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SURVEYS OF SIAMESE CROCODILE (*Crocodylus siamensis*)
HABITAT IN THE MAHAKAM RIVER, EAST KALIMANTAN. *Hellen
Kurniati*..... 51

PEMANFAATAN SATWA LIAR DALAM RANGKA KONSERVASI
DAN PEMENUHAN GIZI MASYARAKAT. *Gono Semiadi*63

MORPHOLOGICAL VARIATION OF WHITEHEAD'S RAT *Maxomys
whiteheadi* (Thomas, 1894) (RODENTIA: MURIDAE) FROM
KALIMANTAN AND SUMATRA. *Martua H. Sinaga, Antonia J. Gorog
& Alejandro A. Chinen*75

KAJIAN ILMIAH IKAN GAR, FAMILI LEPISOSTEIDAE (*Lepisosteus
spp.* & *Atractosteus spp.*): SPESIES ANCAMAN BAGI IKAN ASLI
INDONESIA. *Renny Kurnia Hadiaty*87

THE FEATHER MITES (ACARI; PTEROLICHIDAE) OF PSITTACINE
BIRDS FROM MANUSELA NATIONAL PARK, SERAM ISLAND. *Sri
Hartini & Janita Aziz*97



| | | | | |
|---------------|---------------|-------|------|----------------|
| Zoo Indonesia | Volume 16 (2) | 51-98 | 2007 | ISSN 0215-191X |
|---------------|---------------|-------|------|----------------|

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SURVEYS OF SIAMESE CROCODILE (*Crocodylus siamensis*) HABITAT IN THE MAHAKAM RIVER, EAST KALIMANTAN

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ABSTRACT

Kurniati, H. 2007. Survey of Siamese crocodile (*Crocodylus siamensis*) habitat in the Mahakam River, East Kalimantan. Zoo Indonesia 16 (2): 51-62. A survey was undertaken to collect information on *C. siamensis* habitats and possible locations where *C. siamensis* occur in the lower Mahakam River, East Kalimantan. Interviews with local villagers confirmed that *C. siamensis* were still encountered, and that breeding still occurs. Specific wild habitats visited (Tanah Liat, Paya, Belibis, Amir & Mesangat Lakes) had changed greatly since 1995-1996, but weeds and sedimentation were identified as impacting negatively on the habitats. Fishing pressure had increased in recent years, and young crocodiles were being caught during fishing activities. Around 360 *C. siamensis* were currently in captivity at two crocodile farms and in villages in the Mahakam River area. Hybridization with *C. porosus* had occurred on one of the farms.

Keywords: *C. siamensis*, habitat, Mahakam River, East Kalimantan.

ABSTRAK

Kurniati, H. 2007. Survei habitat buaya *Crocodylus siamensis* di Sungai Mahakam, Kalimantan Timur. Zoo Indonesia 16 (2): 51-62. Survei untuk mengetahui kondisi habitat Buaya *Crocodylus siamensis* telah dilakukan di daerah Sungai Mahakam bagian tengah, Kalimantan Timur. Hasil wawancara dengan penduduk lokal mengindikasikan jenis *C. siamensis* masih terdapat di Sungai Mahakam, dan perkembangbiakan masih terus berlanjut. Habitat spesifik untuk *C. siamensis* (Danau Tanah Liat, Danau Paya, Danau Amir dan Danau Mesangat) telah banyak berubah dibandingkan kondisi pada tahun 1995-1996. Gulma dan sedimentasi lumpur merupakan penyebab utama kerusakan habitat buaya *C. siamensis*. Tekanan dari pengambilan ikan pada habitat Buaya *C. siamensis* kian bertambah pada saat ini, dan anakan Buaya *C. siamensis* juga ikut tertangkap karena aktifitas pengambilan ikan. Sekitar 360 individu *C. siamensis* berada dalam penangkaran buaya di dua lokasi di Kalimantan Timur dan juga di beberapa desa di sepanjang Sungai Mahakam. Kasus kawin silang antara *C. siamensis* dan *C. porosus* telah terjadi pada salah satu penangkaran buaya di Kalimantan Timur.

Kata kunci : *C. siamensis*, habitat, Sungai Mahakam, Kalimantan Timur.

