Community Engagement and Capacity Building for Conservation of the Critically Endangered Siamese Crocodile in Three Villages in Savannakhet Province, Lao PDR

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Cover photograph: Large female Siamese Crocodile at a community wetland in Savannakhet Province, Lao PDR.

I. Introduction

The Siamese crocodile (*Crocodylus siamensis*) is regarded as one of the most critically endangered crocodilians in the world (Platt et al. 2019). During the past 50 years, wild populations of *C. siamensis* throughout Southeast Asia have been decimated by illegal hunting for skins and meat, wanton killing, government sponsored extermination programs, habitat loss, and over-collecting to stock commercial crocodile farms (reviewed by Platt et al. 2019). Furthermore, although hundreds of thousands of *C. siamensis* are now held on commercial crocodile farms in Southeast Asia, the genetic integrity of this burgeoning captive population has been compromised by widespread hybridization with estuarine crocodiles (*Crocodylus porosus*) (Fitzsimmons et al., 2002).

In Lao PDR, potentially viable, albeit fragmented populations of wild *C. siamensis* are confined to wetlands in Attapu, Salavan, and Savannakhet provinces (Bezuijen et al., 2013). Despite being legally protected as a "Prohibited Category I Species" (hunting and trade strictly prohibited) in Laos, Siamese crocodiles are threatened by deliberate killing for food and to protect people and livestock, collection of eggs for domestic consumption and medicinal purposes, incidental take in fishing gear, and habitat loss (Platt, 2012; Bezuijen et al., 2013; Platt et al, 2019). The latter threat is particularly acute in Savannakhet Province, which not only harbors some of the largest remaining crocodile populations, but also supports the greatest rural population density in Laos (Bezuijen et al., 2006, 2013).

Recognizing that *C. siamensis* faced near-certain extinction in Lao unless immediate action was undertaken, the Wildlife Conservation Society−Lao Program working in collaboration with the Lao Government designed and implemented a long-term crocodile recovery plan in 2009 (Hedemark et al., 2009). Surveys first identified a number of small *C. siamensis* populations in Savannakhet Province that would likely benefit from conservation efforts (Bezuijen et al., 2006). These populations already received some degree of protection from the widespread local belief that crocodiles embody the spirits of dead ancestors, and to harm or kill a crocodile would result in misfortune or even death to the transgressor (Platt, 2012; Bezuijen et al., 2013; Platt et al., 2018c). Six wetlands in the Champhone and Xangxoy river systems (including Kout Kouang and Kout Koke) were then 1) selected for inclusion in a community-based conservation project and 2) designated Crocodile Conservation Areas (CCAs). As a direct result of this crocodile conservation program, the Xe Champhone Ramsar Site was established in 2010 with core areas encompassing critical nesting habitat for Siamese crocodiles.

In 2010-11, Village Conservation Teams (VCTs) were organized in rural communities adjacent to conservation areas. VCT cadres attended training workshops held during November-December 2011 where they learned basic monitoring and patrolling techniques, and each participant was issued a Lao-language edition of Simpson (2006). Cadres were subsequently tasked with monitoring crocodile populations, enforcing conservation regulations, and searching for crocodile nests, and received a small monthly stipend for their participation in the project. In addition to monitoring wild populations, WCS in collaboration with the Lao Zoo and area villages initiated an egg

collection and head-starting program; eggs were collected from nests, incubated in specially-designed facilities, and hatchlings then reared to a size (total length [TL] ca. 70-90 cm) considered immune to predation. Augmenting these efforts, a conservation-breeding program using crocodiles genetically confirmed as *C. siamensis* was initiated at the Lao Zoo. Together these programs ultimately provided 65 head-started juveniles that were later released into wetlands near Tan Soum Village in 2013 and 2014. Despite demonstrated success in meeting our objectives, donor funding was unexpectedly terminated in early 2014, conservation efforts were suspended, and no subsequent monitoring or evaluation was conducted.

