CROCODILE CONSERVATION ACTION PLAN OF THE PHILIPPINES

2023-2032

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Cover Photo: crocodile impression on the banks of Mlang River, Barangay Magallon, Mlang, North Cotabato taken by Rainier I. Manalo (2012). All photographs used in the body of this plan were taken by Teri Aquino.

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ACRONYMS

BARMM	Bangsamoro Autonomous Region in Muslim Mindanao
BMB	Biodiversity Management Bureau
CFI	Crocodile Farming Institute
CH	Critical Habitat
CITES	Convention on International Trade of Endangered Species of Flora and Fauna
CLWUP	Comprehensive Land and Water Use Plan
CCAPP	Crocodile Conservation Action Plan of the Philippines
CPPI	Crocodylus Porosus Philippines, Inc.
CR	Critically Endangered
CROC	Crocodile Rehabilitation, Observance, and Conservation Project
CSG	Crocodile Specialist Group
DA-BAI	Department of Agriculture-Bureau of Animal Industry
DCP	Davao Crocodile Park
DCZ	Danish Crocodile Zoo
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DOT	Department of Tourism
DTI	Department of Trade and Industry
FGDs	Focus Group Discussions
ICCAs	Indigenous Community Conserved Areas
ISU	Isabela State University
IUCN-SSC	International Union for the Conservation of Nature - Species Survival Commission
KBA	Key Biodiversity Area
KZP	Krokodyli Zoo Protivin
LCA	Locally Conservation Area
LGUs	Local Government Units
LR/lc	Lower Risk/(least concern)

MOA	Memorandum of Agreement
NCCC	National Committee for Crocodile Conservation
PA	Protected Area
PAMB	Protected Area Management Board
PBSAP	Philippine Biodiversity Strategy and Action Plan
PCG	Philippine Coast Guard
PCSDS	Palawan Council for Sustainable Development Staff
PNM	Philippine National Museum
PWQRT	Provincial Wildlife Quick Response Team
PWRCC	Palawan Wildlife Rescue and Conservation Center
SEAZA-SMC	Southeast Asian Zoos and Aquariums – Species Management Committee
SIPLAS	Siargao Islands Protected Landscape and Seascape
SU	Silliman University
SUAKCREM	Silliman University-Angelo King Center for Research and Environmental Management
TWG	Technical Working Group
UPD	University of the Philippines – Diliman
USM	University of Southern Mindanao
WEO	Wildlife Enforcement Officer

EXECUTIVE SUMMARY

This Crocodile Conservation Action Plan in the Philippines (CCAPP) 2023-2032 takes off from past recovery plans but differs in the coverage of the previous ones which primarily focused on Philippine crocodile (*Crocodylus mindorensis*). This plan (CCAPP 2023-2032) covers the conservation and management of the two naturally occurring crocodiles in the country: the Philippine crocodile (*Crocodylus mindorensis*) and the Indo-Pacific crocodile (*Crocodylus porosus*). The CCAPP 2023-2032 is the updated version of the previous plans and will be subjected for review and updating every five (5) years or as necessary. It provides current information on the wild and captive populations of the two crocodile species in the country, identifies the current threats to the populations and its habitat, and outline conservation strategies and actions for management and conservation purposes.

This plan is an output of consultative process involving local crocodile experts and National Crocodile Conservation Committee as well as focus group discussions (FGDs) and interviews with key stakeholders and visits to critical crocodilian habitats. Stakeholders identified current issues/challenges to crocodile conservation which include:

- Hunting
- Fisheries by-catch
- Issues on genetic integrity
- Inadequate mechanism for traceability of stock
- Information gaps
- Threats to habitat, e.g. habitat loss or conversion, pollution, climate change impacts
- Resource use conflicts (including human-crocodile conflicts)

This plan also identifies and highlight current and potential partners in conservation for the Department of Environment and Natural Resources - Biodiversity Management Bureau (DENR-BMB). These include:

- Local academe
- Local Government Units
- Other National Government Agencies
- Non-Government Organizations
- Private Sector

As a result of the battery of consultations, a vision for crocodile conservation was developed. Three goals and corresponding targets and strategies were set which stakeholders believed could adequately address the challenges in crocodile conservation in the Philippines. Furthermore, stakeholders strategized and identified specific actions to achieve these goals and targets.

Vision

"*Society in harmony with nature, where crocodiles and their habitats contribute to ecological integrity and economic sustainability in the Philippines*"

Goal 1 Promote actions to ensure the protection of crocodiles and their habitats in the mosaic of human land use thereby contributing to ecological integrity

Target: By 2032, crocodile sanctuaries are established in strategic areas in the country.

- Conduct baselining surveys on existing and potential habitats for sanctuary identification
  - (2023-2024) Conduct exploratory surveys
  - (2023-2026) Conduct comprehensive surveys
- Facilitate the establishment and management of locally conserved areas (LCAs)/protected areas (PAs)/ critical habitats or Indigenous Community Conserved Area (ICCA) primarily for the protection and conservation of crocodiles
  - (2023-2027) Designate sites for LCA/PA/CH/ICCA establishment and conduct assessment, mapping, consultations, and delineation of boundaries
  - (2023-2028) Prepare legal documents for establishment
  - (2023-2028) Approve and disseminate proposed declaration
  - (2023-2028) Develop Critical Habitat management plan per site
- Mainstreaming establishment of crocodile sanctuaries into critical habitat system (Wildlife Act)
  - Advocate for the inclusion of crocodile sanctuaries in core zones of suitable CH Zoning and Management Plans
- Carry out DNA mapping
  - (2023) Prepare protocol for DNA mapping
  - (2024) Centralize assessments
  - (2023) DNA marking and screening, microchip embedding
- Establish a release protocol for Philippine crocodiles
  - (2024) Conduct workshop to establish/develop protocols for: (1) pre-release stage and (2) post-release stage
  - (2025-2028) Identify stock ready for release

Goal 2 Enhance positive perception about crocodiles where communities recognize their intrinsic and cultural values as part of global biodiversity

Target: By 2032, increased social understanding and acceptance of crocodiles living in their natural habitats.

- Design and implement Communication Education and Public Awareness (CEPA) program employing multiple media
  - (2023) Conduct needs assessment for CEPA re crocodile conservation
  - (2024-2030) Conduct capability building training to enhance CEPA skills
  - (2023 onwards) Produce and disseminate CEPA materials
  - (2024-2025) Develop materials for integration of crocodile conservation in DepEd programs (e.g. textbooks, educational materials, etc.)
  - (2023 onwards) Conduct Biennial Croc Forum

- Promote social acceptance of crocodile sanctuaries in the country
  - (2024-2028) Conduct livelihood needs assessment in or near prioritized crocodile habitats
  - (2023-2032) Initiate collaborative nest protection scheme and incentive system

- Investigate livelihood options linked to crocodiles in and near crocodile habitats and promote where applicable
  - (2024-2029) Develop community-based Sustainable Ecotourism, Livelihood Programs towards conservation of crocodiles
  - (2023 onwards) Conduct researches on natural history in Ligawasan Marsh tributaries/lakes, artificial breeding, immunological effects of crocodile blood plasma

- Conduct research to improve the understanding (public perception) of wild and captive crocodiles

  - (2021-2028)Conduct research, publish results and develop data bank about crocodiles

- Establish databank for info sharing /Collate results of surveys

  - (2023 onwards) Collate list of papers on the two species of crocodiles in the Philippines (published paper) and upload in the to-be-developed croc website (linked to the BMB website)

Target: By 2032, protective mechanisms for crocodiles and their habitats enhanced.

- Implement protocols for responding to reports of human-crocodile conflicts
  - (2023 onwards) Implement the protocols and measures for managing human-crocodile conflicts (BMB Technical Bulletin No. 2020-02)

        - (2023-2025) Conduct trainings on protocol on managing Human-Crocodile Conflict
    - Encourage participation of local stakeholders in the protection of wild crocodiles
        - (2023 onwards) Develop local conservation programs that engage stakeholders in its implementation
        - (2023 onwards) Forge agreements and pass resolutions towards the protection of wild crocodiles and its habitat (in compliance to Wildlife Act)
    - Mainstream crocodile conservation strategies and programs into existing local and national agenda
        - (2025-2029) Integrate crocodile sanctuaries into City/Municipal Land Use Plan
        - (2023) Establish local conservation centers for Philippine Crocodiles

Goal 3 Properly manage both *in-situ* and *ex-situ* populations of crocodiles to ensure their viability and sustainable use

Target: By 2032, wild and captive populations of crocodiles in the country effectively monitored and managed.

- Mobilize the National Committee for Crocodile Conservation
    - (2023-2032) Oversee/lead in the implementation of the CCAPP

- Strengthen partnerships and networks, taking advantage of existing management bodies; capacity-building of local partners

    - (2023-2032) Conduct trainings and capability enhancement of local partners and stakeholders; include paralegal/enforcement and deputization
    - (2024-2027) Draft MOA between DENR and local stakeholders

- Establish and maintain national stud books (*C. mindorensis* and *C. porosus*) to achieve traceability of stock
    - (2023) Compel all wildlife permit holders to submit DNA profiling of their stock
    - (2023) Conduct training workshop on the development and maintenance of the studbook for crocodiles
    - (2023) Develop a species management program for crocodiles
    - (2023 onwards) Develop and maintain studbook

- Establish and implement a mechanism by which captive and wild populations may be monitored and managed

    - (2023-2032) Conduct monitoring of identified conservation breeding centers
    - (2023-2032) Strictly enforce marking system in captive population (i.e., tail cutting or microchips)
    - (2023) Streamline CITES permitting process for the control of trade in tourist, personal and household effects in reference with the CITES Resolution Conf. 13.7 (Rev. CoP17)
    - (2023-2032) Monitor illegal wildlife activities involving crocodile i.e., wihi farms, zoological parks, museums, and private collections
    - (2024) Conduct workshop to establish a standardized monitoring protocol (survey methods, equipment and supplies, data sheet, basic information needed, seasonality, information guide)

- Encourage and mobilize partnerships in crocodilian conservation
    - (2023-2024) Develop standards for *ex-situ* management of crocodiles in the Philippines

- Conduct management effectiveness monitoring of crocodile conservation work regularly
    - Conduct biennial project evaluations

CROCODILE CONSERVATION ACTION PLAN IN THE PHILIPPINES

2023-2032

I. INTRODUCTION

The country has two species of crocodiles, out of the 25 currently recognized crocodilian species in the world - the Philippine crocodile (*Crocodylus mindorensis*) and the Indo-Pacific Crocodile (*Crocodylus porosus*).

Today, the two species of crocodiles are sparsely distributed in the country, with some degree of concentration in the river systems of Mindanao and Palawan in the case of the Indo-Pacific crocodiles. The Ligawasan Marsh in Mindanao is purported to support both species while Agusan Marsh and the rivers throughout Palawan harbor mostly Indo-Pacific crocodile populations. In the Northern Luzon area, Philippine crocodile populations have been documented in the three provinces of Isabela, Abra, and Cagayan while the Indo-Pacific crocodiles were mostly found near the coastal waters.

