**Crocodile Specialist Group Steering Committee Meeting**
Chetumal International Business and Convention Centre, Chetumal, Mexico
(4 July 2022)

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**East and Southeast Asia**

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## Cambodia

**Wildlife Conservation Society - Sitha Som, Steve Platt, Lonnie McCaskill**

**Koh Kong Reptile Conservation Center**

Over the last 4 years (2018-2022) WCS Siamese Crocodile Wardens and patrols have found a number of Siamese crocodile nests along the Sre Amble River and have recorded seeing juvenile crocodiles in the vicinity of the nest. WCS is currently building 3 small ponds and an incubation house in order to collect wild nest and head-start hatchings. Eggs from nest found on the Sre Amble River will be collected annually and transported to the Koh Kong facility to be raised for approximately 18 months and then returned to the Sre Amble River. They will be kept in soft release enclosures prior to the rainy season. As the river rises the water will overtake these enclosures and the juvenile crocodiles will disperse naturally.

- WCS Cambodia supported the joint government-community patrol team in the Sre Ambel River System to prevent the illegal harvest or entanglement of crocodiles in fishing gear, prevent illegal fishing, and stop the destruction of their habitat. Two WCS staff, one FiA staff, and two local community members conducted monthly patrols within riverine habitats and wetlands used by Siamese Crocodiles. Patrol teams use SMART to document, analyze, and plan patrol efforts and monitor illegal activities.

- Patrol efforts increased between September 2018 and February 2019 as the rainy season advanced. They were lowest during the periods May-August 2018 owing to flooding, which made it hard to access the crocodile wetlands due to strong water current. Evidence of crocodiles was found in all months except July, because it was swept away by the water during that month. At the beginning of the rainy season in 2019, Cambodia experienced a lot of storm and lightning and many rural people were killed and thousands of houses were destroyed. This adverse weather was the cause of the reduced patrol effort from March to April 2019.

- The community patrol team recorded signs of crocodile presence in each wetland such as dung, tracks, and live crocodiles. There were 99 pieces of dungs and 68 tracks recorded from May 2018 to April 2019. The number of dungs and track recorded in 2018, especially in October and November 2018 was higher than during the 2019 survey. This is due to the fact that between early January and the end of April 2019, there was still not much rain, and most of crocodile wetlands were very shallow and dry. Crocodiles may not stay in those habitats; they probably move to the river nearby. Interestingly, more dungs and tracks were found at Kean Tok wetland than in the other crocodile wetlands. The team noted that dung found was different sizes; thus, probably representing different individual crocodiles. Comparing to the 2017-18 survey, the number of dung and tracks recorded was higher and so it is likely that there are more crocodiles present than last year.

- During the 2018-nesting season, the project team found three nests of Siamese Crocodile consisting of a total of 78 eggs at three wetlands: Kean Tok (23 eggs), Pok Tim (27 eggs), and Kambot (28 eggs). This was the highest number of nests that have ever been found in one nesting year in the project area

- Unfortunately, even though our project team relocated all eggs to a location where they would be safe from natural predation and illegal collection, there was not a single hatchling hatched in 2018. This was because of the extensive rain and floods. Compared to a normal year, the heavy rain caused a long period of flooding and the temperature dropped significantly. All wetlands were completely flooded. Nests were relocated from wetlands to dry ground in the village, and when this was flooded, they were moved to the upper part of a house (all of the houses in the village were also flooded), and then finally to the Koh Kong Reptile Conservation Center.

- In 2019 nesting season, we found two nests consisting of 48 eggs. Where 21 eggs were found at Kean Tok wetland, 27 eggs were found in Kambot wetland. However, in the nesting season of 2019, the weather and temperature have been quite good. The project team has learnt from the previous failures. We have carefully relocated the all eggs from those original nests to the local staff's house nearby the wetlands and made two artificial nests using the actual nesting materials and in accordance with our crocodile experts to ensure the safety of eggs from natural predators, flooding, and illegal collection from hunters.