In late 2017, WCS received funding from several zoos in the United States to conduct a rapid assessment of former Crocodile Conservation Areas, evaluate past conservation actions, and determine if renewed efforts were warranted. This survey was conducted in January 2018 and concluded that crocodiles were now present in every Conservation Area and evidence of successful reproduction was reported at multiple sites As a result of the 2018 survey, donor support was solicited and received, and population monitoring and egg collection resumed in May-June of 2019. Our long-term conservation objective continues to be the restoration of a viable metapopulation of Siamese crocodiles in wetlands of the Xe Champhone Ramsar Site.

Recently, Asian Development Bank provided funding for Community Conservation initiatives in Dong Savan, Dong Boun, and Dongyanong Villages as a recommended mitigation measure to offset environmental impacts of a large-scale irrigation scheme in close proximity to the Xe Champhone Ramsar Site. The recommended mitigation measures include establishing VCTs to monitor Siamese crocodiles in critical habitat (Kout Kouang and Kout Koke) in the Xe Champhone Ramsar wetlands. As part of this project, we previously reported on site-specific protocols for monitoring crocodiles and critical habitat (Platt, 2021) and training of VCTs to carry out monitoring activities. Herein we provide additional reporting on crocodile nesting surveys and nest protection efforts at Kout Kouang and Kout Koke during 2022.

II. Physical Description of Wetlands

During this project, we searched for Siamese Crocodile nests at Kout Kouang and Kout Koke, which are included within the larger Xe Champhone Ramsar Wetland Landscape. A detailed physiographic description of these habitats with the Xe Champhone Ramsar Wetlands is presented by Platt et al. (2018b). To briefly summarize, Kout Kouang and Kout Koke are oxbow lakes in the floodplain of the Xangxoy River linked by a shallow slough which retains water for most of the dry season. Both oxbow lakes contain water throughout the dry season, with maximum dry season depths of 2-3 m (Platt et al., unpubl. data). Water levels during the dry season are further reduced by pumping to irrigate adjacent rice fields. During the wet season, overbank and backwater flooding from the Xangxoy River inundate the lakes and surrounding uplands to a depth of >1.0 m in most years. Like most oxbow lakes in the Xe Champhone Ramsar Site, Kout Kouang and Kout Koke are characterized by a matrix of open water interspersed among extensive mats of floating peat supporting grasses, ferns, shrubs, and small trees (**Figure 1**; see also Platt et al. 2018a). To our knowledge, the floristic composition of floating mat plant communities in Southeast Asia remains poorly studied.

These peat mats in Kout Kouang and Kout Koke are extremely stable and in most places are capable of supporting the weight of a crocodile nest or even humans (**Figure 2**). Floating mats are an important source of *Nepenthes* and other medicinal and edible flora (**Figure 2**). Kout Kouang is surrounded by bamboo thickets, secondary forest, and open rice fields. The vegetation surrounding Kout Koke is less disturbed; rice fields are smaller, the banks are covered in dense clumps of timber bamboo, and the secondary forest contains several remnant Dipterocarp trees of an impressive size. A concrete dam that impounds a slough was constructed near Ban Dongyanong in 2011 to provide irrigation water for dry season farming with the objective of reducing extraction pressure on Kout Kouang (Platt et al., 2018b). However, this dam seems to have fallen into disrepair and no longer is functioning. Active crocodile nests containing eggs were found at Kout Kouang and Kout Koke during the early years (2011-213) of the project (Platt, 2012; Platt et al. 2018b) and in surveys conducted prior to the initiation of our conservation activities (Bezuijen et al., 2006, 2013). Platt et al. (2018b) considered the Kout Kouang and Kout Koke some of the most important nesting habitat for Siamese Crocodiles in the Xe Champhone Ramsar Site.

Figure 1: Kout Kouang and Kout Koke are characterized by a mosaic of open water interspersed with extensive mats of floating peat (above). The floating mat pictured below supports a continuous, dense stand of tall grass.