INDO-PACIFIC CROCODILE (*CROCODYLUS POROSUS*)

Also called saltwater crocodile, the Indo-Pacific crocodile occupies non-tidal freshwater portions of rivers, inland freshwater lakes, estuaries, and marshes. It feeds on all kinds of animals from frogs to mammals that find their way to its aquatic territory. This medium-snouted generalist is the largest of all crocodilians (Webb, Manolis, & Brien, 2010) and has the highest bite force recorded of any animal (Erickson, et al., 2012). Long distance journeys occur at sea but in unknown frequency. Breeding and recruitment take place in rivers with significant freshwater input. Females mature at around 2.2 m body length and lay eggs in mound nests (Webb, Manolis, & Brien, 2010). Mating and egg laying seasons vary in different parts of the Philippines but generally occur anytime from February to June. Captive breeding records at the Palawan Wildlife Rescue and Conservation Center (PWRCC-formerly Crocodile Farm Institute or CFI)from 1991 to 2008 showed an average of 40 eggs per female with 65.88% fertility and 67.34% hatchability. No similar figures are available for the wild populations.

PHILIPPINE FRESHWATER CROCODILE (*CROCODYLUS MINDORENSIS*)

The Philippine crocodile is a relatively small crocodilian inhabiting fresh water bodies and, at times, can be observed in saline waters along the coast of northern Luzon when it moves between creeks. It feeds on small riverine or freshwater organisms ranging from dragonflies, shrimps, snails, and small fishes in the case of juveniles and large fishes, small mammals, and waterbirds in larger individuals. Home range of tagged individuals spanned from one to six kilometers in the river systems of Northern Luzon (Van Weerd, 2010).

Mating has been observed as early as January and egg-laying in the months of April and May in the wild and as early as February in captivity. Females are mound nesters although cases have been noted wherein eggs were laid in a hole underneath a mound. Mean clutch size ranged from 15 to 26 in the wild, depending on the region while incubation period ranged from 65 to 85 days (Van Weerd, 2010). Double clutching has been observed in captivity, with second clutches often laid around five months after the first. Egg counts did not vary greatly between clutches of the same female but fertility rates were notably higher in the first clutches (Sumiller, 2000).

The first comprehensive crocodile survey in the 1980s (Ross C. , 1982a) spurred the Philippine government into action when it reported that only about 500-1,000 individuals remained in the wild. Before then, only a few local herpetologists, led by Dr. Angelo C. Alcala, had been working in their private capacity to push for better understanding and protection of these animals. In that same decade, the Philippine government established the Crocodile Farming Institute (CFI) which spearheaded many of the research and conservation work on crocodiles in the country for the next decade after that.

CONSERVATION EFFORTS

In 2000, the Department of Environment and Natural Resources (DENR) issued Special Order 2000-231 which created the Philippine Crocodile Recovery Team that focused primarily on the conservation needs of the critically endangered Philippine crocodile (*Crocodylus mindorensis*) and the first Recovery Plan for *C. mindorensis* was formulated. The same year also saw the launching of the crocodile farming industry in the country with six crocodile farmers who eventually came together in support of crocodile conservation. Since then, crocodile

conservation in the Philippines has become even more complex with more facets and nuances to conservation work that need to be addressed.

The past decade has also seen the advent of new players in crocodile conservation in the Philippines and the rediscovery of small pockets of populations where crocodiles were previously thought to have been extirpated. Conservation successes had its share of drawbacks. The Biodiversity Management Bureau (BMB) deemed it timely to update the previous crocodile conservation plan and expand its coverage to encompass the two species of crocodiles in the country.

PREPARATION OF THE PLAN

Where the previous plans concentrated on the conservation and management of the Philippine crocodile *C. mindorensis*, this updated Conservation and Management Plan for Crocodiles in the Philippines (CMPCP) aims to:

1) update previous plans and provide current information on the wild and captive populations of the two naturally occurring crocodilian species (*C. mindorensis* and *C. porosus*) in the country;
2) identify the current threats to the population and its habitat; and
3) propose conservation strategies for management and conservation purposes.

Key stakeholders were consulted in the preparation of this plan. Interviews and focus group discussions were conducted in municipalities and provinces with crucial crocodile populations. Documentation of these activities is appended to this plan (Annexes 1-10). Related literature has been compiled and reviewed. Visits to selected crocodilian habitats in the country as well as private collections were likewise done to enhance the plan.

II. CROCODILIAN BIOECOLOGY

ECOLOGICAL FUNCTION AND IMPORTANCE IN ECOSYSTEMS

Crocodilians are implicated in positive effects in their environments as "*keystone species*" that maintain system structure and function through their activities. These include nutrient recycling, thus making these ecosystems productive of fish and other animals serving as food for humans. Their fecal matter serves as fertilizers in rivers and lakes. The loss or decline of their numbers in natural habitat may result in the loss of species diversity, which in turn reduces the ability of an ecosystem to respond to environmental disturbances. Humans and crocodiles can co-exist in the same environment; they both have role and responsibilities to the ecosystem functions.

BEHAVIOR

Like any wild animals, the survival of crocodiles relies on access to food and safety/shelter (which also refers to the safety/shelter of their progenies). To threaten or hinder their access to both necessities is equivalent to threatening their survival and will naturally trigger their fight-or-flight reaction. Crocodiles are opportunistic feeders, only feeding whenever food becomes available to them. They have been known to go without feeding for months (the longest period known is one year) and still survive. Thus, when presented with prey, they will fight for it if they can overpower their prey given the uncertainty of their next meal. Similarly, crocodiles are highly territorial and will fight to defend its territory. The female is not usually as territorial as the male unless defending its nest or its young.

Crocodiles are exothermic/poikilothermic animals whereby depending on their environment, they regulate their body temperature by, basking under the sun, or down diving into the water to cool off. Crocodiles can move fast in the water as well as on land. They are often difficult to see in the water and can stay submerged for two hours, lifting their buoyant head to break the surface with only their nasal plate to breathe. Their tail propels them forward quickly with just a sideways flick. A strong swish of the tail can allow it to jump completely out of the water. On land, the crocodile is also capable of fast movement but only in short bursts of energy. After great muscular activity, the crocodile will need to follow it up with a period of rest or inertia. Therefore, it is possible for a person to outrun a crocodile only if he/she does so very fast and continuously, running straight away from the latter before it recovers from its muscular exertion.

Mating occurs in shallow waters with the male emitting low frequency sounds, seen as rippling/splashing of the water. The female, if receptive, allows the male to approach it from behind. The male clasps its legs around the body and coils its tail around that of the female and coitus begins with the pair sinking into the water.

Crocodiles are mound nesters and nesting often coincides with the local wet season. By collecting dead vegetation from the surrounding area, the female piles these up to about half a meter high with a base diameter of about 1.6 meters. The eggs are laid within the mound and the nest is religiously guarded by the female until hatching time which takes about 75 to 90 days, depending on the prevailing incubation temperature, ideally ranging from 31◦ to 33◦C. In the wild, a hatching success rate of 10 to 50% may be expected with only about 1 to 5% of the hatchlings surviving to adulthood.

Crocodiles are highly territorial. Their territorial behavior is defined primarily by the size of the animal and, in the case of the female, by presence of their nest and their progeny. This behavior may be linked to increased aggressiveness as reflected by head slapping, inflated body, and arched tail.

A hierarchy is often observed in crocodiles with the most dominant individual being the largest and having the greatest territory. When the dominant crocodile is removed, it creates a void in the hierarchy and the lesser ones will fight to establish dominance to gain more territory which results in more aggressive display.

III. HISTORICAL ACCOUNT OF CROCODILES IN THE PHILIPPINES

Although several crocodilian species are now found in zoos and private collections throughout the Philippines, only two species occur naturally - the Indo-Pacific crocodile *C. porosus* and the Philippine crocodile *C. mindorensis*. These two species of crocodiles used to be found all over the Philippines (Schmidt, 1935). The Philippine crocodile was first described by Schmidt (1935) based on four specimens presumed to have been collected from Lake Naujan, Mindoro. Publications from the mid- to-late- 1800s already alluded to the presence of the Indo-Pacific crocodiles in the country(de la Gironiere, 1854; Jagor, 1875).Mandibles collected in 1905 from a *C. porosus* and currently kept at the Smithsonian Institution reportedly came from the Philippines. Crocodiles used to be a prominent component of rivers, lakes, estuaries, and marshes in the country (Ross & Alcala, 1983). Over the years, however, its habitat range has drastically shrunk and populations have become severely fragmented. This has been attributed to the already restricted habitat being subjected to conversion for agricultural purposes(Ross C. , 1982b). By the 1980s, the Philippine crocodile had become virtually extinct with few known extant populations even though the Indo-Pacific crocodile was still suspected to be more widespread than records indicated.

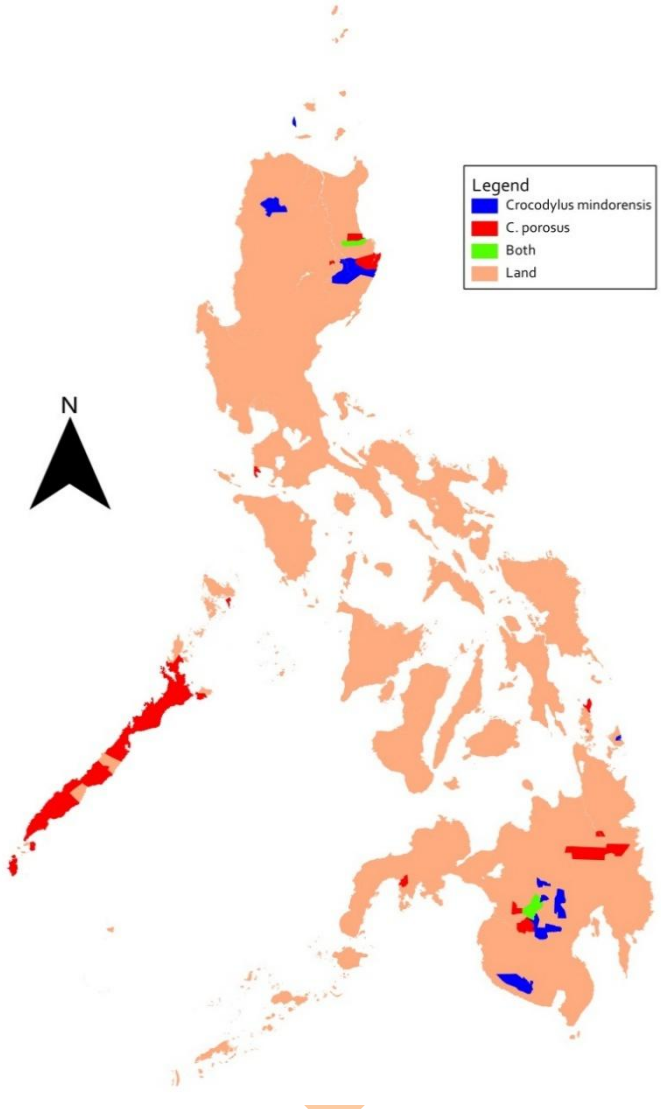

FIGURE 1.DISTRIBUTION OF WILD POPULATIONS OF CROCODILES IN THE COUNTRY.

