

Study of False Gharial (*Tomistoma schlegelii*) Habitat Characteristics in Mesangat Wetlands, East Kutai, East Kalimantan

Lariman¹, Meiryna Desyana², Sus Trimurti³

¹ Biology Department, Faculty of Mathematics and Natural Sciences, Mulawarman University
Jl. Barong Tongkok No.4 Kampus Gunung Kelua Samarinda, East Kalimantan

Abstract: *Mesangat Wetlands are water areas consisting of swamps, rivers and swamp forests located in Mesaat sub-district, East Kutai, East Kalimantan, which have a role as one of the habitats of the chopstick crocodile (Tomistoma schlegelii). The purpose of this study was to determine the habitat characteristics of the chopstick crocodile (Tomistoma schlegelii) in the Mesaat Wetland, East Kutai Regency, East Kalimantan. The method used is direct observation at night at 18.30-22.30 WITA. This study uses exploration and sampling methods for habitat data consisting of vegetation, water quality, and human activities, food availability. The results obtained by the crocodile chopsticks utilize wetlands and surrounding vegetation as nesting, sheltering and foraging for food. The characteristics of the crocodile chopsticks habitat in the wetlands of Mesangat are located in areas far from human activities, having an average water pH of 7, with an average depth of 2 meters and a water temperature of 26oC. The area is overgrown with vegetation and the pits are covered by thickets of trees and grass which are the preferred place for fish to breed and use by crocodiles as shelter and foraging for food. Nesting places for crocodiles and chopsticks nesting in the wetlands of Mesaat are swamps that are close to the river's edge and prefer land with lots of leaf litter and twigs and tree shade.*

Keyword: Habitat, Mesangat Wetland, Crocodile Chopsticks, Disturbance

1. Introduction

Crocodiles are a type of reptile that according to its evolution has existed since two million years ago. There are about 26 species of crocodiles in the world and in Indonesia there are only 5 species. Two of the five types of crocodiles are located on the island of Borneo, namely the Siamese crocodile and the chopstick crocodile (Iskandar, 2000).

The chopstick crocodile is a crocodile that can be found in freshwater waters to far inland in Kalimantan. The chopstick crocodile is one of the crocodiles that is easily distinguished among all types of crocodiles, which can be seen from the shape of its mouth which is long snout which makes it easier for crocodiles to snout chopsticks to prey on aquatic animals, one of which is fish. Geographically, freshwater crocodiles have a limited range of motion compared to estuarine crocodiles, which can live in both fresh and brackish water.

The chopstick crocodile has a smaller body size than the estuarine crocodile, this is because the chopstick crocodile can enter the depths of the inland rivers where the space is narrow, besides that the chopstick crocodile has special recognizable characteristics, namely on the back of the chopstick crocodile it has four rows of scales. which have a shallow keel with a number of scales of about 22 per row and on the back of the head there are two pairs of small, non-consecutive scales, while on the nape of the neck there are four and are united with the keeled dorsal scales, the length of the crocodile chopsticks body size can reach 5.6 meters, generally 3.5 meters long. The upper jaw on the crocodile chopstick snout has about 20-22 teeth, the lower jaw 17-19 teeth, the fifth tooth is usually the largest. The body color is dark green blackish and has a mottled tail that is not ring-shaped (BOSF, 2008).

Crocodiles are opportunistic predators for nearby animals and can prey on animals that are larger than their body size, the main prey for young crocodiles are insects, amphibians, hard-skinned animals, small reptiles and fish, while adult crocodiles prey on larger animals for food such as buffalo, wild animals, farm animals and monkeys. Currently, the chopstick crocodile is experiencing a population decline and is even threatened with extinction due to a decrease in natural habitat (Cadman, 2007).