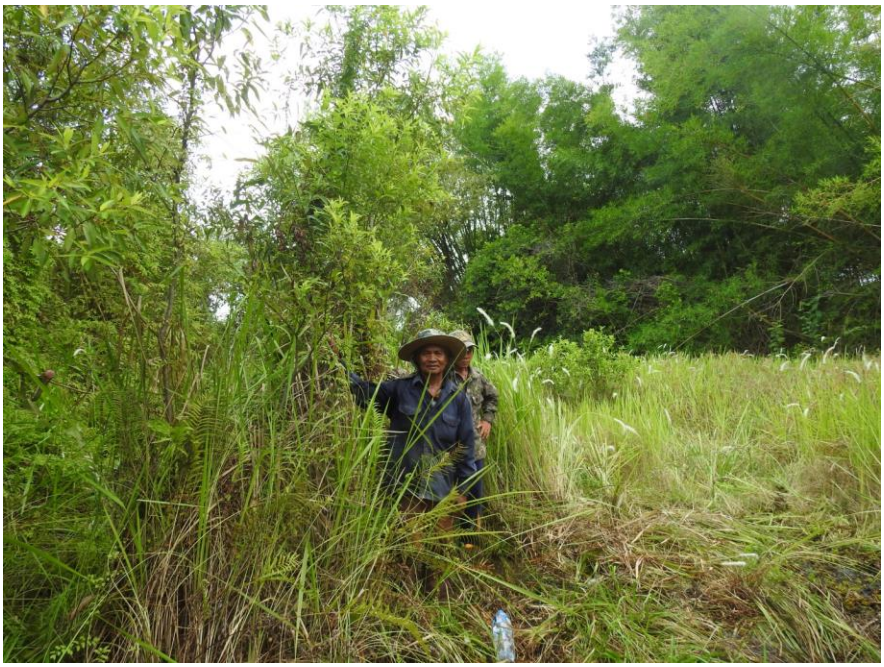

Figure 2: Floating peat mats in Kout Kouang easily support the weight of people (above). Note interspersion of grass, ferns, shrubs, and small trees. The floristic composition of floating peat mats in Southeast Asia is poorly described. Floating peat mats in Kout Kouang and Kout Koke are an important source of *Nepenthes* pitchers and other medicinal and edible plants used by local villagers (below).

III. Overview of Methodology

Developing effective methodologies for monitoring Siamese crocodile (*Crocodylus siamensis*) populations in the Xe Champhone wetlands was accorded high priority in the long-term recovery plan prepared by Wildlife Conservation for this flagship species (Hedemark et al. 2009; Platt 2012). Successful monitoring of Siamese crocodiles in the Xe Champhone wetlands will allow conservation actions to be assessed in an adaptive management context (e.g., Walters 1986). The methodology used by Village Conservation Teams (VCTs) is relatively simple, inexpensive to implement, and yields an index of relative abundance that accurately reflects changes in crocodile populations over time. Herein we present an overview of the methodologies employed to monitor the Siamese Crocodile population throughout the Xe Champhone Ramsar Site, and specifically crocodiles in Kout Kouang and Kout Koke. A detailed assessment of our methodologies is provided in Platt et al. (2014).

Objectives

Our objectives are two-fold: 1) Obtain Siamese crocodile eggs for incubation at our rearing facility in Tan Soum Village. Young crocodiles are released after approximately 2.5 years of head-starting (i.e., rearing to a body size thought relatively invulnerable to predation) in Xe Champhone wetlands to augment the existing population and increase the trajectory of population recovery. 2) Quantify the annual nesting effort and ultimately determine the long-term trend of the Siamese crocodile population in the Xe Champhone Ramsar wetlands. Site-specific recovery of crocodiles in Kout Kouang and Kout Koke is also addressed.