INTRODUCTION

The Siamese crocodile (*Crocodylus siamensis*) is regarded as one of the

world's most endangered crocodylians (Ross 1998), and is included on CITES Appendix I and is listed as "Critically Endangered" by the IUCN-

World Conservation Union (Hilton-Taylor 2000). The IUCN-SSC Crocodile Specialist Group (CSG) considers the conservation of *C. siamensis* to be a high priority (SCWG 2004).

Historically, *C. siamensis* is distributed in Thailand, Vietnam, Laos PDR, Cambodia, Indonesia and Malaysia (Fig. 1). However, *C. siamensis* is probably extinct in Malaysia, and populations in Vietnam and Thailand are represented a few individuals, and reintroduction programs are underway there (Polet 2004; Temsiripong et al. 2004). Recent surveys undertaken in Lao PDR suggest that the population is small and fragmented (Bezuijen & Photitay 2005). Cambodia is considered the stronghold for *C. siamensis* in the region, and the wild population there is considered to include less than 200 adults (Heng 2004; Simpson & Han 2004).

In Indonesia, *C. siamensis* is only found in its natural habitat in the lower Mahakam River system, East

Kalimantan, as reported by Ross et al. (1998; Fig. 5). Surveys in 1995 and 1996 (Ross et al. 1998) concluded that the population was highly disjunctive, and estimated that the population at that time consisted of "several hundred individuals" (Cox 2004). The current status of the *C. siamensis* population is unknown (SCWG 2004), but it is thought to be very small or extinct (Simpson & Han 2004).

In April 2005, the CSG Chairman, met with Government of Indonesia and crocodile industry in Jakarta. All participants agreed that it was important for Indonesian scientists to become more involved with *C. siamensis* (and *T. schlegelii*) conservation efforts in Indonesia, in partnership with the local crocodile industry. As a result of this meeting, this survey was planned and undertaken as a first step towards the development of a future systematic survey program and conservation and management plan.



Figure 1. Distribution map of *Crocodylus siamensis* (yellow color) (Source: www.flmnh.ufl.edu).

MATERIALS & METHODS

Given the remoteness and small number of villages present and the reported shy nature of *C. siamensis* (prefers not to live near people), it was necessary to prioritize the locations/areas that could be visited during the survey period in 9-21 June 2005.

The specific goals of the survey were:

1. To visit crocodile farms in Balikpapan and Samarinda that was known to have *C. siamensis*, and interview the owners to determine the origin/source of the crocodiles.
2. To interview local people about: the historical and current distribution of crocodiles in areas with which they are familiar; the types of crocodile that are present in the river and lakes near their villages; and, to learn about the daily activities of the local people near crocodile habitats.
3. To assess potential crocodile habitats, based largely on the types of plants present in the habitats, and in adjacent areas. Locations of habitats were positioned using GPS.
4. To identify threats that may have negative impacts on crocodile populations and their habitats.

RESULTS

A. CROCODILE FARMS

In East Kalimantan there were two crocodile farms that had collected live *C. siamensis* and *C. porosus* from the Mahakam River and its tributaries. CV Surya Raya Crocodile Farm is located in Balikpapan and PT Makmur Abadi Permai Crocodile Farm is in Samarinda.

1. CV Surya Raya Crocodile Farm (Balikpapan)

There were 41 *C. siamensis* reported to be on the farm (14 males, 27 females; Fig. 2). The owner (Mr. Tarto Sugiarto) stated that the crocodiles were kept solely for exhibition and display, and not for commercial purposes. The Siamese Crocodiles were received since 1990-1991, and were collected by local people from Muara Muntai, Bongan and Muara Ancalong Villages. Muin & Ramono (1994) reported 20 individuals of *C. siamensis* on this farm in late 1993, and Ross *et al.* (1998) reported 37 individuals by September 1996 (mainly juveniles and sub-adults; Cox 2004).

The crocodiles were taken from Tanah Liat, Belibis and Mesangat Lakes. Their average size was 1-2 m. After 14 years in captivity, the average length of the crocodiles was about 3 m. In August, 1-2 nests were produced by some females in semi-natural captivities, but to date none of the artificially-incubated eggs had produced hatchlings.