According to the International Union for Conservation of Nature, the chopstick crocodile is vulnerable (IUCN, 2014). Even CITES Appendix I also confirms that the chopstick crocodile is in the endangered category and should not be traded internationally. In Indonesia the legal umbrella to protect the crocodile chopsticks has been regulated in Government Regulation no. 7 of 1999 concerning the Preservation of Wild Plants and Animals and a Decree of the Minister of Agriculture concerning Additional Stipulations of Protected Wild Animal Species, SK No. 327/Kpts/Um/5/1978 (Iskandar, 2000) The global population of this chopstick crocodile continues decreased due to high human activities (Auliya, 2006).

Every wetlands are water areas consisting of swamps, rivers and swamp forests in East Kalimantan, which have a role as a habitat for various types of wild animals and plants, the animal is the crocodile chopsticks. Mesaat Wetland is one of the conservation areas for the Chopstick Crocodile (*Tomistoma schlegelii*). The ecology of the chopstick crocodile is still largely unknown, including the habitat characteristics of the crocodile in Mesaat. This research will add to the scientific repertoire of the habitat ecology of this species, with the hope that this information can be useful in conservation efforts of this threatened crocodile species.

Based on the description in the background of the research, the problem can be formulated, namely, how are the characteristics of the crocodile chopsticks habitat in the Mesaat wetland, East Kutai Regency.

2. Research Method

Research Time and Place

This research was conducted in June 2020. The research site is located in the Mesaat Wetland, East Kutai, East Kalimantan. Data processing and identification was carried out at the Laboratory of Animal Ecology and Systematics, Faculty of Mathematics and Natural Sciences.

Research Tools and Materials

The tools needed in this research are Global Positioning System (GPS), Thermometer, Hygrometer, Water checker, data sheet, label paper, permanent marker, stapler, digital camera, boat and stationery.

Ways of working

a) Determination of the observation location

At the time of determining the location of observations, information was collected from the Ulin Foundation and literature studies where the chopstick crocodile was found, as well as direct observations in the Mesaat wetlands. Then do a site survey and determine the point of observation stations.

b) Survey method

Crocodile observations were carried out using the Purposive Sampling method combined with the Visual Encounter Survey (VES) search method by directly searching for crocodile chopsticks around the very wet land that the Ironwood Foundation and local fishermen had encountered. For Purposive Sampling, the aquatic observation path is along the waterway in the Mesaat wetland by boat. For the VES method, a search was carried out for 4 hours.

c) Chopsticks Crocodile Collection and Data Collection

Observations were made by tracing the path of observation. At night it is held at 18.30-22.30 WITA. The search for crocodile chopsticks is equipped with GPS and head lamp. Observations started at the zero point of the path and focused on places that were thought to be the habitat or hiding places of the chopstick crocodile. Each chopstick crocodile seen will be recorded when found, activity/behavior, substrate type, and other information which is then labeled. All observational data are filled in the table of the vegetation list and the measured parameters.

d) Chopstick Crocodile Habitat Collection and Data Collection

Habitat data collection was carried out using exploration and sampling methods. The exploration method is carried out by following the direct pathrivers and swamp sites in the Mesaat wetlands by boat at night (18.30-22.30).

e) Vegetation Data Collection

The protective crocodiles used are usually in the form of vegetation and are found in two places, namely on land and in water. Vegetation data collection was carried out in the morning (07.30 - 11.00) data collection was carried out by

walking to places where the presence of crocodile chopsticks had been found was marked and measured with a 10x10 m plot of the place and recorded these variables was done by recording tally sheets in the form of plant names, types of plants and the number of plants found around the location of the 10 x 10 plot of crocodile chopsticks were found.

f) Water quality

Water quality parameters measured by the water checker include: temperature, salinity and pH at each location where crocodiles were found.

3. Data Analysis

Aquatic data analysis

The data obtained from the observation of the chopstick crocodile (*Tomistoma schlegelii*) habitat at each point where the chopstick crocodile was found, data analysis was carried out to determine the correlation of the measured parameters such as air humidity, water acidity, water temperature, water color, and all data taken. in the area where the crocodile chopsticks were found.

