

GLOBAL RE-INTRODUCTION PERSPECTIVES

Re-introduction case-studies from around the globe



**Edited by
Pritpal S. Soorae**



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Cover photo: Clockwise starting from top-left:

- Formosan salmon stream, Taiwan
- Students in Madagascar with tree seedlings
- Virgin Islands boa

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Philippine crocodile hatchling head-start and re-enforcement program in San Mariano, Isabela Province, Luzon, the Philippines

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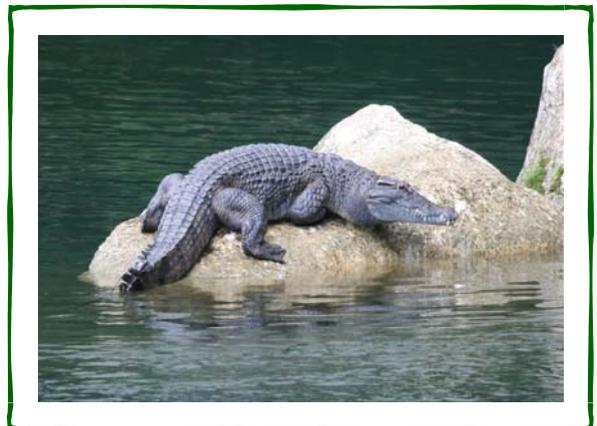
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Introduction

The endemic freshwater Philippine crocodile (*Crocodylus mindorensis*) is probably the most severely threatened crocodylian in the world with an estimated population of less than 100 mature individuals in the wild. The species is listed as critically endangered by IUCN and is on CITES Appendix I. Nationally, the Philippine crocodile and its habitat are protected by the Philippine Wildlife Act since 2004. A number of earlier laws partially protected crocodiles and wetlands. Following an alarming report about the status of the Philippine crocodile in the 1980's, the Philippine government responded with a captive breeding program, which has been successful in propagating crocodiles. However, no crocodiles have been re-introduced to the wild and the species and its habitat continued to disappear. In 1999, a small Philippine crocodile population was discovered in the municipality of San Mariano in Isabela Province. A conservation project here has been successful in generating local government and community support for crocodile conservation through communication campaigns leading to effective participative conservation of crocodiles and wetlands and a growing population which currently (December 2007) stands at ~23 non-hatchling individuals. To aid the recovery of the population, a participative nest protection, hatchling head-start and re-enforcement program is in place since 2005.

Goals

- Goal 1: Local participation in crocodile population monitoring, protection and crocodile nest identification in San Mariano.
- Goal 2: Effective protection of crocodile nests in San Mariano.
- Goal 3: Establishment of an effective, professional but inexpensive and sustainable crocodile hatchling head-start facility in San Mariano.
- Goal 4: Survival of the majority



Philippine crocodile
(*Crocodylus mindorensis*)

of crocodile hatchlings born in the wild in San Mariano, naturally in safe areas and through head-starting in high-risk areas.

- **Goal 5:** Re-enforcement of the wild Philippine crocodile population with captive reared (head-started) juvenile crocodiles in San Mariano.

Success Indicators

- **Indicator 1:** Local crocodile monitoring and protection group trained, established and participating in crocodile monitoring surveys, environmental law enforcement and identification of crocodile nests with at least two local protection group members per crocodile locality.
- **Indicator 2:** 100% of crocodile nests in San Mariano found in an early stage of construction or breeding.
- **Indicator 3:** 100% of found crocodile nests in San Mariano protected by the local protection group leading to survival of at least 75% of nests and minimized losses of nests and eggs to predators, including people, and to natural disasters such as flooding.
- **Indicator 4:** Annual successful breeding of Philippine crocodiles in San Mariano with at least one successfully hatching clutch.
- **Indicator 5:** Local head-start facility established with individual holding pens for at least 20 hatchlings.
- **Indicator 6:** Head start facility well-equipped with clean water system, electricity, trained/salaried caretaker and reliable and varied crocodile hatchling food supply with establishment costs of less than US\$ 10,000 and overhead costs of less than US\$ 250/month.
- **Indicator 7:** Annual (partial) collection of at least 20 hatchlings in San Mariano.
- **Indicator 8:** Survival of at least 50% of hatchlings in head-start facility to juvenile release age of 18 months.
- **Indicator 9:** Survival of at least 50% of released juveniles into wild conditions in the 12 months following reinforcement.
- **Indicator 10:** Annual growth of Philippine crocodile population in San Mariano with a total non-hatchling population in the wild of more than 100 individuals in 2010.