IV. CURRENT STATUS OF POPULATIONS

WILD POPULATIONS

The Crocodile Specialist Group (CSG) of the International Union for the Conservation of Nature (IUCN) categorized the *C. mindorensis* as Critically Endangered (CR). The assessment of the population was updated in 2012. Despite the species being under the same category, the criteria have been changed based from an increased understanding of the cause of population decline which is potentially reversible (Manalo and Alcala 2015). While the conservation status of the global population of *C. porosus* is listed as Lower Risk/Least Concern (LR/LC), the Philippine population is listed as Critically Endangered (Gonzalez *et al.* 2018). However, the basis of this classification does not include the recently surveyed areas in South Western Mindanao which has been found out to be another stronghold of the species aside from Palawan (Binaday *et al.* 2020).In the Philippines, based on DENR Administrative Order No. 2019-09 "Updated National List of Philippine Threatened Fauna and Their Categories", both species is categorized as Critically Endangered.

Most research work in wild populations over the past ten years have centered on *C. mindorensis* primarily because of its critically endangered status. A study of Pomares et al. (2008)covered both species and officially recorded 265 wild individuals from 2007 to 2008 in six sites in Ligawasan Marsh and five in its tributaries. These, however, did not differentiate counts between species. In addition, their study was also based primarily on interview surveys although they spotted 60 individuals during their daytime and nighttime surveys.

CROCODYLUS POROSUS. Majority of the wild Indo-Pacific crocodile populations can still be found in Mindanao, Palawan, and the Northern Sierra Madre area although these are highly fragmented and in decimated numbers. The Mabuwaya Foundation is monitoring the Indo-Pacific crocodile population in Northeast Luzon. Apart from the survey conducted in the early 1980s (Ross C. , 1982a), no abundance estimates for wild populations in the country is available. Surveys are currently being undertaken by a non-government organization (NGO), the Crocodylus Porosus Philippines, Inc. (CPPI), to investigate the distribution and population abundance in some critical habitats of the *C. porosus* in the country.

***CROCODYLUS MINDORENSIS*.** Surveys of wild populations in the country have picked up during the more recent years. Researchers noted that wild Philippine crocodile populations are highly fragmented with often only as many as one breeding pair occupying one river or creek with a few juveniles or sub-adults thrown in. Researches revealed remaining populations in the San Mariano area in Sierra Madre, Abra, and Lake Sebu in South Cotabato (van Weerd, et al., 2006;

Pomares, Tabora, Sanchez, Pimentel, Pomares, & Escalera, 2008; Manalo, Pomares, Mercado, Belo, Saljay, & Tupas, 2012). Information on the population in Ligawasan Marsh, however, is quite limited due to the accessibility and security issues in the area.

In 2005, three nests were found in Northeastern Luzon while reliable reports were received of crocodile sightings in Mindoro and Mindanao. Andy Ross collected information on Mindanao sightings through local contacts (East and Southeast Asia Regional Report, 2006). The Mabuwaya Foundation has been monitoring Philippine crocodile populations and its nest in Isabela Province annually since 2000. Philippine crocodiles have bred every year since 2000 in various locations, with 6 nests in 2021. In 2021, Philippine crocodiles were sighted in eight different localities in the municipality of San Mariano, with a population count of 86 individuals (20 adults, 32 juveniles and 34 hatchlings). In addition, small numbers of Philippine crocodiles are found in the municipalities of Benito Solliven (1 nest in 2021) and in the coastal area of Isabela in Divilacan and Maconacon. However, population abundance estimates have yet to be established. It was nevertheless heartening to note that juveniles were still thriving in the area. In the Muleta River (Ligawasan Marsh tributary), Tambad, Carmen, three nests were sighted, ranging from 22 to 30 eggs per nest (Akmad, Pomares, & Tabora, 2010). Manalo et al. (2012) discovered new pockets of *C. mindorensis* populations at 700-850 masl – higher altitudes than previously believed suitable for crocodilian habitats. Anecdotal reports supported by skeletal remains and skin proved their presence at some point in time in eight out of 21 highland crests and inundated basins or small lakes explored in 2012.

CAPTIVE POPULATIONS

C. POROSUS. In the Philippines, there are currently six commercial crocodile farms which, on their own, account for about 30,000 individuals. Zoos and private collections account for much less than that. PWRCC in Palawan maintains Indo-Pacific crocodiles taken from wild, as well as the specimens turned-over by enforcement authorities and private individuals. Apart from captive-bred stock, PWRCC also takes in crocodiles implicated in human-crocodile conflicts to add to their breeding stock. The latest acquisition was in July 2014 in Rio Tuba, Palawan. The number of private individuals keeping crocodiles as pets, however, cannot be determined.

C. MINDORENSIS. Majority of the Philippine crocodiles in captivity may be found in Palawan at the PWRCC. The original stock had been acquired mostly from various private collections as well as from the wild. A number of progenies of Philippine crocodile have been turned over to two commercial crocodile farmers for breeding and conservation purposes. The Silliman University (SU) captive population, on the other hand, came mostly from one breeding pair from Zamboanga and Pagatban River in Negros Oriental. The management has, since then,

exchanged some of their breeding stock with other collectors in an effort to avoid inbreeding. A genetic study (Hinlo R. , 2010) reported this current SU population to be a mixture of Luzon and the southern pool.

Several private and public zoos both here and abroad also count the species in their displays. The European zoos recently came out with the second edition of their studbook, accounting for 51 individuals in 2013. The population in the European Zoos has apparently been screened in the process of determining their ancestry and degree of relationship (Ziegler, Rauhaus, & Karbe, 2013).Interviews with representatives from the Manila and the Avilon Zoos revealed their desire to have their stock screened for genetic integrity and relatedness. Although the Manila Zoo has already stopped breeding the animal, they expressed their interest in taking part in the genetic screening. Avilon Zoo, meanwhile, has an ongoing Memorandum of Agreement (MOA) with Krokodyli Zoo Protivin (KZP) regarding breeders loaned to the latter. They have prioritized the breeding of this species in their facilities which house exotic crocodilian species as well. Possibly the oldest living *C. mindorensis* in captivity is that in Binalbagan, Negros Occidental which was acquired from a local public market in 1943 as a hatchling.

V. CROCODILE FARMING AND TRADE

Only captive bred *C. porosus* is allowed for commercial breeding/farming and trade. In commercial breeding, only the progenies of the species can be utilized for commercial purposes (e.g. sale of skins, meat and other products derived therefrom). This commercial undertaking on the species in the Philippines is governed by CITES rules, the DENR Administrative Order (DAO) No. 99-45 (Rules and Regulations on the Sale and Farming of Saltwater Crocodile (*Crocodylus porosus*) and DAO No. 2004-55, the DENR streamlining/procedural guidelines in the implementation of Republic Act No. 9147 (Wildlife Resources Conservation and Protection Act of 2001).

Commercialization of the *C. porosus* through appropriate farming technology is a legitimate strategy for its conservation. Close cycle captive breeding of *C. porosus* strictly ensures that commercial trade will not be detrimental to the wild population. These were the founding concepts behind the establishment of the Crocodile Farming Institute – now called Palawan Wildlife Rescue and Conservation Center –in the late 1980s by the Department of Environment and Natural Resources. Two of the six commercial *C. porosus* farms are CITES registered that adhere to CITES standards on genetic integrity, sustainable use, and stock traceability. These crocodile farmers formed the Crocodylus Porosus Philippines, Inc. (CPPI), a non-stock, non-profit environmental NGO that innovate crocodile farming industry in the Philippines. Several

other corporate social responsibility (CSR) projects supports crocodile conservation activities in partnership with the Philippine Government, local government units, and indigenous people community.

Commercial utilization of *C. porosus* for the production of valuable skins is the primary product of the CPPI associated farms, secondary is the introduction of crocodile meat as protein source for human. Crocodile farms in the Philippines have started its contribution to the world trade in 2007. With this small developing industry of six (6) registered farms with 2 of which have processing facilities, about 17,000 *C. porosus* skins has been exported from 2007-2015 (Caldwell, 2017) for the leather industry. Frozen and processed meat products are slowly contributing to the local markets, an average of almost a ton of meat per month, or about 80% of annual meat production is consumed locally. A projection of 10,000 *C. porosus* salted raw skins shall be exported by CPPI associated farms in the next 10 years.

The Palawan Wildlife Rescue and Conservation Center of the DENR serves as the backbone of the growing crocodile industry being: 1) the depository of captive crocodiles and thus maintains the genetic viability of crocodile breeders; and, 2) the source of captive-bred *C. porosus* to supply the needs of crocodile farmers.

VI. CONSERVATION CHALLENGES

Stakeholders from different areas of the country identified similar threats to their respective wild populations of crocodiles. The commonality of the stakeholders' concerns suggests that it could benefit from a cohesive and comprehensive conservation program of a national scope. The identified threats were collated and presented below:

HUNTING

Hunting of both species of crocodiles persists to this day for various reasons. The only known breeding pair in Disulap River, Isabela was killed– the male was killed in 2010 and the female in 2012. A 22-caliber slug was retrieved from the carcass of one of the breeding pair. Although neither the reason for the killing nor its perpetrators could be pinned down, the cause was undeniably anthropogenic. A similar mortality was also recorded in Bukidnon with the crocodile skin displayed in front of the army detachment suspected of being responsible for its death.

Reports of hatchling collection have also been noted in Abra and Ligawasan for *C. mindorensis* populations as well as the *C. porosus* populations in other parts of Mindanao and Balabac, Palawan. According to locals, these usually end up as gifts to local politicians and other prominent members of society. Because of their young age, locals believed most of these hatchlings do not survive to adulthood but nothing was ascertained. In Balabac, Palawan, a local resident annually catches hatchlings to sell to a wildlife trader (Manalo, pers. comm.).

Hunting and killing of adult Indo-Pacific crocodiles have also occurred from time to time as retribution for confirmed or suspected human or livestock attacks as in the latest case of the 16-footer crocodile caught in Rio Tuba, Palawan. At times, even juveniles are also collected as trophies for private collections. In a few cases, crocodiles are killed just because they might kill in the future. Recently, some crocodiles – such as the one caught in Berong, Southern Palawan –have been caught for bragging rights or in the hopes that it might be bigger than "Lolong" and thus earn monetary reward. In the Berong incident, the animal had been rumored to be bigger than "Lolong" so people caught it, expecting some form of reward. The animal supposedly died before they could release it back to the wild. Apparently, people in a lot of places around the country still believe that a good crocodile is a dead one.