Vegetation analysis is necessary because most crocodile nests in Kalimantan are found under large trees. Vegetation observations were carried out to determine the effect of aquatic plants on the survival of the crocodile chopsticks in the very wet land. Data from observations at each location were recorded in tally sheets and analyzed using density index and species frequency. Observations were made descriptively on aquatic plants found at the research site to determine the effect of aquatic plants on the presence of crocodiles in the Mesangat wetlands.

4. Results and Discussion

Water Quality Data

Water quality data is a physical and chemical component that can affect organisms and the continuity of an ecosystem and is the most important factor in supporting the formation of an ecosystem with certain characteristics. According to Alikodra (2002) adaptation of animals to the environment has a different level of adaptation depending on the availability of water. Crocodiles are wild animals that live in or near water, where water is used by crocodiles as a place to live and breed. Water quality can affect the survival and reproduction of each organism directly or indirectly, one of which is the crocodile chopsticks.

Table 1: Water Quality Data in Mesangat Wetlands

No	Location	pH	Depth	Temperature	Salinity
1	Long balau	7	2,25 m	26 °C	0,00%
2	Swamp forest	7	2,24 m	27 °C	0,00%
3	MiddleMesangat	7	2,05 m	26 °C	0,00%
4	Klandimut	7	1,27 m	26 °C	0,00%
5	Raft	7	1,30 m	26°C	0,00%
6	Kelinjau	7	2 m	27 °C	0,00%

The quality data in the waters of the Mesaat wetlands at each point where the crocodile chopsticks were found, the results can be seen in Table 1. Mesaat wetlands have an average pH of 7 which indicates neutral. The discovery of the chopstick

crocodile in the Mesaat wetland area shows that the waters are still suitable for the chopstick crocodile. Where according to Ricker (1973), productive and ideal waters for aquatic animals are pH between 6.5-8.5. Mesaat wetlands have varying depths, at point 4 having the lowest depth of 1.27 m - 2.25 m at a depth of < 4 m this can be used by crocodile chopsticks to find food. The temperature of the Mesaat wetland water is known to be 26-27oC.

Temperature is a factor that affects the body thermoregulation of crocodile chopsticks in different environments, crocodile chopsticks are able to be at temperatures around 20-30 oC. This condition shows that the water quality is still good, where this condition shows an

ideal place for crocodile chopsticks to livelife. Changes in temperature below 20oC or above 30oC can cause stress on crocodile chopsticks and decreased digestibility (Directorate General of PHPA,1996). The salinity of the water in the Mesaat wetland has a value of 0.00%. This value is normal for swamp waters according to Johnson (2005). Salinity values for fresh waters usually range from 0-0.5%.

Vegetation data

The area in the Mesangka wetland has a high diversity of vegetation types so that the presence of vegetation in the Mesangka wetland is a supporting component for the crocodile chopsticks.

Table 2: Types of Plants Found Around the Point of Encounter Crocodile Chopsticks.

No	Spesies	Local name	T 1	T 2	T 3	T 4	T 5	T 6	Amoun
1.	<i>Planchonia valida</i>	Putat	17	5	11	-	7	37	77
2	<i>Lophopetalum javanicum</i>	Perupuk	25	27	54	28	58	9	201
3	<i>Kleinhovia hospita</i>	Kejawi	3	-	1	15	9	-	28
4	<i>Ficus glauca</i>	Temangar	-	-	-	-	-	4	4
5	<i>Pterocarpus indicus</i>	Potokejo	-	31	17	7	6	-	61
6	<i>Ixora fluminalis</i>	Ketumbu	-	-	-	-	4	-	4
7	<i>Dillenia excelsa</i>	Kendikara	-	-	-	3	-	7	10

The results of the study on the very wet land in Table 2 found 7 types of plants that make up the very wet land. From these observations, it can be seen that the number of fertilizing plants is more dominant, namely as many as 201

trees from the total number of places where crocodiles were found, then the number of putat plants is 77 trees and potokejo plants are 61 trees.

