

# People and Crocodiles Sharing One Environment: An Analysis of Local Human-Crocodile Conflict Management Strategies in the Philippines

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## Abstract

Crocodile conservation in the Philippines has always been challenging especially when involving human-crocodile conflicts (HCC). This study determined the leading cause of conflicts, local practices, and management strategies that encourage coexistence. Verification of reported conflicts from 2000-2015 based on literature reviews involved correspondence, face-to-face key informant interviews and focused group discussions. Community visits in 2015-2016 documented the local practices and management strategies addressing such conflicts. Results showed that human pressure in known crocodile habitats triggered the consequential events of 26 HCC cases that mostly occurred in the southern Philippines. The human need to access livelihoods has resulted in encroachment on crocodile habitat. In light of the growing human population, this competition for space is inevitable yet not all encounters end in conflicts. In some sites, mutual coexistence with crocodiles was possible by setting-up of a makeshift bridge or making use of cultural veneration and indigenous knowledge of crocodile behavior. Other management efforts, such as the removal of potential conflict animals, display of warning signs, advocacy campaign, and provision of alternative livelihood, have been the common responses of the government. The success or failure of these efforts can be inferred from the level of local knowledge and social acceptance of local communities as well as the number of crocodile conflicts in the locality.

**Keywords:** Human-Crocodile conflict; Coexistence; Crocodiles, Conservation

## Introduction

Crocodile conservation in the Philippines has been very challenging especially when there are reports of conflicts with humans. The Philippine population of Indo-pacific Crocodile (*Crocodylus porosus*, Schneider 1901) and the Philippine Crocodile (*C. mindorensis*, Schmidt 1935) are protected under the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species [1] and the Appendix 1 of the Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES). However, both species are considered vermin and constantly viewed negatively by the majority of Filipinos [2,3]. The more common and widely distributed *C. porosus* is found in almost all recognizable coastal marine and major inland freshwater habitats in the Philippines [4].

Humans have hunted crocodiles for years in the past due to the economic value of their skin and meat and this is the major reason for the declining population [5,6]. As early as 1980s, the existence of crocodiles in major bio-geographic regions in the Philippines, such as Luzon, Negros-Panay, Mindanao, and Palawan, has been jeopardized. Their presence in small numbers in some wetland ecosystems generally in Mindanao and Palawan are still commonly considered a threat for the livelihood of humans. The continued conversions of its habitats for agriculture and aquaculture projects have also severely reduced the wild population [7] and their chances of survival in the wild [8]. Rapid decline of quality habitats for crocodiles have limited their avoidance options. On the other hand, the rich aquatic resources in mangrove areas, estuaries, and rivers are excellent food source for both humans and crocodiles, making this livelihood option a recipe for potential conflict.

The earliest recorded reports on crocodile attacks in the Philippines were from 1904 to 1928 from the Sulu Archipelago [9]. Rampant hunting was then documented in 1950s, which continued until 1970s. This gradually waned as a result of greatly reduced wild population [10]. Data on crocodile distribution and status became available in 1987 upon the establishment of nucleus captive population of Crocodile

Farming Institute (CFI). CFI acquisition records showed that 141 heads of *Crocodylus porosus* were caught intentionally and accidentally from the wild in 52 rivers of Palawan for 5 years. In Mindanao, 115 heads have been acquired mostly from private collectors which allegedly came from Ligawasan Marsh and adjoining rivers. The succeeding report of conflicts with human was recorded 23 years after CFI ceased their acquisition in 1992.

The challenge for natural resource management agencies in balancing the crocodile conservation with the safety and well-being of people is associated with Human-Crocodile Conflict (HCC) issues [11]. HCC is considered by the IUCN-Crocodile Specialist Group to include “any interaction which results in negative effects on human social, economic or cultural life, on conservation of the species or on the environment”. In the Philippines, most conflicts involved the Indo-pacific or commonly known as Saltwater Crocodile. People living in rural fishing communities often report of crocodile attacks on humans’ and domestic livestock and causing damage to fishing gears. Despite the widely known contribution of crocodiles to increasing fishery productivity, the general instinct of most Filipinos is to eliminate crocodiles from their natural habitat rather than attempt to coexist.