2. PT Makmur Abadi Permai Crocodile Farm (Samarinda)

PT Makmur Abadi Permai Crocodile Farm estimates that it had hold 314 *C. siamensis* (180 females & 134 males; Fig. 3). The owner (Mr. Welly Mawengkang) could not remember the exact number of wild *C. siamensis* that were originally received in 1985 and 1986, but thought it was around 200 individuals. Average size of the crocodiles was 2-3 m. Muin & Ramono (1994) reported 316 *C. siamensis* on this farm in late 1993.

All original *C. siamensis* were from the lower Mahakam River. The owner did not know exactly where the animals were collected, because some crocodile collectors from the Mahakam River brought live crocodiles directly to the farm in Samarinda.



Figure 2. Pure *Crocodylus siamensis* at CV Surya Raya Crocodile Farm in Balikpapan, East Kalimantan (Photograph: H. Kurniati).

He recalled that the villages were around Jempang Lake, where most of the collectors stay. The owner initially thought that all of his crocodiles were *C. porosus*, and had placed all of them (*C. porosus* and *C. siamensis*) together in a semi-natural captivity. The two species of crocodiles grew and bred in this breeding pond for about 10 years.

Hybridization between the two species was apparent (Fig. 3). In 2000, the two species were separated into two different ponds. Some progeny, which might have been hybridizing, were placed with the parent *C. siamensis* stock. Based on an interview with the crocodile keeper, *C. siamensis* lay eggs between October and November, with 30-40 eggs per nest. Only 6-7 nests per year were produced. The owner thought that skins and meat of *C. siamensis* could not be exported. However, he had aware of the regulations relating to CITES Appendix-I animals such *C. siamensis*.

B. INTERVIEWS WITH LOCAL PEOPLE

Based on information received from crocodile farms in Balikpapan and Samarinda interviewed with local people in several villages in the Mahakam River area was conducted. Some local people still keep 1-3 *C. siamensis* at their homes.

1. Muara Muntai Village (S 00° 21' 40" and E 116° 23'16")

In this village, a man, Mr. Sahran, kept three adult *C. siamensis* (average size of 1.5 m). He bought the crocodiles as hatchlings in 1995. They originated from small lakes close to Jempang Lake. One of the crocodiles laid eggs in December 2004.

2. Bongan Village (S 00° 28' 56" and E 116° 17'25")

This village was very close to Tanah Liat, Belibis and Amir Lakes. People in this village usually found nests, hatchlings or juvenile *C. siamensis*

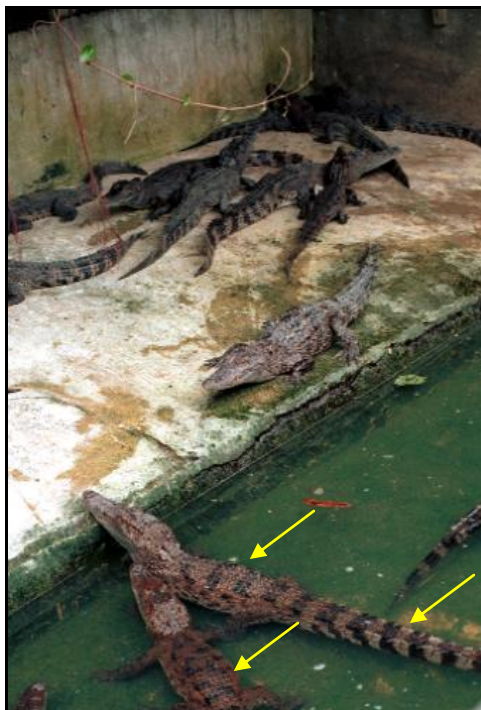


Figure 3. Juvenile *C. siamensis* (hybrids?) at PT Makmur Abadi Permai Crocodile Farm, Samarinda, East Kalimantan. Notice the dorsal skin colour represent more to *C. porosus* with the tail ring band represents more to *C. siamensis*. Ventral belly skin represents more to *C. porosus* (Photograph: H. Kurniati).

trapped by fishhook or traditional fish trap (called *bubu*). Some people release the trapped crocodiles, but others kill and eat them as they were considered to be traditional medicine for mangy skin. If they found nests, all of the eggs were usually taken and the infertile ones were boiled and eaten. Siamese Crocodile nests were usually located in April or May.