Project Summary

Feasibility: San Mariano has three Philippine crocodile localities with reproducing sub-populations: Dunoy Lake/Catalangan River, Disulap River and Dinang Creek/Illagen River. The three sub-populations are theoretically linked as the rivers confluence near San Mariano town. However, 40,000 people live along these rivers. Radio telemetry studies show that crocodiles use limited largely uninhabited stretches of river of about 6 km during the dry season. During the wet season when river currents are very strong, crocodiles retreat to lakes and creeks. Crocodiles have survived in these remote areas because of the traditional practices and belief systems of indigenous peoples (Agta and Kalinga), who have taboos on killing crocodiles. However, continued immigration of land-seeking farmers into San Mariano threatens crocodiles. Wetlands are converted into rice-fields, watersheds are logged, destructive fishing methods such as dynamite and electricity fishing are used and crocodiles are killed for skins, meat or to eradicate

a perceived dangerous pest. Government has little control in the poor uplands of San Mariano.

The Mabuwaya Foundation (**Mabuhay** = long live, **Buwaya** = crocodile) implements a crocodile research and conservation project in San Mariano. A variety of communication and empowerment tools are used to involve communities in crocodile and wetland conservation. This has led to a broad local acceptance of and pride in having the rare Philippine crocodile. A trained protection



Releasing Philippine crocodiles

group of 12 farmers and fishermen is officially deputized and paid by the municipal government to enforce environmental laws. The project works with various levels of local government (village, municipal and provincial councils) to institutionalize crocodile and wetland conservation. The three core localities have been declared crocodile sanctuaries and are protected by the local protection group members who control human activities and participate in crocodile surveys. Breeding occurred in all three localities in 2005 but one nest was accidentally plowed under by a farmer and one nest was raided by army ants killing ten hatchlings. The surviving nine hatchlings were collected. Monitoring of earlier hatchling survival rates showed that these differ greatly between localities. The majority of hatchlings in stagnant Dunoy Lake survive whereas all hatchlings in fast-flowing Disulap River disappear within weeks. These observations, and earlier experiences with successfully raising two crocodiles that were retrieved from fishermen in 2002, led to the design of a nest protection and head-start program.

Implementation: A make-shift head-start facility was set up in 2005 with two large tanks. Due to inter-specific fighting five hatchlings of the nine collected in 2005 were lost. In 2006, two nests (Disulap River and Dinang Creek) were guarded by the local protection group and hatched. One undiscovered nest (Dunoy Lake) hatched as well. This yielded a total of 54 hatchlings of which 35 were collected for head-starting. In 2006, hatchlings were kept in smaller groups in large tanks until inter-specific fighting started after three months as well; four hatchlings were injured but survived. Since then all hatchlings are kept in individual tanks in a new facility. Mabuwaya Foundation staff received training in crocodile husbandry at the government crocodile breeding farm; a daily care taker was trained by Mabuwaya staff. Two earlier raised crocodiles were released in 2006 and 2007 in the Dunoy and Disulap localities and adapted well to the wild without interventions needed. In February 2007, four juveniles (of 2005) were released in a constructed pond next to Disulap River. The pond provides excellent conditions for small crocodiles, with an adequate food supply and the juveniles adapted well to the wild. All 35 hatchlings collected in 2006 survive to date; a

genetic/gender mix of the 31 uninjured crocodiles will be released in February 2008 in three constructed ponds that provide safe habitat and one natural marsh area within the Dunoy and Disulap localities.