To date, management authorities in the country commonly address conflicts by removing the so-called nuisance crocodile and by public awareness. In Palawan and Mindanao, however, major fishing communities continue to live in close proximity to *C.porosus* populations by apparently implementing mitigating measures through their cultural veneration, fishing practices, and indigenous knowledge. These pragmatic strategies are possible sources of information in resolving HCC. In this study, we investigate the relevance of HCC incidents to the livelihood activities of the communities. The need for an informed community on the status of crocodile conflicts and common strategies in addressing HCC is imperative for crocodile conservation. Thereby, documenting this local knowledge yet potential solution is appropriate in designing the only HCC policy resolutions for the Philippines.

## Methods

All available literature from published scientific articles, grey literature, and applied accounts on crocodile attacks in the Philippines were collated and reviewed. The HCC Database of the *Crocodylus Porosus* Philippines, Inc. (CPPI) reported in the country as of December 2016 was consolidated with the extracted CrocBite Database Records of crocodile attacks from 2000-2015 for confirmation. This outcome of the crocodile attacks together with the associated human activities at time of incidents was included in the record. Verification of each incident report through face-to-face key informant interviews and focused group discussions was in southern Palawan and northeastern Mindanao with extant crocodile populations in 2015-2016. Correspondence verification interviews were conducted in other recorded locations in the country. The results however excluded the unverified record of incident.

In 2015, the local practices and management strategies in addressing HCC in 13 river communities was documented in southern Palawan. Management issues and interventions were synthesized with their response to HCC. In Mindanao, literature review on cultural expressions of the Maguindanaon Muslim in Ligawasan Marsh Game Refuge and Bird Sanctuary and Agusanon Manobo in Agusan Marsh Wildlife Sanctuary in relation to their mutual coexistence with crocodiles was gathered. Data were derived from observations, testimonies, and personal accounts of chieftains during focus group discussion in the Agusan Marsh.

## Results

### Status of HCC in the Philippines

The record of crocodile attacks from 2000-2015 (Table 1) is presented below to provide an overview on the level of conflict. This account represents the confirmed HCC incidents reported in known crocodile habitats in the Philippines by *Crocodylus Porosus* Philippines, Inc. (CPPI) to CrocBite. These results, however, are dependent on the effort of reporting. In some cases, the remoteness of communities had hindered reporting and/or validation of reports. The data below inferred that a probable viable population naturally regained but had a consequential effect to the household activities and livelihood of the communities.

There were 26-recorded cases of crocodile related incidents in the Philippines from 2000-2015, of which 20 incidents occurred in southern Palawan. Two incidents were recorded for *C.mindorensis* while others were *C.porosus*. Most of the reported attacks were non-fatal while fatal encounters accounted for about 30%. No incident was recorded from 2001 to 2005 either because none occurred or incidents went unreported due to remoteness of the area.

**Table 1:** Recorded crocodile attacks in the Philippines from 2000-2015\*.

Year	Non-Fatal	Fatal	Total	Activity Details
2000	1	0	1	Boat cleaning
2001	0	0	0	
2002	0	0	0	
2003	0	0	0	
2004	0	0	0	
2005	0	0	0	
2006	1	1	2	River crossing on foot, Laundry
2007	0	0	0	
2008	1	1	2	Swimming, River crossing on foot
2009	1	1	2	Fishing, Canoeing
2010	3	1	4	Electro-fishing, Bathing, Mariculture
2011	0	2	2	Mariculture, Fuel wood gathering
2012	2	0	2	Mariculture, River crossing on foot
2013	0	0	0	
2014	3	1	4	By-catch, Fishing, River crossing on foot
2015	6	1	7	Fishing, Laundry
<b>TOTAL</b>	<b>18</b>	<b>8</b>	<b>26</b>	

\*Source: CPPI HCC Database, 2017

The increase in incidents reflected from 2006 to 2015 was apparently due to an increasing human population that struggled with the need to access livelihood. This observation is inferred from the fact that the attacks were mostly related to livelihood activities such as fishing and mariculture (seaweeds and sea cucumber farming).

The abundance of coastal mangrove areas provides ideal habitat for crocodiles while attracting a demand for livelihood and profit for the increasing human settlement. Fishing communities spend more time attending to their household activities and coastal livelihood notwithstanding exposure to potential conflict.