Table 3: Results of Density and Frequency Data Analysis from Tree Level

No	Species	Amount	K	KR (%)	F	FR (%)
1	Putat	77	3,85	20%	12,8	0,19
2	Perupuk	201	10,05	52%	33,5	0,52
3	Temangar	4	0,2	1%	0,66	0,01
4	Kejawi	29	1,45	8%	4,66	0,07
5	Potokejo	61	3,05	16%	10,16	0,15
6	Ketumbu	4	0,2	1%	0,66	0,02
7	Kendikara	10	0,5	3%	1,66	0,025

From the results above, it can be seen that this type of fertiliser has a relative density value of 10.05%, a putat relative density value of 3.85% and a potokejo relative density of 3.05%, meaning that these three types have a high density level. There are more types of trees than the others. According to Ripin, 2017 these three trees including plants that do live in peat swamps and an ideal habitat for these three plants as well as for crocodiles that like to live in wetland waters.

In this study, wetlands were divided into three zones based on habitat, crocodile encounters and intensity of disturbance. Three wetland zones, namely the upstream zone, the zone in the north. The two middle and third zones are downstream zones.

a) Upstream Wetland Zone

In the upstream zone to the left and right of the upper reaches of the Mesaat River are lowland forests which are dominated by rattan and other shrubs. This area has the highest high and low tides of almost 4 meters and is highly dependent on the waters upstream of the lake. The upstream zone provides food for crocodiles in the form of puyau fish

(Nilem), frogs (*Hylarana eritraea*), spiders (*Arachnida*) and snails (*Pila ampulla*). The upstream zone is in an inland area of the river which is very far away and rarely visited by humans because this part of the river is overgrown with kariba algae (*Salvina molesta*), swamp sugar cane (*Hanguana malayana*), pasau grass (*Pandanus sp*), genjer (*Limncharis flava*), water hyacinth (*Eichornia crassipes*) which is often used by crocodiles as a shelter and nesting area and food availability. There are two crocodiles that can be found in the upstream zone.

b) Wetland Central Zone

In the middle zone, it is included in the swamp forest area, where on the right and left sides there are many tall trees, small fish, frogs (*Hylarana eritraea*), spiders (*Arachnida*) and snails (*Pila ampulla*), long-tailed monkeys (*Macaca fascicularis*), mice (*Muridae*). The middle zone is in the area in the middle of the river and this area there are also fishing rafts to rest. This river is overgrown with perupuk tree (*Lophopetalum javanicum*), kejawi (*Kleinhovia hospita*), Temangar (*Ficus glauca*), potokejo (*Pterocarpus indicu*), ketumbu (*Ixora fluminalis*), kendikara (*Dillenia excelsa*) swamp sugar (*Hanguana malayana*) vegetation. Crocodiles are often used as a search for food. There are 3 crocodiles that can be found in the middle zone.

c) Wetlands Downstream Zone

The downstream zone is different from the upstream zone and the middle zone, in this downstream zone it is not far from the area where the community lives because the downstream zone is a fast-flowing river flow and is relatively clean from floating vegetation, especially the Kelinjau river as a major river or main river along the river. Muara Ancalong District. In this middle zone, there is a lot

of food available for crocodiles in the form of small fish, long-tailed monkeys (*Macaca fascicularis*), proboscis monkeys (*Nasalis larvatus*) and various types of birds. The downstream zone is a river with fast currents and its size is very wide. This river is overgrown with perupuk trees (*Lophopetalum javanicum*), kejawi (*Kleinhovia hospita*), Temangar (*Ficus glauca*), ketumbu (*Ixora fluminalis*), kendikara (*Dillenia excelsa*) and in the downstream zone, land is found that is overgrown with sengon trees. Only one crocodile found in the downstream zone.

Components of the Chopstick Crocodile Discovery Habitat Crocodile habitat has several important components, the habitat of the crocodile chopstick (*Tomistoma schlegelii*) is a place for foraging for food, laying and nesting places, shelter and sunbathing areas.