Post-release monitoring: The two sub-adult crocodiles released in 2006 and 2007 are monitored using radio telemetry. They survive to date and move short distances within their release site. The four smaller crocodiles released in 2006 have been visually monitored daily for four months from a hide by Philippine and Dutch students. Survival, movements, territoriality, prey choice, hunting behavior and activity budgets were studied. Without any interventions they all survive to date (December 2007) and have moved out of the release pond into a nearby creek. The juveniles to be released in 2008 will be monitored using small radio transmitters, and observation hides.

Major difficulties faced

- **Nest protection:** 24 hr crocodile nest protection is relatively expensive (~10 US\$/day for 65 days = US\$ 650/nest) and does not guarantee nests will survive as it is nearly impossible to protect nests from small natural predators such as rats, ants or monitor lizards. Egg collection and incubation is not a viable alternative as electricity supply (incubator) is unreliable in the project region and eggs would need to be transported over dozens of kilometers to a site with electricity over rough trails and roads presenting high risks to egg/embryo survival.
- **Husbandry:** Philippine crocodiles are extremely aggressive towards each other; mortalities and injuries do even result from fighting between three month old hatchlings. All crocodiles therefore have to be kept in separate pens or tanks which raises the costs of a head-start facility. It is furthermore unknown what the impact of solitary raising of Philippine crocodiles will be on social behavior after release into the wild.
- **Permit:** it was difficult to obtain a permit from government for the head-start program, principally because the chief advising scientist long resisted the idea of releasing crocodiles into the wild on the ground that there was not enough information to assess whether captive raised crocodiles would be able to adapt to wild conditions (there is no precedent of Philippine crocodile re-introductions). The permit was eventually granted after several adjustments to the proposal, and a number of support letters from international crocodile specialists.

Major lessons learned

- Captive rearing of crocodiles that are collected as hatchlings from wild nests is relatively easy and cost-effective as opposed to captive breeding of crocodiles for which much larger, more expensive, more sophisticated facilities and more technical knowledge are needed.
- When entering as hatchlings, 18 months seems to be a valid time period to keep Philippine crocodiles in a head start program before releasing them into the wild. Philippine crocodiles grow three times their birth length during this period and this size protects them against most predators that prey on

hatchlings (herons, raptors, monitor lizards, snakes). A 12-month growing period seems too short.

- Releasing captive reared juvenile crocodiles in optimal, if necessary, human-altered habitat with sufficient and varied prey (shrimps, fingerlings and small fish, frogs, snails, dragonflies and other insects) seems to facilitate adaptation and enhance survival. We released juvenile crocodiles in a constructed shallow pond in which we introduced an abundance of prey species. Our released crocodiles adapted very well and all survived the re-introduction without any need for interventions. After six months crocodiles started to explore a wider area around the pond and settled in a nearby natural creek.
- Even (Philippine) crocodiles that have lived in captivity for many years adapt to wild conditions, without interventions, when re-introduced to the wild. We released two sub-adult crocodiles which had been raised in captivity for five years since juvenile stage. Both survived the release and adapted without problems to wild conditions. They did not approach humans, which were present near the release sites, and there have not been any crocodile-human or crocodile-livestock incidents in the 16 and six months respectively following re-introduction.
- The Philippine crocodile head-start program was only started when a successful *in situ* conservation program was already running for six years and firmly in place. Head-start reinforcement programs must be seen as an added strategy to attain a recovery of small populations in the wild, and as such could play an important role. They are certainly not the panacea to the conservation challenges species with extremely small populations, such as the Philippine crocodile, are facing; effective conservation of surviving wild individuals of such a species, and protection of remaining habitat, should be the first priority.

Success of project

Highly Successful	Successful	Partially Successful	Failure
		√	

Reasons for success/failure:

- The project has successfully trained and established a local crocodile protection group which participates in crocodile surveys and searches and guards crocodile nests. 24 hr nest protection is however not a guarantee for nest survival as a guarded nest was lost in 2007.
- The project has successfully established a low cost Philippine crocodile head-start facility. Initial problems with infighting have caused mortality and injury among crocodile hatchlings; after construction of individual holding tanks survival rates have dramatically increased and are well above the target of 50%.
- The project has successfully released a first batch of four head-started Philippine crocodile juveniles in human-altered optimal habitat and two sub-adult captive-raised Philippine crocodiles in natural habitat.