Rain, rivers and radiotrackers: releasing captive-bred harlequin frogs into the wild

By Brian Gratwicke, 13th December 2023

It was like working in a shower. Despite having planned the work for the dry season, the moment we released roughly 400 captive-bred variable harlequin frogs into the wild in January 2018, it rained... and rained, and rained. More than a metre of rain fell on our newly released frogs, a stark contrast to the usual 50–80 mm for that time of year. Amidst the downpour, our challenges multiplied: these tiny, colourful creatures retreated into the newfound wilderness of Panama’s rainforest, seeking refuge from the relentless rain and disappearing from the sight of our determined team of biologists trying to monitor their progress.

The world of harlequin frogs is in crisis. There are about 100 species of these remarkable brightly coloured toads found in Latin America, and the majority of them are categorized as Critically Endangered or Extinct in the Wild on the IUCN Red List—a result of extensive population declines caused by chytridiomycosis, a deadly disease caused by the amphibian chytrid fungus.
Batrachochytrium dendrobatidis (Bd). The uncharacteristic cool and rainy weather that accompanied our release experiment unfortunately seemed to enable the chytrid fungus to flourish. In the resident frog community surrounding our release streams, almost half of the individuals we tested were infected with the disease. However, as the season progressed and the rains subsided, the chytrid fungus returned to a more typical prevalence of approximately 20%.

Our release of a significant number of Endangered harlequin frogs that are highly susceptible to the chytrid fungus prompted some concerns that there may be unintended ecological consequences. Would our released frogs become infected and act as ‘supershedders’ of chytridiomycosis into the environment? To address these uncertainties, we conducted control surveys in another nearby stream, to see how the situation there, where no captive-bred frogs were released, compared to our release site. After testing 230 frogs at both sites over the course of six months we found that the disease patterns in the two streams were very similar. This implied that the rainy conditions had a more profound impact on disease prevalence in native frogs than our introduction of captive-bred Atelopus into the ecosystem.

Prior to release, we attached tiny radiotracking backpacks to several frogs, enabling us to trace their post-release movements. The tracked frogs rapidly dispersed beyond the boundaries of our monitoring area, with females moving the furthest. One of our team members managed to track the signal from a transmitter to a hole in the bank of the stream, but, when he got there all he saw was the glowing red eyes of a smoky jungle frog reflected back from his headlamp. It seemed our unfortunate harlequin frog had probably been devoured by one of the largest and most formidable frogs in Panama.
There is no shortage of debate regarding whether or not it is wise to reintroduce susceptible frogs to an environment still threatened by the original disease. Nevertheless, observation is always the first key step in scientific research, and our careful and systematic observations have provided vital insights into the myriad of challenges these animals face as they transition from captivity to the wild. Predation is one such challenge; the smoky jungle frog quickly taught us this lesson. In captive-bred frogs, the risk of predation is heightened by diet: frogs reared in captivity, nourished on fruit flies and crickets as opposed to ants, mites and other leaffitter invertebrates may lose their natural skin toxins—leaving them more vulnerable to predators once released. We studied a group of frogs in small outdoor enclosures constructed from plastic mesh, called mesocosms for approximately 3 months to investigate whether these frogs regained their protective skin defences once they were back in their natural habitat. Although the number of toxin-secreting bacteria on the frogs’ skin increased in these wild conditions over time, it was insufficient to fully restore their natural defences. Working out how to restore the frogs’ natural skin defences prior to release is therefore now a key priority on our research agenda.
In the end, despite returning to our release site every month for 6 months, we did not see any of our released frogs beyond the third month. Although this may sound disheartening, our results are the product of an extraordinary investment of effort and commitment and have provided important lessons. The insights we have gained from this release trial will enable us to refine our methods and guide our future research within an adaptive management framework. The mission to restore wild populations of these remarkable creatures will require endless determination and dedication, and we are proud to share the lessons we have learnt with our colleagues in conservation.

The article ‘Release trial of captive-bred variable harlequin frogs *Atelopus varius* shows that frogs disperse rapidly, are difficult to recapture and do not readily regain skin toxicity’ is available open access in *Oryx—The International Journal of Conservation*. 
Field team at the Atelopus release site. Photo: Brian Gratwicke.
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