3. Muara Ancalong Village (N 00° 25' 48.6" and E 116° 40' 52.6")

In this village, an old woman had one Siamese crocodile. Based on interview with her, she got the animal from Mentelang River about 20 years ago. The crocodile was trapped in a traditional fish trap when it was hatchling/juvenile. According to the owner, the condition of the Mentelang

River had changed drastically. Right now, there were many villages along the river.

4. Bena Baru Village (N 00° 27' 6.7" and E 116° 43' 2.3")

There was one Siamese Crocodile in this village, which was caught 10 days before the survey team arrived. The 1 m long crocodile was trapped accidentally by fishhook in Mesangat Lake. The owner of the crocodile wanted to keep it and waited for somebody to buy it, but he did not know why it was not easy to sell the crocodile right now. Villagers confirmed that there were many more crocodiles present historically, but due to increase boat traffic and human settlement inside and around the large lakes (Jempang, Semayang,

Melintang), *C. siamensis* seek refuge in the smaller lakes.

C. HABITAT ASSESSMENT

Specific areas surveyed for habitat assessment were Tanah Liat, Paya, Belibis, Amir and Mesangat Lakes (Figure 4).

1. Tanah Liat Lake

Tanah Liat Lake lies at 00°29'20" S and 112°15'48" E; elevation 0 m above sea level (asl). The size was considered small with an open system around 3 km. The dominant plants were *Hanguana malayana*, *Phragmites karka* and floating grass, and swamp forest was found along the

edge. Tanah Liat Lake was considered to be in a severe condition, since 40% of the lake surface was covered by *Eichornia crassipes*. The type of crocodile present in the lake was *C. siamensis*.

Compared to the 1995-96 survey, the habitat in Tanah Liat Lake had changed significantly. In June 2005, *H. malayana* and *E. crassipes* covered more than 50% of lake surface (Fig. 5). Local people did fishing in Tanah Liat Lake, and used many types of fishing gear, including electro-fishing. They know that electric fishing was harmful for juvenile fish, but continue to use the method as they could catch a lot of fish with this equipment.

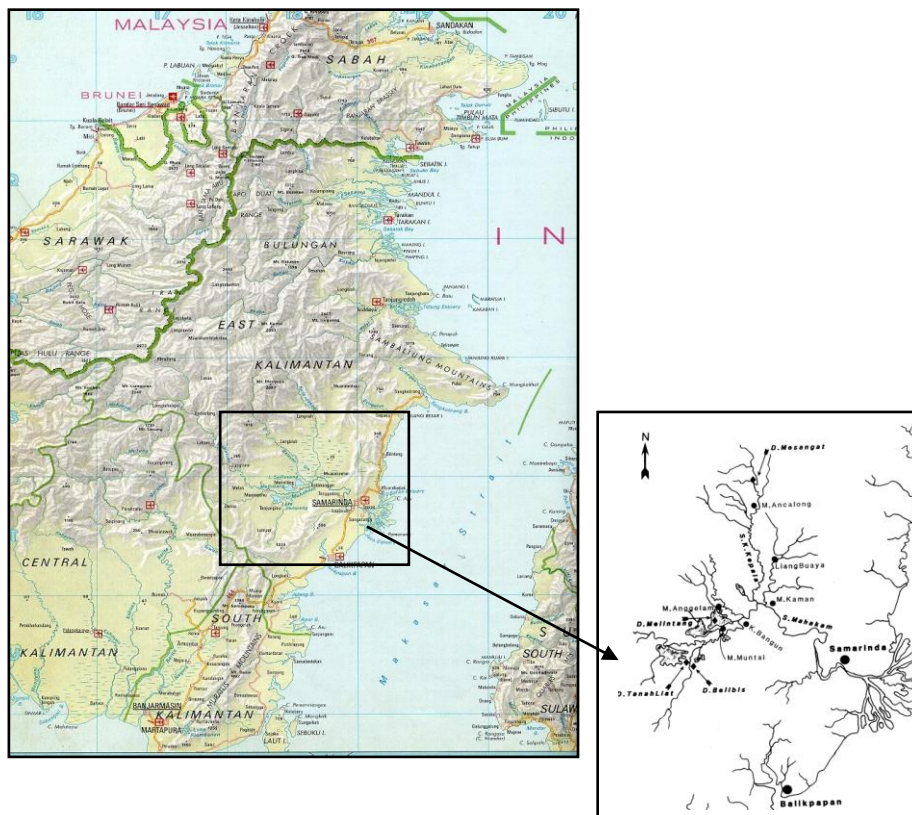


Figure 4. Site map of *C. siamensis* habitats in the lower Mahakam River system.