Timing

The reproductive phenology of *C. siamensis* in Lao appears to vary somewhat between populations in neighboring Thailand and Cambodia (Platt et al. 2014). In Lao, our experience suggests a close correlation between crocodile nesting activity and the annual monsoonal cycle. To briefly summarize our observations, courtship and mating seem to occur during March and April, followed by nest construction and clutch deposition in mid-May and early June. Eggs incubate throughout July with hatching in mid-August and September after a period of about 75 -80 days (Brazaitis and Watanabe 1983; Platt et al. 2011). Given this reproductive phenology, VCTs conduct nest searches in late May, throughout June, into early July. It is essential to conduct repeated nest searches beginning as early as possible because postponing searches until late June or early July increases the likelihood that clutches will be lost due to monsoonal flooding.

Searching

Locating Siamese crocodile nests is in a word, challenging. Siamese crocodiles construct typical mound nests composed of vegetation, soil, and woody debris. Nests are large mounds (ca. 1.5 m wide and 0.75 m high) that can be conspicuous when constructed at an open microsite. However, females often conceal nests in thickets of tangled

vegetation or beneath a dense tree canopy. Nests in the Xe Champhone wetlands are usually positioned along the shoreline in close proximity to water and on floating mats of vegetation. Nests at Kout Kouang and Kout Koke have been without exception constructed in floating peat mats with varying degree of canopy cover. The latter is an important consideration when using Unmanned Aerial Vehicles (UAV; "drones") to search for crocodile nests (see below).

We employ two strategies when searching for crocodile nests. First, intensive foot searches are repeatedly conducted during the nesting season (mid-May through mid-July) by VCTs in their assigned Area of Responsibility (AOR). This AOR consists of village wetlands (in this case Kout Kouang and Kout Koke) of which the VCT is intimately familiar owing to their life-long association with these habitats. Given the high degree of site fidelity exhibited by reproductive female crocodilians, particular attention is devoted to searching locations where crocodiles have nested in previous years. Repeated searches (at least once every two weeks) are necessary because nest construction by individual females is staggered throughout May and June; therefore, a single search will fail to detect nests constructed later in the season. The nest searching skills of VCTs appear to be improving over time.

Floating mats of vegetation are a favored site for crocodile nest construction in Kout Kouang and Kout Koke, but these are especially difficult habitat to search on foot. We therefore recommend that search effort by VCTs be supplemented with reconnaissance flights by drones operated by an individual skilled at identifying crocodile nest mounds. To this end, we conducted a training workshop and field exercise for WCS Savannakhet-based staff on a rotary drone on 2-4 July 2022. Both fixed-wing and rotary UAVs have been successfully employed to search for crocodilian nests (e.g., Elsey and Trosclair 2016; Scarpa and Pina 2019), although the latter are preferred. Specific models for consideration include the Mavic 2 and Autel 2 6K. UAV surveys will henceforth be conducted in late June, at which time nest construction and egg-laying by female crocodiles is expected to be completed. Regardless of whether or not eggs will be collected, each nest will be inspected and opened to determine the clutch size and confirm the presence of viable eggs (see below). Both clutch size and egg viability rates are essential demographic parameters for measuring population recovery.

Egg collection and incubation

Crocodile eggs are collected by VCTs operating under the direct supervision of WCS personnel. The latter are immediately notified when an active nest is discovered and arrangements are made to recover the clutch as quickly as possible. Upon arriving at the nest, GPS coordinates are recorded and multiple photographs taken of the nest and surrounding habitat from different angles. Before opening the nest, the width and height of the mound is measured (in cm), distance to the nearest water is determined (in meters, along the route used by female), and tree canopy cover directly above the nest is estimated (in increments of 20%). The top of the nest mound is then carefully opened to expose the clutch. Each egg is gently removed from the nest and the dorsal surface marked with a pencil to maintain the proper orientation during handling (rotation of the

egg can result in embryo death). The length and width of each egg is measured (in mm) with a dial caliper, egg mass is determined (in grams) with a Pesola spring balance or digital scales, and the presence (or absence) of an opaque band is noted (**Figure 3**). Photographs are taken of the opaque bands from a series of eggs (N = 10); these are used later to estimate the date of clutch deposition (**Figure 4**). After processing, eggs are securely packed in a Styrofoam box containing natural nesting material and transported to a designated incubation facility in Tan Soum Village. Care is taken to minimize jarring and vibration while the eggs are being transported.