### Management Issues and Interventions: Palawan

In 2015, CPPI field surveys suggested that an estimated 346 non-hatchlings *C. porosus* present in southern Palawan mainland and small islands rivers with small human populations and intact mangrove habitats. Several active nests were observed in locations not easily accessible yet still vulnerable to poaching. Of the 13 rivers surveyed, five recorded no HCC (Table 2). All of the surveyed rivers except Bugsuk River were not spared from human induced disturbances. The continuous arrival of in-migrants was observed to be primary cause of mangrove forest utilization. Timber poaching, fuel wood gathering, debarking, and fishing pressures were among the activities that resulted to the displacement of crocodiles from their natural habitat.

The consequential effect of persecution by humans and wildlife poaching has conveyed distress on both habitat and

crocodiles. However, it was observed that the absence of direct action on crocodiles, e.g., hunting, killing, catching, did not necessarily end in conflict. In most areas with recorded HCC, pessimistic views prevailed, leading to reduced crocodile populations. Communities that practice their cultural beliefs and follow ecosystem-friendly approaches provided optimistic results.

In some areas with high occurrence of HCC, installation of warning signs and public consultations constituted the priority efforts in addressing HCC issues. Others concentrated on advocacy campaign, facilitating alternative livelihood, installation of makeshift bridges, and enhancing cultural knowledge and practices to encourage human coexistence. The extremely remarkable private nature of the marshland area of Bugsuk River resulted in the entire habitat remaining intact, conserved, and free of human pressures.

### Mutual Coexistence: Mindanao

Distinction between the two species of crocodiles present in the Philippines is not common knowledge except in communities that have spent generations living with both. Crocodiles have played an essential role in the mythical beliefs, culture, rituals, and cultural practices of the Maguindanaon Muslims (*People of the flood plains*) and the Agusanon Manobo (*River People*) (Table 3).

The beliefs of the indigenous people of Ligawasan and Agusan Marsh involved worship and reverence for the guardian spirits. This act of worship by the Agusan Manobo and Maguindanaon Manobo is related to many unseen spirits that can prevent a

**Table 2:** Management issues and interventions in response to Human-Crocodile Conflict (HCC) in southern Palawan (2015)

No	Location	Issues and Concerns		Human & Crocodile Conflict	Current Community Interventions	Management efforts
		Habitat	Crocodile			
1	Maasin River, Quezon	Continuous arrival of in-migrant	persecution by humans	Yes	Human encroachment	Installation of warning signs
2	Quinlogan, Quezon	Conversion into Agriculture	persecution by humans	Yes	Changing landscapes	Awareness raising
3	Panalingaan River, Rizal	Mangrove conversion, Fuelwood gathering	persecution by humans	Yes	Fishing pressure	Installation of makeshift bridge
4	Canipaan River, Rizal	Timber poaching, mangrove debarking	persecution by humans	Yes	Removal of crocodile	Public consultation
5	Rio Tuba River, Bataraza	Mangrove debarking, Fuelwood gathering	persecution by humans	Yes	Removal of crocodile	Installation of warning signs
6	Sumbiling River, Bataraza	Conversion into Agriculture	Wildlife trade	Yes	Changing landscapes	Awareness raising
7	Bugsuk River, Balabac	None	None	No	Habitat conservation	Private Restriction
8	Tukanigalo, Balabac	Mangrove debarking, Dynamite fishing, Fuelwood gathering	Wildlife trade	Yes	Fishing pressure	Alternative livelihood
9	Dalit River, Balabac	Fishing, Fuelwood gathering	None	No	Cultural preservation	Cultural veneration
10	Agutayan River, Balabac	Continuous arrival of in-migrants	None	No	Cultural preservation	Cultural veneration
11	Rabor River, Balabac	Mangrove conversion, Fuelwood gathering	None	No	Wildlife protection	Alternative livelihood
12	Pasig River, Balabac	Timber poaching, Mangrove destruction	persecution by humans	Yes	Changing landscapes	None
13	Monsod River, Balabac	Conversion into Agriculture	None	No	Indigenous knowledge preservation	Installation of makeshift bridge