Protector

Cover or protector serves as a place to live, breed and shelter from danger, it can even be used as a place to find food. Crocodiles live mostly in water. When it gets dark until before dawn, crocodiles begin to actively look for food

because crocodiles are nocturnal animals, namely animals that are active at night. If during the day crocodiles bask on the banks of the river, in the open.

From the results of the study, several types of vegetation were found, namely vegetation dominated by putat (*Planchonia valida*) and Perupuk (*Lophopetalum javanicum*) trees. In addition, there are also floating vegetation that dominates the very wet land, namely, daffodils (*Hanguana Malayana*) and Kaiba algae (*Salvinia molesta*). The vegetation found in this wetland is used by crocodiles to make nests, shelter, and find food.

Nesting Place

Crocodile chopsticks nesting places are swamps that are close to the river's edge and like land with lots of leaf litter and twigs and tree shade. This litter serves as a source of heat needed by the eggs to keep the temperature stable and helps speed up the hatching process and the crocodile chopsticks usually place their nests under the flood as seen in Figure 1. The crocodile chopsticks nest.



Figure 1: Crocodile chopsticks make nests from mounds of litter under trees around the waters of Lake Mesangat (Staniewicz, 2015).

The last nest of the crocodile chopsticks can be seen in Figure 1. In 2015 in the Mesaat Wetland. The nests are located deep in a remote river stream, which is very difficult to pass at this time due to the highwater level and difficult access to the path to the nest because it is already overgrown with grass.

Generally, crocodiles sunbathe on land and bask in fallen trees that are exposed to direct sunlight to stabilize their body temperature because the crocodile's body is ectothermic or cold-blooded.

Wetlands are very wide and deep waters, along the waters there are many trees and holes covered by thickets of trees and grass which are places favored by fish to breed. Based on information from the community and officers from the Ulin Foundation, the crocodile supit can also prey on land animals that are around the lake, including monkeys (*Macaca fascicularis*), monitor lizards (*Varanus salvator*), proboscis monkeys (*Nasalis larvatus*), wild boars (*Sus barbatus*) and mouse deer (*Tragulus sp.*). Crocodile chopsticks are ambush animals and ambushes are usually carried out when the prey animal is drinking water at the edge of the river and is careless.

Chopstick Crocodile Habitat Disorder

Decades of disturbance of Lake Mevery by fires during El Nio events in the 1980s (Chokkalingam, 2005) facilitated the invasion of exotic species, which thrive in the area, the most widespread of which are floating weeds *E. crassipes* and *S. cucullata*, shrubs and hard grasses, invertebrates such as the apple snail (*Pomacea canaliculata*) and vertebrates such as catfish (*Plecostomus sp.*), tilapia (*Oreochromis mossambicus*) and snakehead fish (*Channa micropeltes*).

The rapid growth of invasive aquatic weeds has caused clogged drains and decreased water depth within the wetlands, limiting access to sites previously cleared during 2009-2011.

This change can also be accelerated by human activities, for example from the remnants of agricultural fertilizers and municipal landfills that enrich lakes with the release of large amounts of nitrogen and phosphorus. As a result, an algae population explosion or blooming occurs, resulting in excessive detritus production which eventually depletes the oxygen supply in the lake. This kind of lake enrichment is called eutrophication.

Eutrophication makes the water unusable and reduces the beauty of the lake. The most invading species spread prolifically as the weeds *Eichornia crassipes* and *Salvinia cucullata*.

Vegetation that thrives as invasive aquatic weeds causes dead-end waterways and causes shallow waters so that access is limited which was previously open during the 2009–2011 period (Behler et al., 2018). Meanwhile, *Ipomea aquatica*, although not the dominant vegetation, can be useful for the Mesaat waters. This type can reduce the content of COD, BOD in waste (Rane, 2016).

5. Conclusion

The Mevery wetlands are vegetated with few trees found along the wetland streams. The characteristics of the crocodile chopsticks habitat in the Mesaat wetlands have an average water pH of 7 with an average depth of 2 meters and a water temperature of 26°C.