Once at the facility, eggs are placed in Styrofoam boxes (i.e., McCaskill Chambers) for artificial incubation (**Figures 4 & 5**). The bottom of each Styrofoam box is filled with a layer of damp sand. The eggs are then partially buried in the sand and covered with a layer of material collected from the nest (important for inoculating eggs with natural bacteria that facilitates degradation of the eggshells prior to hatching), and moist leaves. Small holes to allow for ventilation are made in the sides and top of the Styrofoam boxes. The lid is replaced and the boxes placed in a designated room in the village administrative office and eggs are incubated at the ambient temperature. The nesting material is moistened as needed by the VCT in Tan Soum Village. This practice maintains near saturation levels of humidity and prevents the eggs from desiccating. Prolonged desiccation can result in embryo death. Upon hatching, the neonates are transferred to outdoor rearing pens with care provided by a trained VCT member.

Measuring crocodile population trends

Long-term population trends can be determined by regressing annual nesting effort (y) against year (x) (McNease et al. 1994). The average rate of population change can then be calculated from the slope of the linear relationship between annual nesting effort and year (Bayliss et al. 1989). Because at least five data points are required for linear regression analyses, at present we lack sufficient data to quantify population trends. However, several inferences can be made based on observations made during the early years (2011-13) of this project.

III. Crocodile nesting at Kout Kouang and Kout Koke

In accordance with our protocols outlined above, VCTs initiated nest searches at Kout Kouang and Kout Koke during mid-May 2022 and these continued through early July 2022. During this period, the VCTs devoted a minimum of 14 days to nest searching. In addition, opportunistic searches were conducted by VCT members during the course of routine daily activities (e.g., fishing and harvesting plant resources). Given the sporadic nature of these activities, quantifying this additional opportunistic search effort is not possible, but was nonetheless productive. As a result of both scheduled and opportunistic searches by VCTs, three Siamese crocodile nests were found at Kout Kouang and Kout Koke. All three nests contained an intact clutch of viable eggs that were collected and transported to Tan Soum Village for incubation. Our results are summarized in Table 1 with a detailed description of each nest provided below.

Figure 3: Crocodile eggs are removed from the nest mound, weighed and measured, and securely packed with nesting material in a Styrofoam box for transport to incubation facility in Tan Soum Village.

Figure 4: Opaque banding on eggshell is used to determine if the egg is viable (above). Viable eggs are placed on a layer of moist sand in a McCaskill Chamber for incubation (below). Each McCaskill Chamber can hold 20-25 eggs depending on size of the eggs.

Figure 5: Eggs in the McCaskill Chambers are covered with a layer of nesting material and dried leaves (above) and incubated at ambient temperature in the administrative office at Tan Soum Village (below).

Table 1: Summary of Siamese crocodile nesting at Kout Kouang and Kout Koke during the reproductive season of 2022. CS = Clutch size. VE (%) = Number of viable eggs in clutch followed by percent viable eggs in parentheses. The number of eggs incubated is less than clutch size because one egg was left in each mound at the request of the VCTs (see text). Hatching rate was calculated as the percent of incubated eggs that eventually hatched. Asterisk denotes a single hatchling from Kout Kouang (2) that succumbed shortly after emerging from the egg.

Nest	CS	VE (%)	Incubated	Hatched (%)
Kout Kouang (1)	13	13 (100)	12	9 (75.0)
Kout Kouang (2)	28	28 (100)	27	19 (70.3)*
Kout Koke	29	29 (100)	28	19 (67.8)
Total	70	70 (100)	67	47 (70.1)

Crocodile Nests (Kout Kouang)

Two Siamese crocodile nests were found by VCTs at Kout Kouang in early June (**Figures 6 & 7**). The WCS Crocodile Team accompanied the VCT to Kout Kouang on 7 June 2022, inspected the nests, recovered the eggs for incubation, and transported the clutches to our facility in Tan Soum Village. In accordance with the desires of the VCT, a single egg was left in each nest to propitiate the spirits believed to protect the crocodiles from harm (see Platt et al., 2018c for a discussion of these beliefs and their conservation implications).