FISHERIES BY-CATCH

According to the records of PWRCC, at least 40 of the 177 crocodiles acquired by the institution from May 1987 to May 2008 had been trapped by fishing gears. Fish corrals or "baklad" accounted for 14 cases; other gears implicated were various types of nets, shrimp trawls, crab pots, hook and lines, fishpond traps, and beach seines. In more recent years, some crocodile mortalities have been linked to fisheries interaction, primarily illegal fishing practices. The death of hatchlings and juveniles found floating in the Binungan River in Abra in 2000 had been attributed to dynamite fishing (Manalo R. , 2008). Electrofishing has been observed to result in hatchling mortalities in the Sierra Madre region as well as in Agusan Marsh. Nets are still implicated in hatchling and juvenile mortalities but to a much lesser extent. The first evidence of the population in Isabela were actually caught in the net by a local fisher before it was turned over to Plan International, a local NGO operating in the area at the time.

ISSUES ON GENETIC INTEGRITY

Studies (Hinlo R. , 2010; Hinlo, et al., 2014)have shown genetic differentiation between populations in northern Luzon and those located in the central and southern Philippines. The follow-up study by Hinlo et al. (2014) determined that the distinction between the Luzon and Mindanao populations were more a result of geographic drifting rather than selection. Considering the very small Luzon population, many believe that the genetic variation between the *C. mindorensis* populations should be set aside as the benefits of introducing individuals from the larger Visayas-Mindanao pool outweighed its drawbacks. Their study further found some Isabela individuals that clustered with the southern population, speculating that the two populations may not be dissimilar at all. Since the study also stated that they were not able to validate this finding through records or observations, it could not rule out the possibility of error in sampling or recording. As such, questions arose on the validity of the conclusion that the two populations are genetically similar enough to be mixed.

Although they found evidence of increasing relatedness in the Isabela population, the study also noted that samples were taken from hatchlings likely from the same nests. Given that, it would only be logical to find a high degree of relatedness in the samples. Unless, sampling is truly a cross-section of the population, then conclusions drawn from the study results needed to be viewed with caution. With no validation that the samples were truly representative of the whole Isabela population and no direct evidence of genetic bottlenecking, mixing the southern with the northern population might be somewhat precipitate.

More importantly, a total of 92 hybrids were identified in the study by Hinlo (2010) from two different facilities. Three of these were inadvertently released into the wild during the first reintroduction program in 2009 (Hinlo R. , 2010; Tabora, et al., 2012; Hinlo, et al., 2014). Although these hybrids were reportedly retrieved soon after their release, information regarding the recapture was apparently not well disseminated (Adams & Manalo, 2014). Furthermore, the study by Hinlo (2010) stated that only one out of the 92 *C. mindorensis* x *C. porosus* hybrids came from the Davao Crocodile Park (DCP) while the rest were collected from the PWRCC.

The inadvertent introduction of three *C. mindorensis x C. porosus* hybrid sub-adults into the Isabela population in 2009 reflected major flaws in the reintroduction and introduction programs of the country. The current protocol for screening candidates prior to release mainly focused on health issues and did not test for genetic integrity. It operated on the presumption that the source stock (PWRCC) was uncompromised which was apparently wrong. As early as 2008, hybrids had already been detected in the captive *C. mindorensis* population (Louis &

Brenneman, 2008). It was rather unfortunate, though, that the results of further studies identifying the source of these hybrids (Hinlo R. , 2010; Tabora, et al., 2012; Hinlo, et al., 2014) came to light only after the reintroduction event. These studies nevertheless determined that PWRCC as the major stock source has been compromised. In view of this, it might be prudent to view local alternative sources for future restocking of the wild population. Lastly, further genetic studies are necessary at this point to safeguard the success of future reintroduction and introduction efforts.

TRACEABILITY OF WILD AND CAPTIVE CROCODILES

The current monitoring system consists of reports submitted by permit holders to BMB and issuance of transport permits is devolved to regional offices of the DENR with random visits to facilities. This setup appears to be inadequate in achieving traceability of wild and captive populations in the country. One crocodile farmer recalled being issued a transport permit for *C. mindorensis* while moving Indo-Pacific crocodile breeders. As of 2006, the DENR-BMB list of entities keeping crocodiles, which is a consolidation of field reports yet to be validated did not differentiate between the two species (DENR-BMB records). It is difficult to trace individuals if records are not detailed or accurate with no validation system in place. Although there is a studbook for *C. mindorensis* populations outside of the country (Ziegler, Rauhaus, & Karbe, 2013), there is no national equivalent available for either of the two species. Wild stock could easily be mixed with captive ones and harvested or sold with no one the wiser. With the expansion of commercial crocodile farming operations in the country, monitoring both wild and captive populations is bound to get more difficult if changes in the current system are not implemented.

In the 23rd CSG Working Meeting in Lake Charles, Louisiana on 25 May 2014, the issue of stock traceability was raised in relation to Madagascar and Columbia. CITES, as a monitoring body, takes strong issue with the illegal sale of wild stock mixed with captive ones and has placed trade restrictions on Madagascar since 2010 (Webb G. , 2014). With the current issues in the monitoring system for the Philippines, there is a need for caution to avoid landing in the same situation as Madagascar.

More than this, the inability to monitor crocodilian stocks also undermines whatever conservation work has been done in the country. Given that hunting continues to this day and some have become really good at it, restocking of the wild population will never succeed if the extraction process is faster.

In light of the growing commercial trade not strictly limited to the legal crocodile farmers alone, there is a need to implement a system to facilitate traceability of crocodile stocks in captivity.

INFORMATION/RESEARCH GAPS

As previously mentioned, current understanding of wild crocodile populations in the country is limited (van Weerd, et al., 2006) with more research done on the *C. mindorensis* than the *C. porosus*. It is only in the recent years that additional pockets of wild populations of both species have been discovered. Most of these populations have not yet been properly studied owing to various reasons ranging from inaccessibility to logistical issues. Abundance estimates have been attempted in some areas like Isabela (Tarun, Guerrero, Rodriguez, Telan, van Weerd, & van der Ploeg, 2004) and Ligawasan Marsh (Pomares, Pomares, & Escalera, 2008) but their methods differ, precluding comparison of results. Since there is a lack of standardized method in establishing abundance, determining the population abundance for the whole country cannot be achieved as of this time. Knowledge on the current state of crocodile habitats is also limited due to several reasons, including inaccessibility and civil unrest in critical sites such as Ligawasan Marsh (Pomares, Tabora, Sanchez, Pimentel, Pomares, & Escalera, 2008). Although a number of genetic studies (Louis & Brenneman, 2008; Hinlo R. , 2010; Tabora, et al., 2012; Hinlo, et al., 2014) have already been done, a lot more questions need to be answered if only to ensure the integrity of the wild stock. Behavioral studies have been few over the past ten years (van Weerd, et al., 2006; Pomares, Pomares, & Escalera, 2008; Akmad, Pomares, & Tabora, 2010). Nevertheless, Dr. Angelo Alcala (pers. comm.) of the Silliman University-Angelo King Center for Research and Environmental Management (SUAKCREM) strongly believes that current knowledge of crocodilian behavior is already adequate and that future research should be more experimental in nature, focusing on answering specific questions such as quantifying the relationship of crocodiles to fish productivity. Lastly, there is very limited work focused on validating or quantifying success of crocodile conservation works in the country.

THREATS TO HABITAT

Impacts on crocodilian habitats have fragmented wild populations, making its conservation a tricky prospect. Fragmentation of the Sierra Madre population, for example, now requires establishment of eight separate sanctuaries instead of the previously proposed larger one to render its protection doable. The crocodiles move freely between these sanctuaries as shown with telemetry and

FIGURE 2. AGUSAN MARSH SHOWS VARYING DEGREES OF EROSION OF ITS BANKS AND DRYING UP IN SOME PARTS OF ITS EXPANSE.

monitoring studies. But habitat degradation and loss is definitively a serious threat to wild Phil crocs, also in NE Luzon. The same is true with the *C. porosus* population whose habitat has now been limited to smaller areas within the major strongholds: Sierra Madre, Agusan Marsh, Ligawasan Marsh, and Palawan. The Palawan crocodile population is now seen mostly in the southern part of the province and sparsely at that. With the population of both species fragmented as such, conservation efforts need to focus on the establishment of sanctuaries in strategic areas before both the population and their habitat are totally diminished. Comprehensive programs need to be implemented in these critical places which will undoubtedly require more logistics than may be currently available.

HABITAT LOSS OR CONVERSION. Forests and wetland habitats all over the country have been progressively developed for agricultural purposes over the years. Residents have converted surrounding forests and the wetlands in the Sierra Madre area to rice fields and for other agricultural purposes, often employing the slash and burn method. Oil Palm and banana plantations line the banks of Agusan and Ligawasan Marshes. River banks are eroded (Figure 2). As a result, the remaining crocodilian habitats, which have been limited to start with, are compromised. Proximity to these agricultural developments increases the possibility of contamination of the river systems with fertilizers to pesticides. Although water quality tests have supposedly been conducted in these areas, results were not easily obtained. The habitat encroachment also increases the probability of human-crocodile conflict in these areas.

FIGURE 3. (TOP PHOTO) A RELATIVELY NEW TRIBUTARY THAT FORMED IN AGUSAN MARSH, THIS PREVIOUSLY MUDDY AREA HAS NOW BECOME PASSABLE TO BOATS. (BOTTOM PHOTO) ACCUMULATED SILT AND MUD PUSHED BY THE RIVER CURRENT, EFFECTIVELY CREATING A BARRIER WITHIN THE WIDE AREA OF THE MARSH.

POLLUTION. In addition to chemical pollution from surrounding agricultural lands, crocodilian habitats also have to contend with the impacts of other human activities such as mining. Necropsy results of the Indo-Pacific crocodile known as "Lolong" revealed high levels of mercury – a by-product of silver mining –in the liver and kidneys that suggest prolonged exposure to the contaminant (Toledo, Lastica, Aquino, Rebong, & Manalo, 2013). During the Agusan Marsh Wildlife Sanctuary Protected Area Management Board (PAMB) meeting, several representatives of the surrounding municipalities revealed that water quality testing in their respective areas confirmed the presence of mercury in the Marsh. In Sto. Tomas, Davao, the

regional DENR cited an incident where the water system was intentionally poisoned. Although the perpetrator was never caught nor actual motives verified, authorities suspected that the crime had something to do with the recent release of crocodiles in the area.

CLIMATE CHANGE IMPACTS. There is no more denying the reality of climate change especially in the Philippines with its increasingly frequent phenomenal storms. However, response of estuaries and coastal systems to climate change is still predictive at best. Suspected impacts to these habitat types can include (Climate ready estuaries):

- salt-water intrusion into aquifers as the sea rises;
- flooding of coastal wetlands and marshes;
- changes to water availability and quality;
- changes in habitat and species distributions; and
- lowered oxygen levels in wetlands.