Figure 5. Comparison area of Tanah Liat Lake in 1995 (left; Photograph: J. Cox) vs. 2005 (right, Photograph: H. Kurniati), where the area had been covered densely with *H. malayana* and *E. crassipes*.

2. Paya River and Paya Lake

Paya Lake was originally a river, and was formed when the river became blocked by sedimentation of mud. Paya Lake lies beside Tanah Liat Lake. During the survey, Paya Lake could not be entered due to low water levels, and stopped at the mouth of the lake (00°27'13.6" S and 116°16'30.1" E; elevation 0 m asl). Based on interviews with local people, the habitat of Paya Lake was similar to the Paya River. In Paya Lake, fishermen usually found hatchling or juvenile Siamese crocodiles trapped by fishing gear such as fishhook or traditional fish trap. In May 2004, a fisherman found a *C. siamensis* nest in the lake.

3. Belibis & Amir Lakes

The Belibis Lake lies in 00° 27' 21" S and 116° 17' 04" E; elevation 0 m asl, and Amir Lake was located beside Belibis Lake. Amir Lake was formed

by sedimentation of Belibis Lake. In 1996, Belibis Lake and Amir Lake were one (Ross et al. 1998). However, sedimentation separated Belibis Lake into two parts; the new one was now known as Amir Lake. Currently Belibis and Amir Lakes could not be entered by boat or canoe except during high water levels. Local people had to walk about 100 m in muddy swamp to enter the lakes.

Based on interview with the local people, *H. malayana* was the dominant plant in the two lakes. People who lived in Bongan Village regularly went to Belibis and Amir Lakes for fishing. However, since 2002 they did not fish in Belibis Lake because *H. malayana* covers most of the water surface.

4. Mesangat Lake

Mesangat Lake lies at 00°31'06" S and 116°41'47" E; elevation 0 m asl. Swamp flora in this lake comprised

mainly *H. malayana*, *Leersia hexandra*, *Thoracostachyum sumatranum* and *Scleria* spp. Mesangat Lake was categorized as good habitat since the habitat had not been extensively damaged. However, based on the observations Mesangat Lake was not a typical lake, but was rather like a large freshwater swamp. Almost the entire water surface was covered with floating plants.

Based on interviews with local people, there were two species of crocodiles in Mesangat Lake, namely *C. siamensis* and *Tomistoma schlegelii*. During the visit to the lake, one possible *C. siamensis* nest was found. A fisherman (Bapak Yus) explained that *C. siamensis* (or Buaya Badas Hitam) usually build nests among grassy areas or *H. malayana*, whereas *T. schlegelii* (or Buaya Sapit) build nests in the forest (forest means land with many big trees). The habitat in Mesangat Lake had almost never changed. However, the number of people fishing in this lake had increased 3-fold since 1996, to about 50 fishermen.

D. THREATS

More than half of the local people in lower Mahakam River are fishermen. They knew that Siamese Crocodile habitats were a source of fish, and that floating plants were home of juvenile fish. To their knowledge, most of the habitats surveyed in 1995-1996 had not changed. Nevertheless, several threats that were gradually destroying the habitats were identified. These threats were categorized as "direct" or "indirect".

1. Direct Threats

Hanguana malayana and *E. crassipes* (water hyacinth; introduced from South America), fishing activities and mud sedimentation had been impacting *C. siamensis* habitat. Weeds were natural enemy for crocodile habitats, with the capacity to change the floral

structure considerably. The process of sedimentation was accelerated with the growth of weeds. Belibis Lake was one of the *C. siamensis* habitats where weeds and mud sedimentation had "dried up" the lake, preventing access except during periods of high water levels. Weeds and sedimentation had also been impacting on Tanah Liat, Paya, Amir and Mesangat Lakes. The number of fishermen in the Mahakam River was increasing, due to increasing numbers of villagers and also due to an influx of new people from other areas.