- All crocodiles at Koh Kong Reptile Conservation Center (KKRCC) were moved to Phnom Tamao Zoo with a proper head-starting areas supervised by Fauna and Flora International (FFI), because at the KKRCC there was insufficient space and a lack of human resources to take care of the crocodiles when they grew larger.

- After the a few months rearing at the zoo, WCS and FFI released 20 head started C. siamensis aged from three to four years in December 2018 in Stung Khiev River in the middle of Cardamom Mountain. The ratio of male to female is 12:8. Prior to release, the team transported them using baskets and long fish traps from the zoo by car and motorbikes to the soft-release pen where they were kept for at least two weeks

- WCS has been working intensively with FiA on the draft of proclamation to put Sre Ambel River System as the Fisheries Conservation and Management Zone. Multiple meetings and consultations were held at both national FiA office and provincial levels. As of March 2019, the proclamation No 133 dated 06 March 2019 has been ratified by the Minister of Ministry of Agriculture, Forestry and Fisheries to put the Sre Ambel River System into the Fisheries Conservation and Management Zone for Southern River Terrapin (1424 ha) and Siamese Crocodile (46 ha) comprising of 1470 ha. This zone was divided into two important areas: 1) Conservation Area: This category is determined by very high conservation values including breeding grounds of key species. There are two locations falling into this category covering an area of 11 ha. These are the strictest zones from all activities except the scientific research activity. 2) Protection Area: This category consists of 35 ha covering two main wetlands. This zone is prohibited from any illegal activities such as illegal fishing, logging and sand mining. Only family fishing and any activity that are not harmful to fisheries resources will be allowed

- 2019 2 nests were collected along the Sre Amble River resulting in 32 hatchlings to be head-started at the WCS Koh Kong Reptile Conservation Center.

**WCS 2020 plan going forward**

*Ex-situ* Conservation

An intense search of suitable wetlands along the Sre Amble River will be conducted every year during the nesting season (late May through June). Siamese Crocodiles construct mound nests of vegetation, woody debris, and soil, which are often concealed in dense cover along the shoreline or positioned on floating mats. Village teams (i.e. Community Conservation Teams; see Platt et al. 2014) will be employed to search for nests together with WCS field staff. Owing to dense vegetation and unstable footing, crocodile nests on floating mats can be difficult to locate on foot. Therefore, these habitats will be searched using small, commercially available drones. Once nests are located, field staff will remove the clutch following protocols out lined by Platt et al. (2008), and transfer eggs to via road to the RCC in Koh Kong. Incubation will be carried out in Styrofoam Boxes (i.e. McCaskill Chambers) maintained at ambient temperatures to insure a mix of male and female offspring. Upon hatching (late July through early September), neonates will be reared in an indoor nursery for 2-3 months, and then transferred to outdoor nursery ponds for head starting. After one year, crocodiles should be transferred to a larger pond and remain there until transferred to pre-release acclimation pens. During the head-starting process, juveniles will periodically be segregated into different ponds according to body size to reduce intraspecific completion. Based on experience in Laos, approximately 18-20 months will be required to rear juveniles to a body size suitable for release (Total length of 75 to 100 cm).

*In-situ* Conservation

Crocodiles will be returned to the wild using a soft-release approach that has proved successful in Laos (Platt et al. 2014; Platt 2018). To briefly summarize, head-started crocodiles will be transferred into a pre-release acclimation pen constructed in the target wetland during the early dry season (e.g., December or January) and held therein until water levels begin to rise early in the wet season (June). Head-started crocodiles will self-liberate when rising water tops the pen, allowing crocodiles to swim free. Prior to release, a sub-sample of crocodiles will be out fitted with VHF radio transmitters to facilitate post-release monitoring of survival and dispersal. Monitoring of the released crocodiles should occur as often as possible, but at least 1-2 times monthly, and continue for the life of the transmitter batteries (ca. 1.5 to 2 years).