Human settlements tend to grow where fresh water is found. Development along the margins of the coastal and estuarine systems, however, impedes the inland migration of the ecosystems. This results in enhanced stress and local impacts. In essence, humans exclude on natural coastal change and response. Thus, although climate change cycle cannot be stopped, its impacts can be mitigated by addressing anthropogenic activities that exacerbate it.

Residents and researchers have observed major topographical changes over time apart from the increasing severity of floods in the Agusan Marsh. Where water used to abound, small muddy mounds of earth have now cropped up. A few land barriers have been eroded, giving way to the formation of new tributaries (Figure 3). It is unclear, however, how much of these changes are due to natural causes, climate change impacts, or anthropogenic reasons and whether these changes are a good or bad thing. What is clear is that the circulation in the Marsh has drastically changed over the past few years. As things stand, this will affect the distribution of crocodiles in the area.

FIGURE 4.FARMERS PUMP WATER FROM AGUSAN MARSH TO IRRIGATE THEIR LANDS.

RESOURCE USE CONFLICT.

The demand on the Philippine environment has increased with the growth of its population. Human settlements naturally gravitate towards aquatic habitats, including those occupied by crocodiles. As a result, conflicts in the use of natural resources have escalated. In Ligawasan Marsh, stakeholders noted the

various mining activities, natural gas exploration, and peat soil dredging has managed to destroy potential and existing habitats for crocodiles. Farmlands surrounding Agusan and Ligawasan Marshes have been blamed for draining the water systems (Figure 4). Illegal harvesting of mangroves in Palawan has been identified as one of the causes for flushing out large crocodiles into human settlements, triggering off human-crocodile conflicts.

HUMAN-CROCODILE CONFLICT. Most humans and crocodiles generally clash as a result of resource use conflicts, at times resulting in death of either or both. These conflicts bring about a negative social reaction, feeding a very human fear of mortality that is not very easy to overcome. Despite logic and a call for rational behavior from some sectors, the public often spiral into a panic, generally unable to accept any human responsibility, and derailing whatever conservation work may have been present on the ground. At the same time, sensitivity and compassion for the bereaved family often constrain crocodile conservationists from pursuing the issue.

Human-crocodile conflicts (HCC) are not as common in the Philippines as they are elsewhere in the world, e.g., Indonesia. The Philippines, when compared to other countries, has one of the lowest numbers of incidences in the world. Compared to Indonesia, which recorded a little less than 400 HCCs from 2000 to 2015, the Philippines only noted 61 cases for a longer time frame (2000-2020), 43 of which were non-fatal encounters. Most of these involved the *C. porosus* as they can grow bigger than 10 feet long. In 2019, 12 HCCs occurred, the highest annual count for these incidents in the country. Most encounters were observed from September to November, coinciding with the tail-end of the breeding and hatching seasons. The apparent increase in incidence underlines the magnitude of resource use conflicts in the country. Three cases involving the *C. mindorensis* were all non-fatal, with two occurring in Isabela and one in Bukidnon.

To balance the protection of human life and property with that of crocodile conservation, there is a need to address HCCs in all its perspectives, taking into consideration the conflict's negative effects on human social, economic or cultural life, and on the conservation of the species or on the environment. The BMB -Technical Bulletin No. 2020-02 or the Protocol on Managing Human-Crocodile Conflicts has been issued to provide guidance in responding to HCCs to reduce or mitigate such conflicts so that both human and crocodilian lives are protected and peaceful co-existence prevails. There are five criteria listed in the Technical Bulletin to properly assess whether the crocodile under discussion should or should not be removed from its habitat. It should be emphasized that the situation should satisfy ALL five criteria before a decision to remove the animal from the wild can be made. Failure to satisfy even just one criterion should prompt for the non-removal from its natural habitat.

Handling crocodiles should only be conducted under strict supervision of a recognized expert. It should always be remembered that the animal should not be subjected to unnecessary stress or trauma as stated in the Animal Welfare Act 2006 as amended by RA No. 10631. Handling and restraining crocodiles will be walking on a thin line. Crocodiles that are one meter or less can be handled by a single person through hand picking with jaws securely closed by one hand. The capture of large individuals should be performed by 2-3 persons using rope with wet/moist cloth to cover the eyes of the animal to reduce stress. If done incorrectly and/or in a prolonged manner, this may compromise the welfare of the animals. Thus, it is best to follow the proper handling and restraint protocols and ensure that release of the animal is immediately and safely executed once all necessary procedures are done and safety of the team has been assured. If done properly, undue stress and trauma may be avoided for both the animal and the team. It is important to note that, whatever action is ultimately taken (removal or non-removal of the animal from the wild human-crocodile conflict response should always culminate in the conduct of information dissemination/awareness campaigns and the identification and implementation of appropriate mitigating measures.

Public perception is a major consideration when dealing with these types of conflicts. In most cases, the community believes that the crocodile initiated the conflict. To suggest otherwise could be viewed insensitive and thus counterproductive to conservation. To let this negative view continue, however, does not also help crocodile conservation. The problem obviously requires a major shift in perception that will require a lot of effort and will take a long time before it becomes evident. Bottom line, nevertheless, is that perceptions can be changed.

VII. REVIEW OF PAST PLANS AND CONSERVATION ACTIONS

CONSERVATION WORK ON THE C. MINDORENSIS

The past two recovery plans for the *C. mindorensis* basically identified similar actions. For purposes of simplifying the discussion, the conservation actions recommended in the last Recovery Plan are discussed here. To achieve the primary goal of re-establishing wild populations of *C. mindorensis* and ensuring its long-term survival throughout its historic range, the National Recovery Plan for 2005-2008 identified conservation strategies which were, in part, achieved over the past decade:

1. ESTABLISH PROTECTED WILD POPULATIONS OF *C. MINDORENSIS*.

Eight crocodile sanctuaries were initially established in Northern Sierra Madre through local initiative: Dunoy Lake, Disulap River, and Dinang Creek. (***Note***: As of 2016, seven more sanctuaries have since been established, making a total of ten.) These protected areas harbor at least one breeding pair of *C. mindorensis* at the time of its establishment. To support restocking of the wild population, the Mabuwaya Foundation under the Crocodile Rehabilitation, Observance, and Conservation Project (CROC) in the Sierra Madre area initiated a head-starting program in 2005 using eight hatchlings that were rescued from an ant-infested nest (East and Southeast Asia Regional Report, 2006). A total of 88 hatchlings were collected until 2008 with a 72% (n=63) survival after a year in captivity. Of these, 32 were released back to the wild and post-release observations showed good progress (van de Ven, et al., 2009)

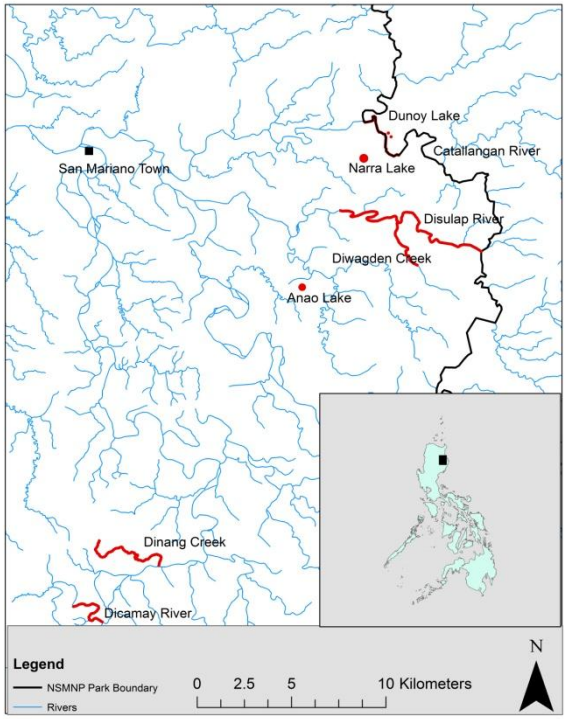

FIGURE 5. MAP SHOWING THE ORIGINAL EIGHT CROCODILE SANCTUARIES ESTABLISHED IN ISABELA. (MAP COURTESY OF MABUWAYA FOUNDATION)

In July of 2009, 50 captive-bred sub-adult Philippine crocodiles from the PWRCC were released into Dicatian Lake, Divilacan, Isabela (Van Weerd, 2010). Genetic studies later revealed, however, that three *C. mindorensis* x *C. porosus* hybrids were inadvertently included in the group released (Hinlo R. , 2010; Tabora, et al., 2012; Naish, 2012). The hybrids were later recaptured and removed from the wild although this activity was not well disseminated to stakeholders (Adams & Manalo, 2014).

Down in Mindanao in 2006, 12 adult *C. mindorensis* were released by CPPI into a 500-sqm enclosed swamp area at the Pag-asa Farm in Kapalong, Davao. The animals survived in the area without human intervention, i.e., no feeding or any physical interaction with people. Monitoring was done remotely using a closed-circuit camera and observations were recorded. Three of these individuals were later recaptured and released in 2009 into a large swamp area in Sto. Tomas, Davao del Norte and these were reported to have moved further down from the area of its release. In 2013, CPPI also

introduced 36 juvenile progenies of the breeders from the semi-controlled setup into the Paghungawan Marsh, Siargao Islands Protected Landscape and Seascape (SIPLAS) as part of their introduction project. The progenies are currently being monitored closely and CPPI has reported two mortalities to date. It should probably be noted that the original breeding stock came from PWRCC and it is not certain whether or not these had been genetically screened prior to release.

2. **PROMOTE AND ENCOURAGE POSITIVE COMMUNITY ATTITUDES TO, AND A GOOD UNDERSTANDING OF CROCODILES IN THE PHILIPPINES.**

Information and awareness campaigns were conducted separately in known habitats of the *C. mindorensis*. Regional offices of the DENR have conducted local information campaigns which included the protection of crocodiles in the wild. Mabuwaya Foundation, a non-governmental organization, focused on enhancing awareness of the local communities and their sense of ownership of the Philippine crocodile population in the Sierra Madre area and their efforts have yielded success (van der Ploeg & van Weerd, Devolution of Natural Resource Management and Crocodile Conservation: The Case of San Mariano, Isabela, 2004; van der Ploeg, Cureg, & van Weerd, Mobilizing public support of in-situ conservation of the Philippine crocodile in the Northern Sierra Madre: "Something to be proud of!", 2008). At the same time, the CPPI conducted information campaigns in the Agusan Marsh and in Siargao with local partners. They are likewise helping the local communities explore the potentials for ecotourism in the respective areas. In Palawan, the PWRCC continues to promote crocodile conservation through its Crocodile Conservation Week, among other activities.