The presence of chopstick crocodiles in wetlands is very much found in areas that are very far from human activities where the area is overgrown with vegetation and the pits are covered by thickets of trees and grass which are places favored by fish to breed and exploit. crocodiles as shelter and foraging for food.

Nesting places for crocodiles and chopsticks nesting in the wetlands of Mesaat are swamps that are close to the river's edge and prefer land with lots of leaf litter and twigs and tree shade.

6. Suggestions

From the results of this study, further research can be carried out on the existence of wild animals in the Mesaat wetlands which are endangered and further research can be carried out on the existence of the Chopstick crocodile habitat in various areas so that there will be more supporting data to maintain the original habitat of the Chopstick Crocodile for its survival.

References

- [1] Alikodra H. S. 2002. Wildlife Management Volume 2. Bogor: Publishing Foundation, Faculty of Forestry, Bogor Agricultural University.
- [2] Auliya M. B., Shwedick, R. Sommerlad, S. Brend and Samedi. 2006. A short-term assessment of the conservation status of (*Tomistoma schlegelii*) (Crocodylia: Crocodylidae) in Tanjung Puting National Park (Central Kalimantan, Indonesia). A cooperative survey by the Orangutan Foundation (UK) and the Tomistoma Task Force, of the IUCN/SSC Crocodile Specialist Group.
- [3] Behler, N., Bezuijen M., Simpson, B., Daltry, J. and Tempsiripong, Y. 2012. *Crocodylus siamensis*. The IUCN Red List of Threatened Species 2012:e.T5671A3048087. <http://dx.doi.org/10.2305/IUCN.UK.2012.RLTS.T5671A3048087.en> Accessed: 12-24-2019 15:45.
- [4] [BOSF] Borneo Orangutan Survival Foundation. 2008. Field Guide for Amphibians and Reptiles in the Mawas Area of Central Kalimantan Province (Notes in the Hundreds of Protected Forests). Palangkaraya: Borneo Orangutan Survival Foundation
- [5] Cadman M. 2007. Consuming Wild Life: The Illegal Exploitation of Wild Animals In South Africa, Zimbabwe and Zambia. A Preliminary Report for Animal Rights Africa and Xwe African Wild Life.
- [6] Chokkalingam U, Kurniawan I & Ruchiat Y (2005) Fire, livelihoods, and environmental change in the Middle Mahakam peatlands, East Kalimantan. *Ecology and Society*, 10:26.
- [7] [Directorate General of PHPA] Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry. 1996. Reptile inventory guidelines. Bogor : Development, Management and Safeguarding Project for Central Conservation Area Fiscal Year 1995/1996. Director General of PHKA.
- [8] Iskandar D. T. 2000. Turtles and Crocodiles Indonesia & Papua New Guinea. Bandung : PALMedia Citra.
- [9] [IUCN] International Union for the Conservation of Nature. 2014. The IUCN Red List of Threatened Species. Version 2014.1. available at: www.iucnredlist.org (Accessed: 23 August 2020).
- [10] Johnson, W. S. and D, M, Allen. 2005. Zooplacton Of The Atlantic And Gulf Coast, A Guide To Their Identification And Ecology. The Johns Hopkins. University Press. Baltimore and London
- [11] Rane, N.R., Patil, S.M., Chandanshive, V.V., Kadam, S.K., Khandare, R.V., Jadhav, J.P., and Govindwar, S.P. (2016). *Ipomoea hederifolia* rooted soil bed and *Ipomoea aquatica* rhizofiltration coupled phytoreactors for efficient treatment of textile wastewater. *Water Research*, 96, 1-11.
- [12] Ripin, Dwi Astiani, Burhanuddin. 2017. Types of Trees Composing Vegetation of Peat Swamp Forest on the Kampar Peninsula, Teluk Meranti District, Riau Province, *Journal of Sustainable Forest Vol. 5(3) : 807 - 813.*
- [13] Staniewicz A. 2015. Conservation of the Sunda gharial (*Tomistoma schlegelii*) in Lake Mesaat, Indonesia. *International Zoo Yearbook*, 49:137–149.