Restoration of Siamese Crocodiles to the Sre Ambel landscape should be accompanied by community education programs, perhaps conducted concurrently with similar programs for *B. affinis*. A priority for educational programs should be to stave off potential human-crocodile conflicts. Although Siamese Crocodiles – even large adults – pose no danger to humans, conflicts could develop if crocodiles damage fishing gear. Enlisting local villagers as members in Community Conservation Teams will go far towards alleviating potential conflicts because team members will have a vested interest in protecting crocodiles.

**Evaluation and assessment**

Recovery efforts for the Siamese Crocodile along the Sre Ambel River will be evaluated through annual counts of nesting effort. Nest counts are a valuable tool in crocodilian managements programs and are used successfully to monitor populations of both hole- and mound-nesting species (Bayliss, 1987). Trends in nest count data provide a statistically rigorous means to assess the numerical response of crocodile populations over multiple years (Nichols 1987). Because head-started Siamese Crocodiles will require 5-6 years to reach sexual maturity, 10-12 years may be required to amass sufficient data for assessing population recovery. In the meantime, spotlight surveys (Bayliss 1987) could provide a “soft” index of population abundance, although might be of limited utility in the densely vegetated wetlands where most crocodiles occur.

**Implementation**

As a first step towards implementing this plan, it will be necessary to immediately upgrade the crocodile rearing facilities at RCC. The needed infrastructure at RCC should closely follow the design of the crocodile rearing facility constructed by Flora-Fauna International (FFI) at Phnom Tamao Zoo near Phnom Penh. For our immediate needs (2020) the following must be constructed:

1. Nursery room with tubs for housing neonate crocodiles for 2-3 months post-hatching. These tubs will be used to house hatchlings from eggs to be collected during the 2020 nesting season. Juvenile crocodiles hatched in 2019 should be transferred directly to nursery ponds (see below).

2. At least three outdoor nursery ponds are needed to house juvenile crocodiles hatched in 2019 and others expected for 2020.

3. Two large grow-out ponds should be constructed to house juvenile crocodiles before being transferred to the pre-release acclimation ponds.

- In 2021, construction of the head start facility was completed and the 37 juvenile Siamese crocodiles were moved to size appropriate groupings in the pools. In just 6 months, most of the crocodiles have doubled in size with some reaching a meter. Plans to release back on the Sre Amble are developing and funding for post release tracking is ongoing.

**Fauna and Flora International Cambodia Crocodile Conservation Program - Pablo Sinovas, Sam Han, Hor Ling, Joe Rose**

- Our captive breeding program at Phnom Tamao Wildlife Rescue Centre (PTWRC) produced 65 hatchlings in July 2018.

- In 2019, we had no reproductive success at PTWRC, likely a combination of a warmer and drier than usual breeding season, the limited number of breeding pairs and the fact that not all females lay eggs every year. The health status of breeding adults had been checked as good by an expert vet in 2018, the status of facilities and husbandry practice has been assessed as very positive by a number of crocodile husbandry experts in 2019. Efforts will focus on sourcing additional breeding adults.

- In December 2018, the Cambodian Crocodile Conservation Project (a collaboration between FFI and the Government of Cambodia) released 20 juvenile captive-bred crocodiles into a protected sanctuary site in the wild. And in December 2019, we released another 10 juvenile crocodiles into another suitable site in the Cardamom Mountains.

- The December 2019 release involved a local school for the first time, as part of a release event aimed to increase awareness and a sense of ownership amongst the local community in crocodile habitat.

- The Siamese Crocodile Conservation Breeding Centre at PTWRC has been considerably improved and expanded during 2019. This has included, *inter alia*, the addition of two juvenile holding and raising enclosures, four quarantine holding enclosures, one hatchery/nursery room with heated and UVA/UVB lighted hatchling pools, a food preparation area, a loading and drop-off bay for receiving rescued crocodiles and preparing for releases, an administration

office which also doubles up as incubation room, an entry road, a perimeter fence and a toilet block.