The first nest we examined was constructed on a floating pet mat directly on top of a nest mound from 2021. The nest was constructed at a slightly elevated microsite at the base of a *Salix* clump with 0% overhead canopy cover and approximately 1.0 m from water. Tracks and drag marks suggested the female was in attendance at the nest, but probably fled at the approach of our group. The nest mound measured 140 cm × 130 cm wide and 35 cm high. The mound was composed of largely of ferns and grasses with lesser amounts of *Salix* foliage and climbing fern. The plants used for nest construction are abundant in the area surrounding the nest site. The clutch consisted of 13 eggs, all of which exhibited prominent opaque bands and appeared viable. Based on the extent of the banding, we estimate this clutch was deposited in mid-May. Twelve of these eggs were collected and returned to Tan Soum Village for incubation. Of these 12 eggs, nine hatched in early August.

The second nest we examined was constructed on the same floating mat and about 30 m from the first nest. As with the first nest, this nest was also constructed on top of a nest mound dating from 2021. The mound was constructed at the base of a *Salix* clump along the edge of a channel through the peat mat used by the female to access the site. The nesting female was present, but fled upon our approach. During our drone workshop on 4 July 2022, we observed the female guarding this nest, although the mound no longer contained eggs (see below). The mound measured 120 cm × 150 cm wide and 35 cm high and was slightly shaded (ca. 25% canopy coverage). Nest materials consisted of largely grass with some ferns, climbing ferns, and clumps of *Salvinia* dredged from the channel adjacent to the site. We recovered 28 eggs from the mound of which 27 were collected for incubation. Opaque bands were present on all 28 eggs and the extent of these bands suggested the clutch was deposited in mid-May. Of the 27 eggs incubated, 19 hatched in early August, although one hatchling died before it could exit the egg.

Crocodile Nest (Kout Koke)

A single Siamese crocodile nests was found at Kout Koke by VCTs in early June (**Figure 8**). The WCS Crocodile Team accompanied the VCT to Kout Kouang on 13 June 2022, inspected the nest, recovered the eggs for incubation, and transported the clutch to our facility in Tan Soum Village. As with the nest at Kout Kouang, a single egg was left in the nest at the request of the villagers.

The nest at Kout Koke was constructed on an elevated microsite of an extensive floating peat mat within a dense clump of *Phragmites*. Reaching the nest proved difficult and required us to clamber along a fallen tree and then descend on a makeshift bamboo walkway. The mound was positioned about 50 cm from water at a completely open location was 0% canopy coverage. The female was attending the nest, but fled at our approach. Fresh crocodile tracks, scrapings, drag marks, and scat were present at the mound indicating prolonged attendance and nest guarding by the female. The scat was collected as part of a microplastics study. This female was observed in attendance at the mound during our drone training workshop on 4 July 2022. The mound was largely composed of *Phragmites*, which was unsurprising given the location within a dense brake of this grass. Other components of the mound included Climbing Fern and soil. The mound was among the largest of the nine nests we examined in 2022, measuring 170 cm × 160 cm wide and 50 cm high. The clutch consisted of 29 eggs, 28 of which we collected for incubation. All 29 eggs appeared viable and the extent of banding indicated the clutch was deposited in late May. Nineteen of the 29 eggs hatched in early August and the neonates are being head-started at our rearing facility in Tan Soum Village.

IV. Conclusions

In summary, we found three Siamese crocodile nests at Kout Kouang (N = 2) and Kout Koke (N = 1) during the 2022 breeding season. These three nests represent 66.6% of the Siamese crocodile nests we found throughout the Xe Champhone Landscape in 2022, underscoring the importance of the two oxbow lakes to crocodile conservation in

Figure 6: Two Siamese crocodile nests found on a floating peat mat in Kout Kouang. Mounds were constructed on slightly elevated microsites from vegetation available at the nest site (grasses, ferns, and *Salix* foliage).