**Table 3:** Cultural expressions of Maguindanaon [19] and Manobo [20] people in their coexistence with crocodiles

	Cultural Expressions	Practices favoring Co-existence
Beliefs	<ul style="list-style-type: none"> <li>• Presence of unseen spirits that interfere with human lives</li> <li>• Strong regard for land as the source of life</li> <li>• Communities are intimately related to crocodiles (Crocodiles are the souls of dead relatives come back to life)</li> <li>• Crocodiles recognizes a person's pure intention</li> </ul>	<ul style="list-style-type: none"> <li>• Cutting of hardwood would bring calamity and devastate their homeland</li> <li>• Recipients of the ecosystems services provided by the crocodiles</li> <li>• Giving respect to the crocodiles as vital members of the wetland ecosystem</li> </ul>
Religious Rituals	<ul style="list-style-type: none"> <li>• Conduct of <i>Panawagtawag</i> or peace offerings</li> </ul>	<ul style="list-style-type: none"> <li>• Thanksgiving ritual is normally offered whenever a Manobo fisherman catches more fish in a crocodile inhabited area</li> <li>• Requesting permission from the spirit-owner of the crocodiles to conduct activities</li> </ul>
Cultural Practices	<ul style="list-style-type: none"> <li>• Respect to life</li> <li>• Crocodiles are indicators of a healthy fish population</li> <li>• Crocodile inspired designs and symbolism in their craftsmanship and artworks.</li> </ul>	<ul style="list-style-type: none"> <li>• understanding of crocodile feeding habit &amp; aggressiveness when disturbed</li> <li>• Possession of amulet for safety and protection</li> <li>• Fishing in conservative and traditional ways</li> <li>• Signs are known to be symbols of courage, power, and high regard for the crocodile's reputation</li> </ul>
Anecdotal Accounts	<ul style="list-style-type: none"> <li>• Disturbance of known crocodile habitats</li> <li>• Unannounced &amp; unaccompanied visitors have experienced unexplained mishaps</li> </ul>	<ul style="list-style-type: none"> <li>• Scarcities of fishes prompted the crocodile to find more available food sources</li> <li>• Respect for their forefathers and ancestral domain</li> </ul>

person from accomplishing their desired activities. They believed in the presence of spiritual unseen beings residing and guarding their forests, rivers and animals. Unwise utilization of resources such as the cutting of hardwood was believed to bring about a calamity that could devastate their homeland. As recipients of the environmental services, their actions toward crocodiles needed to be in harmony with its existence. They also believed that crocodiles were able to recognize a person's pure intention and allowed themselves to be seen by the person. According to them, this belief was an expression of respect to the crocodiles as vital members of the wetland ecosystem.

A general form of religious ritual called *panawagtawag* has been their way of paying respects to the unseen spirits that protected nature. Offering of thanksgiving normally happened when a fisherman caught more fish in a crocodile-inhabited area. Other rituals were performed once in a while for a specific purpose but were oftentimes to request permission from the rightful spirit-owner of the crocodiles for a peaceful conduct of activities in the marsh. The respect to life was one very clear attribute of the Agusanon Manobo cultural practices. They lived side by side with crocodiles, making use of their knowledge and understanding on the feeding habit and aggressiveness when aggravated. Possession of an amulet (like crocodile tooth) was imperative for safety and protection. They believed that the presence of crocodiles was indicative of a healthy fish population. Their conservative and traditional way of fishing practices prevented resource use conflicts. Crocodile-inspired designs and symbolism are inscribed in their armaments, which symbolized courage, power, and high regard for the crocodiles.

Reports of human-crocodile conflicts are believed to be the result of disturbances in known crocodile habitats. The scarcity of fish in the marsh could have prompted the crocodile to look elsewhere for food sources that could have led to the attacks on livestock in nearby communities. Some anecdotal accounts told of visitors who dropped in unannounced, unaccompanied, and

consequently experienced unexplained unfortunate events. In essence, all the indigenous people wanted were respect for their forefathers and ancestral domain.

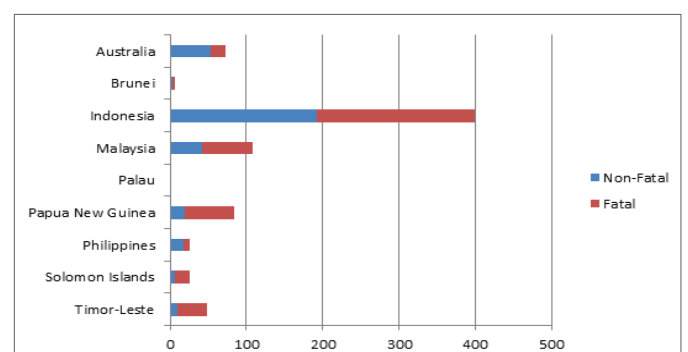
Agusanon and Maguindanaon Manobo, as settlers of the Marsh, referred to some crocodiles as "*Pagali*", literally translated as 'relative'. This distinction denoted two separate groups although both promoted the evolution of their traditional practices that conserve environmental resources and guardians in harmony with nature.