2. Indirect Threats

Although the Indonesian Government had closed several logging companies in the upper Mahakam River, however, illegal logging still continues. Interviewees believe that high flood levels over the last 3-4 years during the rainy season were caused by forest degradation in the upper Mahakam River. It was unclear whether there was a relationship between logging and increased flooding, but certainly increased sediment in floodwaters due to erosion might be a result of logging. This had a negative impact on the people living in the lower Mahakam River through habitat change. The Siamese Crocodile was potentially affected by this also. Floodwaters invaded human settlements and cover crocodile nests, resulting in crocodile egg mortality.

DISCUSSION

This survey confirmed previous reports (Ross et al. 1998) that Mesangat Lake consists of stable permanent water. There were no serious threats of weeds and mud sedimentation so far, although fishing pressure had increased over the last decade. Both *C. siamensis* and *T. schlegelii* were reported to be present in this lake. This lake represented the least disturbed habitat visited during the survey.

Mesangat Lake was an isolated lake, and was not affected by water flows associated with the Mahakam River. On the other hand, Tanah Liat Lake and nearby lakes received water from the river, which contains sediment, especially in the rainy season. As a result of sedimentation, large areas of water were now covered by invasive plants such as *H. malayana* and *E. crassipes*. One fisherman indicated that *C. siamensis* might use *H. malayana* for nesting, but the long-term impacts of the changes in vegetation on the habitats were unknown.

None of the principal habitats of Siamese Crocodile in the lower Mahakam River were protected. Wetland International-Indonesia Program had proposed Mesangat Lake, together with other lakes in Mahakam River system (Jempang, Semayang & Melintang), to be fully protected (Wibowo 1997). However, Forestry Department of Indonesian Government had not approved the proposal. Most of the people in the lower Mahakam River were fishermen. Numerous waterways in crocodile habitats were fished intensively with fishing nets, hooks and fish traps. These types of equipment catch hatchlings and juvenile crocodiles. The use of electro-fishing equipment might also had a detrimental effect on the crocodile population.

In Indonesia, *C. siamensis* was protected under Indonesian Law UU No. 5/1990 and PP No. 7 & No. 8/1999 (Departemen Kehutanan 2003), and all activities related to the commerce of this species were prohibited. This was not clear to local people and also to some of the local crocodile industry members. For example, Muin & Ramono (1994) reported four *C. siamensis* and six *T. schlegelii* being held by a villager at Muara Muntai Village in 1993. We interviewed a villager in the same village, who had three *C. siamensis* that he had obtained in 1995. One

villager had a crocodile that had been obtained 20 years ago, and one *C. siamensis* was caught as recently as 10 days before this survey was undertaken.

Captive breeding had not been successful at one of the farms visited, and only infertile eggs were produced (see Cox 2004). There had been limited success at another farm, but adult *C. siamensis* and *C. porosus* were housed in a common pond, and there had been hybrid offspring produced. The *C. siamensis* on the crocodile farms represent a significant source of adult stock that could be used to produce crocodiles for re-stocking, should that prove to be a strategy to adopt in the future. Care should be taken to ensure that hybridization was controlled, and if possible eliminated. The separation of adult *C. siamensis* and *C. porosus* at the farm where hybrids were encountered is a step in the right direction. Phenotypic characteristics alone were unable to separate hybrid *C. rhombifer-C. siamensis* hybrids from pure *C. siamensis* in Vietnam, and DNA testing were required to establish identity (N. Fitzsimmons pers. comm.). Genetic testing would probably be required in Kalimantan for possible future re-stocking of depleted populations.

Overall, pressure on the existing *C. siamensis* habitat was high, and it might not be easy to minimize the threats caused by activities of local people. Community based conservation was a possible conservation strategy which might be suitable for the local community in the Mahakam River area. As had been shown in other countries, long-term conservation might be depended on some form of use.

This survey had confirmed that *C. siamensis* were still present in the upper Mahakam River, and breeding still occurs. However, more detailed systematic surveys over a wider area

were required to assess the current status of the wild *C. siamensis* population.

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