In addition, a first-of-its-kind three-day Filipino dialogue with foreign conservationists dubbed as *FORUM ON CROCODILES IN THE PHILIPPINES* took place in 2007. The event was organized by CPPI and co-hosted by the National Museum of the Philippines, Silliman University, and the Veterinary Office of the City of Manila. Held at the Museum of the Filipino People, Rizal Park, Manila, it featured some 30 papers and a series of posters covering both *C. mindorensis* and *C. porosus*, and a range of associated crocodilian activities within the Philippines. After a decade, the 2nd forum on crocodiles was held in 2019 at the SEAMEO – Southeast Asian Regional Center for the Graduate Study and Research in Agriculture at the University of the Philippines, Los Baños, Laguna. It intends to explore possibilities for furthering crocodile conservation and sustainable management in the country.

Lastly in 2012, the Philippines hosted the 21st biennial working conference of the CSG of the International Union for the Conservation of Nature - Species Survival Commission (IUCN-SSC) at the National Museum of the Filipino People in the city of Manila. CPPI served as Secretariat Chair and main sponsor for the event together with the DENR-BMB, the National Museum of the Philippines (NM), and other corporate partners.

3. **CO-ORDINATE THE MANAGEMENT OF CAPTIVE *C. MINDORENSIS*.**

The responsibility of monitoring captive populations both within and outside of the country lies wholly on the DENR-BMB and has been difficult to accomplish. Only those that were registered with the office could be monitored. These registered stocks are sprinkled all over the country and abroad. As of 2006, the DENR-BMB records reflected 24 individuals and companies in the country with wildlife permits, keeping anywhere from 1-164 crocodiles each. The list does not yet include those that were given permits after 2006, such as the *C. mindorensis* that has been in captivity acquired in 1943 from Binalbagan, Negros Occidental and the specimen in Cabadbaran, Agusan del Norte acquired in 1973 from Jabongga, Surigao del Norte (Manalo, pers. comm.). As of 2013, Philippine crocodiles are kept in seven European zoos, two Australian zoos, and 12 North American zoos. However, given the current monitoring scheme it is not possible to note whether stock have been exchanged or moved because the records are not updated nor are the details complete. The DENR-BMB mainly relies on reports submitted by the legalized entities with no way of confirming any suspicions of anomalies. An effective system of monitoring and validation of reports has yet to be established.

4. **DETERMINE THE ECOLOGY OF *C. MINDORENSIS*.**

Investigating rumored populations of the Philippine crocodile yielded new insights into the ecology of the animal. Recently discovered pockets of wild populations indicated that the species survived higher altitudes than previously believed (Manalo, Pomares, Mercado, Belo, Saljay, & Tupas, 2012).This led conservationists to expand their investigation area to include sites not considered in past surveys for wild populations. A study by Pearcy (2011) on the implications shape on niche preferences established the difference in habitat choice between the Philippine and the Indo-Pacific crocodiles. Her findings and that of Manalo et al. (Manalo, Pomares, Mercado, Belo, Saljay, & Tupas, 2012) would suggest that the probability of interbreeding in the wild would very low indeed. Thus the probability of hybrids occurring in the wild is deemed low and would likely have been produced in captive conditions.

5. **CLARIFY THE POPULATION GENETICS OF *C. MINDORENSIS*.**

Hinlo(2010),building up from a previously unfinished study, concluded that no inbreeding had yet occurred in the wild population. However, she likewise observed an increasing relatedness in the samples that might lead to inbreeding in the future. Hinlo also noted that there was genetic distinction between the Luzon and the Visayas-Mindanao populations but concluded this to be a result of geographic shifting rather than evolution. Genetic profiling also revealed the presence of *C. mindorensis* x *C. porosus* hybrids in the current captive stocks of PWRCC and DCP (Louis & Brenneman, 2008; Hinlo R. , 2010; Tabora, et al., 2012; Hinlo, et al., 2014).

6. **INTEGRATE *C. MINDORENSIS* CONSERVATION WITH THE CONSERVATION OF FRESHWATER WETLANDS AND OTHER THREATENED FRESHWATER WILDLIFE IN THE PHILIPPINES.**

Only three known crocodile habitats are included in the National Wetlands Action Plan. In the regional offices of DENR, particularly those in the Mindanao area, information campaigns to further crocodile conservation have been conducted as part of their other regular programs. In Isabela, the *C. mindorensis* has been used as the flagship species for their wetlands conservation projects. It is unfortunate, however, that the species was not fully considered during the deliberation on and prioritization of Key Biodiversity Areas (KBA) in the country. Nevertheless, critical habitats of the species did manage to be included in the list.

7. **BUILD PARTNERSHIPS TO SUPPORT CONSERVATION OF *C. MINDORENSIS*.**

To augment conservation efforts of the PWRCC, the DENR-BMB had also collaborated with other organizations and institutions in specific activities such as the joint publication of the second edition of the National Recovery Plan for the Philippine Crocodile (2005-2008) with the Melbourne Zoo and this current Recovery Plan (2021-2028) with the CPPI. It also conducted surveys and information campaigns in partnership with organizations such as the Mabuwaya Foundation and CPPI (East and Southeast Asia Regional Report, 2006). DENR-BMB bound itself through MOAs with these partner organizations in the pursuit of crocodile conservation in the country.

8. **ESTABLISH FUNDING SOURCES TO IMPLEMENT CONSERVATION ACTIONS FOR *C. MINDORENSIS*.**

   The Philippine Government annually allots about nine million pesos from the national treasury for the operations of the PWRCC through the DENR-BMB budget since the withdrawal of financial support from Japan. PWRCC is the special project of the DENR-BMB that is mandated to promote crocodile conservation in the country. In addition to this, a MOA was signed between the DENR and the Danish Crocodile Zoo (DCZ), allowing for the transfer of crocodiles to the latter's facilities to initiate a captive population in European zoos and generate funds to support in situ actions (East and Southeast Asia Regional Report, 2006). In the private sector, CPPI member farmers fund small projects such as surveys and information campaigns conducted by their staff and partners which include the DENR-BMB. Other zoos such as the Gladys Porter Zoo in the US and Melbourne Zoo in Australia also collect funds to finance local conservation efforts by Mabuwaya Foundation in Isabela.

9. **ENSURE THAT ALL RELEVANT PHILIPPINE GOVERNMENT POLICIES SUPPORT THE CONSERVATION OF *C. MINDORENSIS*.**

   In 2006, MFI facilitated the preparation of wetland conservation plans, drafting of local legislation, and setting up of local environmental law enforcement groups in 20 villages in Northeastern Luzon (East and Southeast Asia Regional Report, 2006). On the national level, the Philippine government continued to enforce Republic Act 9147, more popularly known as the Wildlife Act, all over the country. In connection with this, DENR-BMB deputized a number of locals in critical habitats as wildlife enforcement officers (WEOs) to help reduce illegal wildlife trade and other crimes to the environment. In Palawan, the Palawan Council for Sustainable Development Staff (PCSDS) ensured that the two species of crocodiles are included in their amended list of threatened species in the province. It recently drafted a set of criteria to help regulate the removal of crocodiles and is preparing to push for the establishment of a crocodile sanctuary/protected crocodile habitat in the province.

CONSERVATION WORK ON THE INDO-PACIFIC CROCODILE.

There has been minimal conservation work done on the Indo-Pacific crocodile over the past decade. The CPPI continues to conduct information campaigns and research activities in Palawan, the Visayas, and Mindanao regions in partnership with local universities such as the

University of Southern Mindanao. One such activity is geared towards establishing a population abundance estimate for wild *C. porosus* in Palawan, Sulu Archipelago, Zamboanga Peninsula, central Mindanao and Agusan Marsh. Other actions mainly involved removal of adults from the wild that were implicated in human-crocodile conflicts. These were carried out by the PWRCC upon the request of the Local Government Units (LGUs).

VIII. CONSERVATION PARTNERS

Conservation work in general is challenging in the Philippines but crocodile conservation is even more so given the negative public image of the animal. Altering this negative image alone is already a monumental task – what more to implement a cohesive and comprehensive conservation plan. As such, the DENR-BMB, which is the national agency tasked to undertake this daunting work, needs to actively source out support from other offices and institutions. It has to identify appropriate agencies and align the needed crocodile conservation work with the latter's focus or concerns.

LOCAL ACADEME

For a long time, the SU has been the only local school involved in crocodile conservation. It is good to note that, in recent years, more local universities are getting involved in localities with critical crocodilian habitats. The Isabela State University (ISU) has not only done research, it also provides assistance to the Mabuwaya Foundation in the production of information materials and the conduct of its educational campaigns. They also established the Philippine Crocodile Conservation Center in 2022 in San Mariano which will combine a breeding and headstart program, a visitors center and a research facility on crocodiles in northern Philippines. The University of Southern Mindanao (USM) continues to conduct research in areas that would be hard to reach by non-locals. Local academic institutions in proximity to crocodile habitats have the advantage of familiarity and the kind of access to the sites only afforded to locals. This kind of advantage needs to be played up more. Other local universities need to be involved as well and young crocodile researchers need to be cultivated.

LOCAL GOVERNMENT UNITS

Social acceptance of crocodiles in the country is a major handicap for conservation work. As gleaned from past experiences, the LGU can either help overcome it or add to it. As a partner, they have the authority to pass and execute laws and the funds to make things happen. At the same time, the LGU would like to see development take place in their jurisdiction. It is thus crucial to be able to translate to them the ecological and the financial benefits of having wild crocodiles within their area of authority. As such, a major component of information campaigns

in the future needs to target LGUs specifically, especially those with crocodile populations in their area. If successful, they can spell the difference between success and failure of crocodilian conservation.

With the increased of human-crocodile incidents in southern Palawan, a PCSD Resolution No. 20-710, has been passed approving the ten-year Conservation Strategies for Indo-Pacific Crocodiles in Balabac, Palawan in partnership with the USAID – Protect Wildlife Project and the Local Government of Balabac. The municipality of Rizal and Quezon in Palawan has taken the initiative of developing a critical habitat for *C. porosus* in Barangays Canipaan and Sowangan respectively. The contiguous coastal mangroves of Del Carmen in Siargao Island are one of the locally declared *C. porosus* sanctuary in the Philippines. In the northeastern Luzon, the municipalities of San Mariano, Maconacon, Palanan and Divilacan, Isabela Province has enacted municipal ordinances that protect Philippine crocodiles as flagship species and established Philippine crocodile sanctuaries protecting Dunoy Lake, Disulap River, Dinang Creek, Po River, Dibukarot Creek and Dicatian Lake respectively. Crocodile sanctuaries are believed and perceived by the local communities as fish sanctuaries, providing healthy aquatic ecosystems productive of fish and other animals serving as food for humans.

NATIONAL AGENCIES

The balance between crocodile conservation and development can be achieved with the support of other national agencies. The Department of Tourism (DOT), for one, can help develop and endorse ecotourism ventures or programs in crocodile sanctuaries, possibly boosting development and social acceptance in these crucial areas. It can also promote the crocodile conservation message to a broader audience using a different perspective.