### Incidents in Southeast Asia and Oceania

A comparison of crocodile attacks in Southeast Asia and Oceania countries in 2000-2015 showed that the populations in Indonesia contributed more in this region (CrocBITE 2015). The Philippines was among those with the lowest number of recorded incidents (Figure 1).

### Discussion

In the CPPI HCC record contributed to CrocBite [9] database, the majority of the involved victims could be supplementary to fishing in areas where crocodiles search for food and as results



**Figure 1:** Southeast Asia & Oceania crocodile attack data from Jan. 2000-Dec. 2015

\*Source: CrocBITE WORLDWIDE CROCODILIAN ATTACK DATABASE, 2015

of defending their territory. Distinctive knowledge of the fishers on the presence of *C. porosus* has led to low percentage of fatal attacks. Nevertheless, the scarcities of suitable locations for mariculture activities have intend the residing communities to struggle and compete for resources with crocodiles. The level of human population disturbance and high in-migration rate are related to the declining trend of crocodile population [12,13]. Regoniel et al. [14] also noted that crocodile is likely to migrate with limited food resources or if the disturbances are great. Manalo et al. [15] concluded that the increasing human pressure would be the major threat to crocodile populations in southern Palawan.

The continued existence of habitat degradation caused by human inhabitants had changed the suitability of habitat despite several management interventions implemented. Southern municipalities in Palawan, particularly Quezon, Rizal, Bataraza and Balabac, are known to contain viable habitats with probable *C. porosus* populations [15]. Sopsop et al. [16] indicated that the mangrove forests of the municipalities of Bataraza and Balabac have undergone extensive damage due to debarking activities which extends to mainland Palawan. Manalo et al. [17] noted that these southern Palawan Rivers are remarkable habitats for *C. porosus* and should be considered under the Environmentally Critical Areas Network (ECAN) coastal/marine Core Zone of PCSD Resolution 05-250 or the “PCSD resolution providing guidelines for the terrestrial and coastal/marine zoning.

Mutual coexistence with *C. porosus* existed particularly in southern Philippines. Cultural expressions that reflected in their local fishing practices have contributed to the increase in livelihood of fishing communities. These remnants of the first Austronesian invasion [18] but now locally known as “People of the flood plains” and “River People” believed that Crocodiles are an object of fear, reverence and veneration as well as indicators of a healthy wetland ecosystem [19,20]. These positive implications of their cautious fishing attitude were attributed by the presence of crocodiles in their environment [21]. According to them, crocodile habitats are perceived as fish sanctuaries; an assurance of healthy fish stocks to sustain their fishing practices. It was notable that fish and other aquatic fauna were abundant in areas where crocodiles and indigenous people co-existed.

## Conclusion and Recommendations

The Philippines, as one of the range states of *Crocodylus porosus*, has not been spared of issues concerning human-crocodile conflict. Addressing these management issues generally involved the strong participation of local communities. Community responses towards the use of crocodile habitat were apparently vital to the recovery of resident crocodile population. Increasing human pressure served as a driver in promoting negative behavior towards crocodiles in their natural habitat. In areas with lesser human disturbances, HCC could be diminished or immediately addressed.

Human encroachment on crocodile habitat due to the need in accessing livelihood has resulted conflicts. This was commonly responded to by the removal of potential conflict animals, display of warning signs, advocacy campaign, and provision of alternative livelihood. However, indigenous people, among others, have shown that tradition and cultural beliefs could help avoid HCC. Their reverence, veneration, and cultural understanding of crocodiles reduced the potential for conflicts. The innate and inherited practices of indigenous people in their fishing environment could serve as model of precautionary measures in areas with high crocodile density.

This study recommends the implementation of incentive system for nest protection as potential pragmatic solution in understanding the breeding behavior of crocodiles. The provision of land-based alternative livelihood could also help in resolving further conflicts. There is an urgent need for local legislation that strictly prohibits hunting (ergo, no removal), proper appropriation of land and water use system, and stringent implementation of fishing regulations in known crocodile habitats. Moreover, declaration of Critical Habitat in contiguous viable crocodile habitat could highly contribute in addressing human-crocodile conflict. The success or failure of these efforts can be inferred from the increase or decrease of the level of knowledge and social acceptance of local communities as well as the number of crocodile conflicts in the locality.

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