- In collaboration with the Royal University of Phnom Penh (RUPP) and the Royal Zoological Society of Scotland (RZSS), FFI has established protocols and in-country capacity to run DNA tests in Cambodia in order to check for purebred Siamese crocodiles. We have identified 16 single-nucleotide polymorphism (SNP) markers that distinguish between saltwater and Siamese crocodiles. The first in-country tests took place in October 2019. This achievement will significantly facilitate the process of releasing crocodiles into the wild.

- During the second half of 2019, we have stepped up communications with crocodile farmers in the country, including the Crocodile Farmers Association, about possible contributions of purebred stock towards conservation efforts. So far, 80 baby crocodiles and two adult males have been contributed and we hope to significantly scale up these numbers in 2020. All donated and rescued crocodiles are DNA-tested to ensure that only purebred crocodiles enter the breeding and release programme.

- We have worked closely with local communities, local authorities and the Ministry of Environment to protect key crocodile habitats.

- In October 2019, for the first time we brought together, from different locations across the Cardamom Mountains, the 30+ community crocodile wardens that we support. We held a two-day capacity building and motivational conference for our wardens in Phnom Penh, which included a visit to the crocodile breeding centre at Phnom Tamao.

- FFI conducted annual monitoring at five crocodile sanctuaries in the Cardamom Mountains. Analysis of monitoring data from the last two decades indicates that the population in the Cardamom Mountains is stable overall, with the two sites known to hold the largest populations of the species showing evidence of reproduction, and a stable and growing population, respectively.

- FFI also undertook annual nest surveys, with two nests located in 2018 and one (empty) nest located in 2019. In 2019, we piloted the use of a drone to locate nests at a suitable location in addition to our regular ground-level surveys. While the drone survey did not reveal any nests, it confirmed it can be a helpful aid in open habitats. FFI also provided technical support to WCS on the care of hatchlings taken from nests found downstream from one of our release sites.

- FFI, in collaboration with La Trobe University, undertook a food web analysis at crocodile release sites in the Cardamom Mountains to improve our understanding of fish resources in those rivers, with the peer-reviewed results published in 2019 (DOI: 10.1002/aqc.3159).

- In 2018, FFI provided training to WWF staff in Cambodia on the monitoring of Siamese crocodiles.

**Update for July 2022**

- In March 2021, FFI, in collaboration with the Cambodian government, successfully conducted the largest-ever release of Siamese crocodiles, releasing 25 individuals into a protected sanctuary site in the Cardamom Mountains. This was also the most technologically advanced release undertaken, with all crocodiles carrying implanted acoustic transmitters and the largest individuals tagged with satellite trackers – a first for the species. Additionally, eDNA samples were taken following a controlled protocol and prior development of species-specific primers,

and these are being analysed to determine the potential of this novel method in future crocodile surveys. The release has been covered in detail in the following media article: https://southeastasiaglobe.com/cambodia-crocodiles-set-loose-to-save-their-lives/

- A team of FFI-supported community crocodile wardens in the Cardamom Mountains won the prestigious IUCN WCPA International Ranger Award in 2021, in recognition of their incredible work over the years to prevent the extinction of the Siamese crocodile. More information: https://www.iucn.org/news/protected-areas/202106/chhay-reap-community-crocodile-wardens-2021-international-ranger-award-winners

- The breeding stock at the Phnom Tamao Wildlife Rescue Centre (PTWRC) conservation breeding facility, managed by FFI in collaboration with Cambodia's Forestry Administration, has been significantly augmented, creating a good basis for increased productivity in future years.

- FFI is spearheading collaborations with conservation partners in Cambodia to release Siamese crocodiles in additional suitable sites across the country in order to maximise the species' long-term survival prospects. These include ongoing collaborations with Rising Phoenix in northern Cambodia, WCS in Tonle Sap Lake and WWF in eastern Cambodia.

## Indonesia

**Wildlife Conservation Society: Conservation of Siamese crocodile in Indonesia:** (Matt Linkie)

Brief summary

- WCS worked with the East Kalimantan Natural Resource and Conservation Agency and the East Kutai Environment Agency, with permission from PT. CDM, to conduct drone nest survey in July 2017. Our plans to investigate Siamese crocodile population status have been delayed.
- We provided inputs to the development of the Mesangat-Suwi Management Plan that runs from 2019-2023. The Ecosystem Essential Area (EEA) Forum is now implementing activities from this plan, such mapping and replanting degraded areas around the wetland to maintain the EEA integrity.
- WCS has continued to contribute to multi-stakeholder discussions on establishing Lake Mesangat as an EEA.