Figure 7: Eggs were collected from both nests at Kout Kouang by WCS staff and Village Conservation Team. The upward facing surface of each egg is marked with a pencil to insure proper orientation when handling, transporting, and incubating eggs.

Figure 8: Crocodile nest found at Kout Koke by VCT. The clutch was collected by WCS staff and VCT on 13 July 2022. The nest mound was among the largest found in the Xe Champhone Ramsar Site during 2022.

Lao PDR. Moreover, of the nine nests we found in the Xe Champhone wetlands, seven (77.7%) were constructed on floating peat mats. This finding highlights the importance of floating peat mats as critical nesting habitat for Siamese crocodiles. The fact that 100% of the eggs we examined at Kout Kouang and Kout Koke were viable suggests that a robust crocodile population inhabits these oxbow lakes. Our findings stand in marked contrast to some other sites in the Xe Champhone wetlands where a high percentage of the eggs we examined in 2022 proved to be infertile, i.e., opaque banding was absent. It is important to note that during the early years of our project (2011-13), only two nests were found in Kout Kouang and Kout Koke, and both contained clutches of non-viable eggs. Our 2022 results therefore indicate that1) the number of nesting females present in Kout Kouang and Kout Koke has increased, and 2) an adequate number of males to insure fertilization are now present. Finally, dry season water extraction for irrigation remains a serious threat to the continued persistence of crocodiles in Kout Kouang, Kout Koke, and other wetlands (especially oxbow lakes) in the Xe Champhone wetlands. We reiterate our earlier recommendation that at least 2-3 m of water should remain in oxbow lakes (including Kout Kouang and Kout Koke) throughout the annual dry season if Siamese crocodiles are to remain a functional member of wetland wildlife communities in the Xe Champhone Ramsar Site.

V. Recommendations

- **A vegetative buffer of at least 30m from the dry-season shorelines of Kout Kouang and Kout Koke should be maintained where still present and restored along recently cleared land**. The recent clearance of natural habitat up to the shoreline of the two oxbows has resulted in the loss of Critical Habitat for the Siamese crocodile, especially for future nesting. Furthermore, clearing of land up to the shoreline increases impacts of erosion and sedimentation. Failure to at least partially reclaim and restore 30m vegetative buffers put both water bodies at risk of filling in with sandy sediment, a detriment to Siamese crocodiles, fisheries, and water storage for irrigation. Funding to secure agreements for reclamation of shoreline buffer area as well as to pay for materials and labor for restoration plantings should be secured.

- **Water depth of at least 2-3m in the dry-season should be maintained in Kout Kouang and Kout Koke through development of water use regulations, water user groups (WUGs), and regular monitoring**. To ensure viability of these two oxbows as critical dry-season habitat for Siamese crocodiles, year-round water depths >2m must be maintained. These depths are also of importance to fisheries as many species require deeper pools during the dry-season and fisheries productivity will be safeguarded in part via maintenance of these minimum depths. Hydrologic mapping of each oxbow will provide information on each the water storage capacity of each waterbody. Following these calculations on rice production needs will establish an annual average availability of water for irrigation, which is then the determinate factor for the total area of rice production each oxbow can provide. Once storage capacity is calculated legal regulations regarding total

volume of water available for irrigation per dry-season should be established. Water User Groups (WUGs) should be established at each Oxbow, with membership including at least one member of each household that farm in the area using irrigation from the oxbow. Technical oversight should be funded to help facilitate these WUGs and to perform regular monitoring of water levels.

- **Village Conservation Teams (VCTs) should continue to be supported financially and through regular trainings to maintain and improve their abilities to monitor biodiversity and ensure compliance with regulations regarding use of both oxbows**. VCTs are the frontline, critical component to successful implementation of the diverse activities necessary for crocodile conservation. Secure funding and technical support is critical for long-term success.

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