The PCSD has a jurisdictional mandate on the implementation of the Wildlife Resources Conservation and Protection Act of 2001in the province of Palawan. An Administrative Order No. 11 S.2006 promulgating the rules and regulations governing the conservation and protection of mangrove areas is likewise administered under the SEP law by the council. The PCSDS has created an Environment and Natural Resources Committee sub-committee on crocodile conservation and management being chaired by the DENR – Palawan Wildlife Rescue and Conservation Center that can complement with the National Committee for Crocodile Conservation (NCCC) in implementing conservation and management work in the said province.

Other national agencies such as the Department of Trade and Industry (DTI) and the Department of Agriculture (DA)also needs to be involved, especially in dealing with the captive crocodile populations, to maximize the impacts of specific conservation activities.

NON-GOVERNMENT ORGANIZATIONS

The CPPI is a relatively new organization but it has already made its mark in crocodile conservation. Although limited in logistics, CPPI conducts conservation work in crucial habitats such as Abra, Palawan, the Visayas, and Mindanao. It is working closely with the LGU of Siargao Island to develop an ecotourism program focusing on the introduced *C. mindorensis* in the island. It has shown its strength in research and conservation work and has now expanded to cover information campaigns and networking locally and internationally to bring about the advancement of crocodile conservation. Its grassroots approach has enticed many stakeholders to take pride and ownership their wild population. These are only a couple of NGOs that operate in critical crocodilian habitats in the country. Other NGOs in the same area can be tapped and their areas of expertise utilized to gain more success in conservation. This highly regulated industry can be a model for commercial and conservation partnership.

While the Mabuwaya Foundation is not as wide in its coverage, this NGO has likewise made significant headway in protecting the Isabela population of *C. mindorensis*. Mabuwaya Foundation (MFI) is a local NGO registered in Securities and Exchange Commission with the goal to conserve and protect the Philippine crocodile and its habitat. MFI is involved in research, Communication, Education and Public Awareness (CEPA) campaigns, restoration of crocodile habitats through reforestation and agroforestry, assisting communities on livelihood, capacity building to local communities, establishments Local Conservation Areas such as fish and crocodile sanctuaries and head-starting program.

Mabuwaya Foundation started protecting less than 20 crocodiles in the wild in 2001 and have recorded 13 crocodile killings in 1998. With intensive communication campaigns and involving local communities in its endeavor, the Philippine crocodile has now increased into 100 individuals in the wild and crocodile killings dropped from 13 in 1998 to 1 in 2015 with ten Philippine crocodile sanctuaries in 7 crocodile localities (Balbas, pers. comm.).

PRIVATE SECTOR

The potential role of the private sector as funding and stock source has not been fully realized. Private zoos such as the Gladys Porter and the Melbourne Zoos have generated financial support for *C. mindorensis* conservation activities in the country. The Manila Zoo and Avilon Zoo and other private collections in the Philippines have old *C. mindorensis* stock which have not yet been genetically profiled but may possibly present a potentially uncompromised stock source for reintroduction programs until the problem with the PWRCC stock has been corrected. Private companies (other than commercial crocodile farmers) with their Corporate Social Responsibility programs have yet to be convinced to support the conservation work on crocodiles in the country.

IX. RECENT UPDATES

Since the conceptualization of this plan, DENR and their partners have conducted activities geared towards the achievement of the targets identified within CCAPP.

- Initial surveys results have led stakeholders to remove Malitubog/Maridagao, Tributary/Pulangi River, Maguindanao from the list for exploratory surveys and to replace it with Ebpanan Marsh which appears to be more promising as a crocodile conservation site. It also led to the addition of Seven Lakes in the Municipality of Lake Sebu (Region 12), San Guillermo, Isabela (Region 2), Lanao del Sur (BARMM), and Tineg, Abra.
- Exploratory surveys in the following areas have been conducted and the presence of crocodile populations were confirmed, leading the stakeholders to elevate these sites to the next step in baselining which required more comprehensive surveys:
    - Cuyapon, North Cotabato
    - Pagatban River, Negros Oriental
    - Surigao del Sur
    - Siargao
    - Tawi-tawi
    - Moleta River, Pulangui, Bukidnon
    - Mlang, North Cotabato
- Successive comprehensive surveys in Bugsuk Island, Balabac Island, and Jones, Isabela revealed these areas had the strong potential for Critical Habitat declaration. These areas are being monitored while steps have been taken towards establishing them as Critical Habitats.
- The NCCC tasked the TWG to draft a set of protocols for proper handling of Human-Crocodile Conflict (HCC) incidences. The TWG, based on their knowledge of the biology, ecology, and physiology of the animal, identified 5 criteria to be considered when deciding on the action to be taken in HCC incidences. It also created a decision tree to help managers come to a more appropriate response to such incidences. The protocol was then disseminated for consultation. Afterwards in 2020, DENR-BMB came out with Technical Bulletin 2020-02: Protocol for Managing Human Crocodile Conflict (HCC) in the Philippines.
- The said Technical Bulletin was the basis for designing the training module targeting Provincial Wildlife Quick Response Teams (PWQRTs) in provinces with known crocodile populations. Initial training of PWQRTs was conducted in October 2020 via zoom. Follow up trainings have been scheduled for August and September 2022 in CARAGA and Region 9.

X. VISION, GOALS, TARGETS AND STRATEGIES

Reflecting on the urgency and similarity of issues and threats in different parts of the country, crocodile conservation is sorely in need of an adaptive, comprehensive and cohesive program to address these effectively. As a result of consultations with the stakeholders, a vision for the long term conservation of crocodiles was agreed upon. Strategies and corresponding actions were proposed in order to achieve the vision of the plan. Three strategic goals with four major targets were identified which needed to be achieved to address the challenges in crocodile conservation.

Vision

"*Society in harmony with nature, where crocodiles and their habitats contribute to ecological integrity and economic sustainability in the Philippines*"

Goals

- Promote actions to ensure the protection of crocodiles and their habitats in the mosaic of human land use thereby contributing to ecological integrity;

- Enhance positive perception about crocodiles where communities recognize their intrinsic and cultural values as part of global biodiversity; and

- Properly manage both *in-situ* and *ex-situ* populations of crocodiles to ensure their viability and sustainable use.

The corresponding targets, strategies and specific actions are outlined in the table below.

GOAL 1. (*Conservation Research*) Promote actions to ensure the protection of crocodiles and their habitats in the mosaic of human land use thereby contributing to ecological integrity

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
By 2032, crocodile sanctuaries are established in strategic areas in the country.	Conduct surveys on existing and potential habitats for sanctuary identification	**(2023-2024)** Baselining Step 1: Exploratory surveys in: 1. Rizal, Cagayan 2. Naujan and other areas in Mindoro Oriental 3. Mindoro Occidental 4. Edpanan Marsh, No Cotabato 5. Panguil Bay, Misamis Occidental & Lanao Norte 6. Dalupiri Island, Aparri 7. Dinagat Island, Caraga 8. San Guillermo, Isabela 9. 7 lakes , Municipality of Lake Sebu 10. Lanao del Sur 11. Tineg, Abra	Baselining: 11 sites surveyed for confirmation	DENR: BMB, PWRCC, DENR Regional Offices PCSDS ARMM LGU Academe: USM, SU, ISU, WPU, PSU Mabuwaya Foundation CPPI Avilon Zoo National Museum	900	750									Sites that have undergone exploratory surveys and found with viable population and potential for CH/PA declaration will continue onto comprehensive survey; sites without viable population after a maximum of 2 exploratory surveys per sight shall end survey effort
		(2023-2026) Baselining Step 2: Conduct comprehensive surveys: 1. Canipaan, Rizal, Palawan 2. Cuyapon, North Cotabato 3. Pagatban River, Negros Oriental 4. Surigao del Sur 5. Siargao 6. Tawi-tawi 7. Moleta River, Pulangui, Bukidnon 8. Mlang, North Cotabato	Baselining: Population density in proposed and existing sanctuaries established, and survey reports submitted to BMB		1000	2250	1250	250							Sites that have undergone comprehensive survey and elevated for CH/PA declaration will continue for monitoring activities
		(2023-2032) Step 3: Monitoring populations 1. Bugsuk, Palawan	Monitoring reports		600	1400	3200	4200	4400	4400	4400	4400	4400	4400	ideal: 4 monitoring surveys/yr @50k per trip

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
		2. Balabac Island 3. Jones, Isabela													
	Facilitate the establishment and management of locally conserved areas (LCA)/ critical habitats (CH) /protected areas (PA) and/or ICCA primarily for the protection and conservation of crocodiles	**(2023-2027)**Designate sites for LCA/CH/PA/ICCA establishment: -assessment -consultations - mapping	LCAs/CHs/PAs/ICCAs declared for crocodile conservation	DENR-BMB-PWRCC DENR Regional offices LGU PCSDS Academe Mabuwaya Foundation CPPI Avilon Zoo National Museum	600		300	300	600						1 Palawan-Victoria Anepaan 2023-2024 1 Abra 2025-2026 2 R10 2026-2027 2027-2028 1 R2 2023-2024 1 CARAGA 2027-2028
		(2023-2028) Prepare legal documents for establishment		DENR-BMB PCSDS											
		(2023-2028) Approve and disseminate proposed declaration -demarcation		DENR-BMB PCSDS											
		(2025-2029) Develop Critical Habitat management plan per site	6 Management Plans developed	DENR regional office stakeholders PCSDS			1000		500	500	1000				
	Mainstreaming establishment of crocodile sanctuaries into critical habitat system (Wildlife Act)	Advocate for the inclusion of crocodile sanctuaries in core zones of suitable CH Zoning and Management Plans	Crocodile conservation actions outlined in management plans	DENR-BMB-PWRCC DENR Regional offices LGU PCSDS Academe Mabuwaya Foundation CPPI Avilon Zoo National Museum											

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
	Carry out DNA mapping	**(2023)** Prepare protocol for DNA mapping	Established population genetics and nomenclature	DENR-BMB USM UP Diliman (UPD) Other possible partners	500										workshop costs
		(2024) Centralize assessments	Official DNA bank			100									infrastructure support for DNA bank @50,000 per non-frost freezer unit
		(2023) DNA marking and screening, microchip embedding	2,050 crocodiles screened 500 *Crocodylus mindorensis* (captive & wild) (no.) 50 *Crocodylus porosus* (wild) (no.) 1,500 *Crocodylus porosus* captive (no.)		700000										Prioritize Cp captive population in PWRCC for 2023; include PhilZoos population for 2024
	Establish a release protocol for Philippine crocodiles	**(2024)**Conduct the following: 1. Integrated Collection Assessment & Planning Workshop for the Conservation Planning Specialist Group (CPSG) 2. Reintroduction workshop (Re-introduction Specialist Group RSG)	Manual on release protocol for Philippine crocodile drafted DAO adopting Manual of Release Protocol drafted	CPPI PWRCC USM Mabuwaya Foundation Avilon Zoo		500									
		(2025) Conduct public consultations on drafted release protocol	public consultation report/ documentation												