Thomas Ziegler
1) BEHLER, N., KOPSIEKER, L., STANIEWICZ, A., DARMASYAH, S., STUEBING, R. & T, ZIEGLER (2018): Population size, demography and diet of the Siamese crocodile, *Crocodylus siamensis* (Schneider, 1801) in the Mesangat swamp in Kalimantan, Indonesia. – Raffles Bulletin of Zoology 66: 506-516.

## Laos

**Wildlife Conservation Society: Steve Platt, Oudomxay Thongsavath, Sam Leslie, Lonnie McCaskill**

- WCS is re-engaging in Siamese crocodile conservation initiatives in the Xe Champhone Ramsar site and Tansoum Village Siamese crocodile project.

- 2019 wild eggs were collected in the Angiew wetland and transferred to the Tansoum Village for hatching and head starting. That resulted in 47 hatchlings that were released in April 2020 in the same wetland in Champone District at Savavvakhet Province

- Currently there are 70 hatchlings being head started at the Tansoum village that will be released in the Angiew Wetland when size appropriate.

- 27 Siamese crocodile eggs were collected by Steve Platt and Oudomaxy Thonsavath from the Xe Champhone Ramsar Wetlands in Savannakehet Province Lao PDR. The female was noted to have tail scute clips for identification and it was confirmed as a first known reproduction of head started reintroduced Siamese crocodile hatched 11 August 2012 and released in 2014 considered a conservation milestone for the WCS program in Laos! The eggs will be incubated in the Tan Soum Village and released in 2.5 years back into the wetland!

**Thomas Ziegler - Kölner Zoo**
**Activity in Laos**

- Siamese crocodile research and conservation (in total 7400 euros in 2018-19)

- WCS head-started and released 47 Siamese crocodiles 30 April

- 2400 euros provided to Lao Conservation Trust for Wildlife (LCTW) in December 2018 for renovating facility for keeping and breeding pure *C. siamensis*

- 2000 E Monitoring Siamese crocodile population in Khammouane Province, Laos, July 2018

- 3000 euros for genetic analyses of crocodiles held in zoos and at the LCTW, conducted by Prof. Dr. Minh D. Le at the Faculty of Environmental Sciences, VNU University of Science, Vietnam National University, Hanoi, and at the Central Institute for Natural Resources and Environmental Studies, Hanoi National University, Hanoi, Vietnam

- NGUYEN, T. T., ZIEGLER, T., RAUHAUS, A., NGUYEN, T .Q., TRAN, D. T. A., WAYAKONE, S., LUU, V. Q., VENCES, M. & M. D. LE (2018): Genetic screening of Siamese crocodiles (*Crocodylus siamensis*) in Laos and Vietnam: Identifying purebred individuals for conservation and release programs. Crocodile Specialist Group Newsletter 37(3): 8-14.

- SOUVANNASY, P., LUU, V. Q., SOUDTHICHAK, S., WAYAKONE, S., LE, M., NGUYEN, T. Q. & T. ZIEGLER (2018): Evidence of another overlooked Siamese crocodile (*Crocodylus siamensis*) population in Khammouane Province, central Lao PDR. Crocodile Specialist Group Newsletter 37(3): 6-8.

- Ziegler, T. (2019): Herpetological research and conservation in Vietnam and Laos in compliance with the <<one plan approach>>. Opening presentation, 4th National Scientific Conference on Amphibians and Reptiles in Vietnam, Thanh Hoa, Vietnam, 30.8.2019.

