77, d.f. = 75, $R^2$ = 0.15). Average recapture rates decreased significantly through time for both types of habitats (linear regression (days since relocation): $\beta$ = -0.001, t = -3.65, p < 0.0001, d.f. = 75, $R^2$ = 0.15). Our data suggest that we were initially able to relocate individuals in both natural and artificial sites, but numbers declined over time. The causes of this low recapture rate may include the timing of the relocation, which was carried out during the dry season, or dispersal of individuals from their relocated habitats after the fluorescent dyes wore off. Future research will focus on estimating survival probabilities across time using mark and recapture modeling.

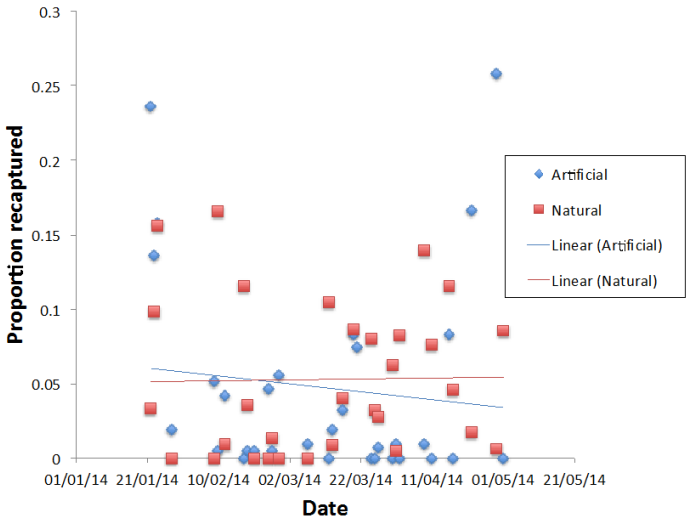


**Figure 1.** Frequency of individuals recovered over time after relocation of *E. cooki* in natural and artificial habitats.

* To whom correspondence should be addressed: al.lopeztorres@gmail.com

*Conservation Evidence* is an open access online journal devoted to publishing the evidence on the effectiveness of management interventions. The other papers from *Conservation Evidence* are available from www.ConservationEvidence.com. The pdf is free to circulate or add to other websites and is licensed under the Creative Commons Attribution 4.0 International License http://creativecommons.org/licenses/by/4.0/.



ISSN 1758-2067