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
		(2025-2028) Identified stock ready for release	250 *C. mindorensis* crocodiles released												target release sites: declared LCA

GOAL 2. (*Community Education and Public Awareness*) Enhance positive perception about crocodiles where communities recognize their intrinsic and cultural values as part of global biodiversity

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
By 2032, increased social understanding and acceptance of crocodiles living in their natural habitats.	Design and implement Communication Education and Public Awareness (CEPA) program employing multiple media	**(2023)** Conduct needs assessment for CEPA re crocodile conservation	Needs Assessment Report and CEPA Plan drafted and submitted for approval	DENR-BMB PWRCC DENR Regional Offices LGU PCSDS Academe Mabuwaya Foundation CPPI Avilon Zoo, and National Museum	**500**										CEPA plan to include promotion of release protocol
		(2024-2030) Conduct capability building training to enhance CEPA skills	Training report; awareness assessment reports submitted			**1400**			**1400**			**1400**			
		(2023 onwards) Produce and disseminate CEPA materials	CEPA materials produced			**200**	**200**	**200**	**200**	**200**	**200**	**200**			
		(2024-2025) Develop materials for integration of crocodile conservation in DepEd programs (e.g. textbooks, educational materials, etc.)	consultant/writer engaged Memo circular issued			**100**	**300**								
		(2023 onwards) Conduct Biennial Croc Forum	Forum resolutions crafted Proceedings of the Crocodile Forum circulated		**1000**		**1000**		**1000**		**1000**				

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
	Promote social acceptance of crocodile sanctuaries in the country	**(2024-2028)**Conduct livelihood needs assessment in or near prioritized crocodile habitats	Needs assessment report and recommendations drafted and submitted to BMB	DENR-BMB PCSDS DENR –Regional Offices CPPI MFI Academe		**600**		**300**	**300**	**600**					
		(2023-2032) Initiate collaborative nest protection scheme and incentive system	Increase in the number of wild nests protected (no.)	DENR-BMB PCSDS DENR –Regional Offices CPPI MFI Academe	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	500	
	Investigate livelihood options linked to crocodiles in and near crocodile habitats and promote where applicable	**(2024-2029)** Develop community-based Sustainable Ecotourism, Livelihood Programs towards conservation of crocodiles	Initiated livelihood programs sustained (no.)	DENR-BMB PCSDS DENR –Regional Offices CPPI MFI Academe		**600**	**600**		**300**	**300**	**600**				Anchor onto Biodiversity Friendly Enterprise
		(2023 onwards) Conduct researches on natural history in Ligawasan Marsh tributaries/lakes, artificial breeding, immunological effects of crocodile blood plasma	Research papers published												
	Establish databank for info sharing /Collate results of surveys	**(2023 onwards)** Collate list of papers on the two species of crocodiles in the Philippines(published paper) and upload in the to-be-developed croc website (linked to the BMB website)	Crocodile databank linked up to BMB platform Bibliography of crocodile papers in the Philippines available online regularly updated	DENR-BMB DENR –Regional Offices											

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
By 2032, protective mechanisms for crocodiles and their habitats enhanced.	Implement protocols for responding to reports of human-crocodile conflicts	**(2023 onwards)**Implement the protocols and measures for managing human-crocodile conflicts based on BMB Technical Bulletin No. 2020-02	All HCC incidences are reported and responded to prescribed protocols HCC incidences with prescribed protocols reported and responded (no.)	DENR-BMB DENR –Regional Offices PCSD CPPI MFI LGUs	100	100	100	100	100	100	100	100			Protocols for responding to reports of human-crocodile conflicts established
		Create functioning PWQRTs to respond to HCCs	established and functional PWQRTs PWQRTs established and functional (no.)		510					510					
		(2023-2025) Conduct trainings on managing Human-Crocodile-Conflict	PWQRT knowledge and skills improved		1000	1000	1000								2023: 4B; BARMM; 2024: CAR, R2; 2025: R10, R12
	Encourage participation of local stakeholders in the protection of wild crocodiles	**(2023 onwards)**Develop local conservation programs that engage stakeholders in its implementation	Management Plans adopted and implemented	DENR – Regional Offices PCSD LGUs		150	150	150	150	150	150	150	150	150	
		(2023 onwards) Forge agreements and pass resolutions towards the protection of wild crocodiles and its habitat (in compliance to Wildlife Act)	Effective and sustained conservation programs compliant to R.A. 9147 implemented	DENR –Regional Offices PCSD LGUs											
	Mainstream crocodile conservation strategies and programs into existing local and national agenda	**(2025-2029)**Integrate crocodile sanctuaries into City/Municipal Land Use Plan	Established crocodile sanctuaries included in CLWUP Crocodile sanctuaries included in CLWUP established	DENR Regional Office LGUs			100		50	50	100				

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
		(2023) Establish local conservation centers for Philippine Crocodiles	Conservation centers operational with permits in compliance to City/Municipal Ordinance; RA 10631 and RA 9147 (no.)	LGU MFI USM CPPI DENR Regional Offices DENR-BMB DA-BAI											

GOAL 3. (*Conservation Management and Monitoring*) Properly manage both *in-situ* and *ex-situ* populations of crocodiles to ensure their viability and sustainable use

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
By 2032, wild and captive populations of crocodiles in the country effectively monitored and managed.	Mobilize the National Committee for Crocodile Conservation	**(2023-2032)** Oversee/lead in the implementation of the CCAPP	NCCC annual report submitted to the Secretary	National Committee on Crocodile Conservation and its TWG	**200**	**200**	**250**	**250**	**300**	**300**	**350**	**350**			DAO Special order 2015-1010 NCCC; TWG = BMB SO 2016-223
		Endeavor to access financial support and other resources for the implementation of CCAPP and provide recommendations on their effective use	CCAPP budget requirements allocated	DENR-BMB-PWRCC DENR regional offices LGU PCSDS Academe Mabuwaya Foundation CPPI											

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
				Avilon Zoo National Museum											
	Strengthen partnerships and networks, taking advantage of existing management bodies; capacity-building of local partners	**(2023-2032)** Conduct trainings and capability enhancement of local partners and stakeholders; include paralegal/enforcement and deputization	Training module incorporating crocodile conservation drafted and implemented ·Training report/s prepared (no.) ·Local action plans prepared and implemented (no.)	ELEPS DENR-BMB DENR Regional Office PWRCC PCSDS MFI		**1000**		**1000**		**1000**		**1000**		1000	
		(2024-2027) Draft MOA between DENR and local stakeholders	MOA for empowering and retooling stakeholders drafted and forged/signed	DENR Regional Office NCCC NGOs Academe AFP DILG (BFP & LGUs)		**400**			**400**						

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
	Establish and maintain national stud books (*C. mindorensis* and *C. porosus*) to achieve traceability of stock	**(2023)**Compel all wildlife permit holders to submit to DNA profiling of their stock 1. inventory of registered & unregistered wildlife holders 2. orientation workshop 3. DNA profiling of breeder stock	·Inventory list of registered & unregistered wildlife holders (no.) ·workshop documentation (no.) ·DNA results compiled (no.)	DENR		**900**									2023: list from regions of wildlife permit holders 2024 Workshops: 1 Luzon; 1 Visayas; 1 Mindanao DNA costing on wildlife holders
		(2023) Conduct training workshop on the development and maintenance of the studbook for crocodiles	Stud book developed and maintained	NCCC NCCC-TWG SEAZA-SMC PhilZoos											Budget for purchase of program c/o Noel & Rainier
		(2023) Develop a species management program for crocodiles													Budget for purchase of program c/o Noel & Rainier
		(2023-onwards) Develop and maintain studbook			**200**	**200**	**250**	**250**	**300**	**300**	**350**	**350**			Budget for purchase of program c/o Noel & Rainier
	Establish and implement a mechanism by which captive and wild populations may be monitored and managed	**(2023-2032)**Conduct monitoring of identified conservation breeding centers 1. creation of monitoring team 2. adaptation of monitoring template for auditing	NCCC monitoring team organized (BMB SO prepared/approved) ·conservation breeding centers in the Philippines following ethical standards operationalized	DENR-BMB DENR Regional Offices DA-BAI PCSD	100	100	100	100	100	100	100	100	100	100	Breeding Centers to monitor: PWRCC Silliman University JKM USM MFI Special monitoring to consider croc concerns of CCAPP beyond regular auditing requirements
		(2023-2032) Strictly enforce marking system in captive population (i.e., tail cutting or microchips)	All captive individuals tagged following national standards (no.)	CPPI PWRCC MFI Avilon Zoo											Refer to CITES resolution blablabla for terminology

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
		(2023) Streamline CITES permitting process for the control of trade in tourist, personal, and household effects in reference with the CITES Resolution Conf. 13.7 (Rev. CoP17)	DENR policy /guidelines for the control of trade in souvenir products prepared and implemented	DENR-BMB CPPI											Follow up on pilot study results
		(2023-2032) Monitor illegal wildlife activities involving crocodile (i.e., poaching, hunting incidents and unauthorized sale of live crocodiles and derivatives) within farms, zoological parks, museums, and private collections	policy on local trade between institutions with live crocodiles reviewed and implemented	DENR-BMB DA-BAI DENR regional offices PCSDS											
			Patrolling in CH/sanctuaries increased (no.)												
			Sales of crocodiles and derivatives monitored												
		(2024) Conduct workshop to establish a standardized crocodile population monitoring protocol (survey methods, equipment and supplies, data sheet, basic information needed, seasonality, information guide)	standardized monitoring protocol developed and implemented	DENR-BMB		200									
	Encourage and mobilize partnerships in crocodilian conservation	**(2023-2024)** Develop standards for ex situ management of crocodiles in the Philippines	crocodile ex situ management standards developed		150	300									

Target	Strategy	Specific Action	Indicator	Responsible Agency	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Remarks
	Conduct management effectiveness monitoring of crocodile conservation work regularly	Conduct biennial project evaluations	Biennial project evaluation report submitted to the BMB Director/DENR Secretary	DENR-BMB		300		300		300		300		300	

XI. MONITORING AND UPDATING OF THE PLAN

As in any other plan, it would be prudent that the actions identified should be monitored and evaluated for its effectiveness, as well as regularly updated to address emerging issues and challenges. In the event of an increase of wild crocodile population within the duration of the plan, a concept of conservation through sustainable use (CSU) will be introduced for the *C. porosus* and more sanctuary establishment for *C. mindorensis* can be consideredin the review of the plan. The BMB through the NCCC shall monitor and evaluate the implementation of the activities in the CMPCP. The CMPCP shall be reviewed and updated every five (5) years or as necessary.

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