- **Lao Zoo Siamese crocodile Jeremy Phan**-The Lao Conservation Trust for Wildlife has officially started their Siamese crocodile breeding program. In their newly renovated crocodile enclosure, there are two groups setup for breeding. One group consists of 1 male and 1 female, which has already produced a nest only a few weeks after moving them. The other group consists of 5 females (currently waiting for genetic samples to be processed to move a male

into the group). Our goal is to allow the hatchlings to grow up independent of human intervention, but if this is not successful then we will of course intervene. This new crocodile habitat will be utilized to educate Lao people and tourists alike about the plight of the Siamese crocodiles and hopefully push people to help save them. We are thankful for the Cologne Zoo for helping to sponsor this project and we look forward to releasing crocodiles into the wild in the upcoming years.

**Vietnam: Thomas Ziegler Kölner Zoo**

- Herpetodiversity research in Vietnam and adjoining countries: Linking morphology, molecular biology and population surveys with nature conservation. BMBF Travelling Conference "Biodiversity as a basis for sustainable bioeconomy: New ways towards Biodiversity (BIONOM)", The Vietnam National Museum of Nature, Hanoi & The Natural History Museum, Berlin, Hanoi, 9.2.2018

**Philippines: Crocodylus Porosus Philippines Inc.** (Rainier I. Manalo)

- On September 7-11, 2021, a Vortex population management-modelling workshop for *Crocodylus porosus* was conducted to assess the effects on the possibility of 10-year sustainable harvesting model for *C. porosus* in Palawan. This is in partnership with the Palawan Council for Sustainable Development (PCSD) and the Rio Tuba Nickel Mining Corporation (RTNMC).

- A split-listing proposal for the transfer of the Philippine population of Saltwater crocodiles (*Crocodylus porosus*) on Palawan Islands, from Appendix I to Appendix II, with a zero-export quota for wild specimens, in accordance with Resolution Conf. 9.24 (Rev. CoP17) has been drafted and submitted to the CITES Secretariat.

- In collaboration with the Philippine Government, the Cologne Zoo in Germany has successfully repatriated two Philippine crocodiles named "Dodong" and "Hulky" last 15 December 2020. These pure bred crocodiles will be part of the species' captive breeding program for future introduction programs in the wild.

- A grant-aid from ZGAP was received and managed by CPPI for the conduct of habitat suitability assessment in Palawan and Mindoro as new release sites for the repatriated *Crocodylus mindorensis* has been initiated. This also includes the establishment of Philippine Crocodile Research and Education Center in Siargao Island, Mindanao.

- The BMB Technical Bulletin No. 2020-02 or the Protocol for Managing Human-Crocodile Conflict (HCC) in the Philippines was developed by the National Committee on Crocodile Conservation.

- The Crocodile Conservation Action Plan in the Philippines 2023 – 2032 has been reviewed and developed to manage the population of both *Crocodylus porosus* and *C. mindorensis* in the Philippines.

- In 2021, Mabuwaya Foundation has found six Philippine crocodile nests and counted 86 crocs, including 20 adults, in Isabela, Northeastern Luzon. New localities with wild Philippine crocodiles were found in the municipalities of San Mariano (2 areas) and Jones, Isabela (1 area).

- There are now 8 crocodile sanctuaries in San Mariano that are locally managed and protected by communities and local government.

- The Philippine Crocodile Conservation Center (PCCC) was completed and opened on the Isabela State University San Mariano campus. The PCCC is a breeding and head-start facility and a visitor's center on Philippine crocodiles and the biodiversity of the Sierra Madre Mountains.

**Thomas Ziegler - Kölner Zoo**

- Rauhaus, A. & T. Ziegler (2019): The Philippine crocodile (*Crocodylus mindorensis*) – Husbandry at the Cologne Zoo and buildup of a conservation breeding program. Annual meeting of the DGHT working group crocodiles, Wuppertal Zoo, 30.06.2019

- Ziegler, T. (2019): Successful Buildup of a Philippine crocodile (*Crocodylus mindorensis*) conservation breeding program in Europe. 2nd Forum on crocodiles in the Philippines, SEAMEO-Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), University of the Philippines Los Banos, Laguna, Philippines, 7. März 2019