

The success of captive breeding and rearing on Orinoco crocodile population revival

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Conservation of endangered species, particularly large predators, is an issue of the utmost importance in an era in which extinctions are occurring at an alarming rate. The Orinoco crocodile (*Crocodylus intermedius*) is not only one such large predator, but is also endemic to its home—the Orinoco River basin of Venezuela and Colombia (Hernández et al., 2021). This habitat restriction puts it at an even more vulnerable position for extinction. The threat to the existence of the Orinoco crocodile can be linked to their high market value. Because they are so valuable, the species has been over-hunted, particularly in the 1900s. In fact, their population in the wild is as low as just a few hundred. (Ramo et al., 1991). The issue with such a small population is that, even if it is to regrow, the likelihood of inbreeding increases, which can cause harmful genetic drift in the population (Hernández et al., 2021). The Orinoco crocodile is not set on a completely unavoidable path for extinction, however. There are ways to combat their decrease in population. One such way to boost the wild population of Orinoco crocodiles is to breed and raise them in captivity with the intention of releasing them into the wild. Such reintroduction programs have been being utilized lately to not only increase the number of individuals in the wild, but also to raise a reserve population of Orinoco crocodiles if they go entirely extinct in the wild (Carmichael, pers. Comm., 2022). It is possible to view reintroduction programs skeptically, and to assume that introducing captive-bred species into the wild is not likely to succeed. However, reintroduction programs of Orinoco crocodiles have proven to be successful in hatching a greater number of eggs than would be possible in the wild, to produce offspring that are able to survive in the wild, and to be most successful when they involve local efforts.

Reintroduction programs that start with artificial egg incubation have the benefit of ensuring a high percentage of eggs that successfully hatch. The natural process of egg laying until egg hatching is fraught with difficulty. There are plenty of ways in which eggs can be prevented from hatching, including both natural processes, such as flooding, as well as human intervention—cracking, stealing, etc. (Barros et al., 2010). Artificially incubating eggs, therefore, not only keeps the eggs out of reach of humans, but also keeps them in an ideal environment that protects them from the dangers of nature that prevent eggs from hatching. For example, Barros et al (2010) were able to successfully hatch 53.7% of a group of Orinoco crocodile eggs through artificial incubation. Though they acknowledge that this number is not ideal, they concluded that their yield was sufficient to justify removing the eggs they incubated from their nest, where they would have been subject to the usual difficulties of human interaction and harsh natural conditions. This finding is confirmed by Espinosa-Blanco et. al (2013) who were able to successfully hatch 51.9% of the eggs that they artificially incubated, which was a considerable step up from their naturally incubated control group, where only 36.3% of the eggs were hatched. They were able to further extrapolate that their method could lead to the successful production of 1,200 hatchlings in a year; a number which would greatly benefit the wild Orinoco population. Not only can artificial incubation allow for a greater percentage of hatchlings than natural incubation, but the environment of incubation can be set so that it favors the hatching of a female crocodile (Barros et al., 2010). Indeed, the ability to control the sex of the hatchlings is beneficial for conservation efforts since a female-skewed population of hatchlings is usually preferred. This is likely because male Orinocos are territorial and will kill each other over space, and also because physiologically, fewer male crocodiles are required to produce more hatchlings (Carmichael, pers. Comm., 2022). Artificial incubation is an effective and productive method for incubation for Orinoco crocodile conservation and repopulation, but the eventual reintroduction of these hatchlings to the wild is equally as, if not more, important.

In order to promote the survival of the Orinoco crocodile species, it is

important not only to ensure the hatching of the eggs, but also the survival of the offspring in the wild. Of course, after hatching a baby crocodile, one cannot simply let it free in the wild, or it would almost certainly succumb to predation. For this reason, baby offspring can be raised (for a short time), in captivity, and then released into the wild. Of course, if an animal is to have any chance of surviving in the wild it cannot be raised by humans late into its life, or it will not learn to fear humans and will become dependent on its caretakers. For this reason, reintroduction programs are exclusive with regards to which institutions can raise Orinoco crocodiles with the goal of introducing them to the wild (Carmichael, pers. Comm., 2022). When done properly, however, introducing captive reared Orinoco crocodiles has been proven to be successful in both preventing the further decline of wild populations, as well as creating new ones (Hernández et al., 2021). Maria del C. Muñoz and John Thorbjarnarson (2000) found such encouraging results. They found not only high survivability of captive reared Orinocos in the wild, but they also noted spatially that the captive reared Crocodiles were often found in similar areas to wild-born individuals. This indicates that not only can captive reared Orinocos successfully survive in the wild, but they can also live normal lives and even intermix with individuals that were not raised in captivity. Since it has been shown that Orinocos that were raised in captivity are indeed able to survive in the wild, the next logical step in Orinoco conservation is improving the process of reintroduction so that it involves the assistance and protection of local government, as well as the education of local people to maximize its benefit.

The reality of conservation efforts of all varieties is that the local society must be heavily involved in the effort if any lasting change is to occur. Building on this, it has been suggested that the involvement of the Colombian and Venezuelan government and general population ties in well to captive rearing and reintroduction of Orinoco crocodiles. Without local populations buying into conservation efforts and playing a key role in them, certain behaviors such as poaching and trapping of the crocodiles can still occur. Furthermore, artificial incubation and reintroduction efforts are not at their strongest unless the population that lives among the Orinoco crocodile gives their expertise of the area to the project (Barros et al., 2010). Indeed, Hernández et al. (2021) found that successfully introduced populations of captive reared Orinoco crocodiles were most likely to succeed if they were introduced to an area that would grant them protection from law enforcement against being poached (namely, in this case, a cattle ranch). Therefore, getting the captive reared crocodiles to hatch and be introduced to the wild is only part of the larger goal of conservation of Orinoco crocodiles. In order to secure their place in their native environment, local government, and education of the local people with regards to the Orinoco crocodile is a step that will ensure the survival of the population in the long run (Hernández et al., 2021). Venezuelan and Colombian law enforcement and residents must be involved in the conservation of the Orinoco crocodile, as studies have shown that local involvement correlates to better survivability of the reintroduced crocodiles.

The process of reintroduction as a means of conservation is well underway for the Orinoco crocodile, and the questions that remain are mostly surrounding how to improve it. From the beginning of an Orinoco crocodile's life, it has been shown that artificial incubation of eggs allows for higher rates of successful hatching (Barros et al., 2010; Ramo et al., 1991). It is also known that a crocodile can be raised in captivity in such a way that allows for it to be introduced into the wild (Carmichael, pers. Comm., 2022), and that such crocodiles are able to survive in the wild long-term (Hernández et al., 2021; del C. Muñoz and Thorbjarnarson, 2000). Furthermore, local involvement which will benefit both the Orinoco crocodile as well as local residents aides, and is even necessary, for optimal conservation results (Hernández et al., 2021). Reintroduction programs for Orinoco crocodiles have been shown to work in favor of the conservation of the wild population and should continue to be used as a tool for conservation.

References

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