Diet and demography of *Tomistoma schlegelii* in Mesangat Lake, East Kalimantan, Indonesia

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SUMMARY

Mesangat Lake is a periodically flooded wetland with distinct dry (May – September) and wet (October – April) seasons. The water levels recorded throughout the year range from 0.3 to 4 m and are suspected to play a role in the ecology the two crocodilian species living in the area. In this preliminary dry season study we aimed to assess the population size and distribution of *Tomistoma schlegelii* in Mesangat Lake, investigate the species diet and nesting preferences and test the methods used. We carried out 66 spotlight surveys and two day-time nest searches in June-September 2011, with the mean water level of 60 cm throughout the study period. We obtained stomach contents from captured *T. schlegelii* by stomach flushing. Out of 58 crocodiles spotted, we identified 45 *T. schlegelii* and 5 *Crocodylus siamensis*. Additionally, 7 *T. schlegelii* and 8 *C. siamensis* were captured by local fishermen. Of the seen *T. schlegelii* 80% were estimated to range between 50-100 cm and the average length of crocodiles captured was 80 cm (n = 20, SD = 19.5). We found invertebrate remains in the stomachs of all the *T. schlegelii* examined, and fish remains in 50% of the stomachs. We only found evidence of preying on mammals in the two crocodiles over 1 m long, supporting the notion of ontogenetic shift to larger prey in this species. In contrast to the 2010 wet season study, no *T. schlegelii* were found in the open areas with floating vegetation, suggesting habitat selection and possible movement in response to season and water level. However, unequal sampling due to poor access to some of the open areas may have confounded these results and further detailed habitat selection studies are required to confirm this hypothesis. We found one live *T. schlegelii* nest at the water's edge in Loah Preng, however it was later predated in early September. Overall, a lower number of crocodiles were spotted during the dry season (dry season = 58, wet season = 155), most likely due to limited access to many areas of the wetland. However, a much larger number of *T. schlegelii* individuals were captured (dry season = 20, wet season = 4), indicating this is the preferred season for the studies that require handling individuals.

INTRODUCTION

Tomistoma schlegelii is one of the largest (4-5 m) extant crocodilians, however due to its secretive lifestyle and cryptic colouration many aspects of the basic ecology and behaviour of this species still remain undocumented (Stuebing et al. 2006). The main natural habitat of *Tomistoma* is peat swamp forest, and adjacent wetlands (Bezuijen et al. 2001, Stuebing et al. 2006). Drainage of wetlands, conversion into agricultural land, illegal logging and forest fires have led to habitat loss and fragmentation of these natural habitats, resulting in serious threats to the long-term survival of the species (Chokkalingam et al. 2005, Auliya et al. 2006, Stuebing et al. 2006). Currently there is no global population estimate for *Tomistoma*, and their distribution is limited to Indonesia (East Sumatra, West Java and Kalimantan), Malaysia (Peninsular Malaysia, Sarawak) and Brunei. The species appears to be extinct in Thailand (Stuebing et al. 2006, M. Bezuijen, pers. comm.).

Tomistoma schlegelii is classified as 'Endangered' in the IUCN Red List (iucnredlist.org, 10.01.2012). The species is also listed under CITES Appendix I, Appendix A of the European Union Endangered Species Act and protected by the US Endangered Species Act and Indonesian and Malaysian laws.

Population studies to date (Muin and Ramono, 1994, Bezuijen et al. 1997, 2002, 2004, Kurniati et al. 2005, Auliya et al. 2006, Cox, 2006) have mainly provided data on the population locations, sizes of the few individuals caught, and some information on the location and season of nesting. However, little is still known about the key features of its ecology, such as diet, which could provide better understanding of the habitat use and show any possible effects this factor may have on the present and future conservation status of the species. The only account of *Tomistoma* diet to date was provided by Bezuijen et al. (1997) who reported that despite its moderate physical similarity to the fish-eating Indian Gharial (*Gavialis gangeticus*), *Tomistoma* in Sumatra have been found to have a much broader diet including relatively large mammals, reptiles and birds as well as small invertebrates. Anecdotal reports of *Tomistoma* preying on swimming primates also seem to suggest the species may be an opportunistic and generalist feeder (Yeager, 1991, Rachmawan and Brend, 2009). In spite of that, the species seems to pose a relatively small threat to humans, and reported attacks are extremely rare (Kurniati, 1998, Rachmawan and Brend, 2009). The diet of juvenile *T. schlegelii* in the wild is largely unknown, and based on the stomach contents of three individuals captured in Sumatra Bezuijen (2001) suspects their diet to consist mainly of small aquatic invertebrates and fish.

Little is known about the reproductive biology of *Tomistoma* and almost all the information has been gathered through observation of captive animals. Both sexes reach sexual maturity at approximately 20 years of age (at length about 3 m for females and 4 m for males) and mating can sometimes be observed in captivity (Trutnau and Sommerlad, 2006). Captive females lay 20-60 eggs in mound nests made from sand and plant materials (U. Youngprapakron, pers. comm.). *Tomistoma* eggs are the largest of any crocodilian species, usually 10 cm

long and 7.5 cm wide, with an incubation period of 70 – 90 days (Trutnau and Sommerlad, 2006). In the wild, very few *Tomistoma* nests have been documented (Bezuijen et al. 1997, 2001, 2002, 2004) and of those the majority have been described as dry vegetation mounds (about 2 m wide and 0.5 m high) built under trees near water. Protective behaviour of the female around the nest has on one occasion been observed in the wild (Trutnau and Sommerlad, 2006). However, crocodile eggs, used in traditional medicine, are still consumed by local people in Mesangat area. So far nothing has been reported about parental care, hatchling size at birth and growth of young in the wild.

The Lower Mahakam river area in East Kalimantan contains a series of large seasonal lakes, and hundreds of smaller ones, forming a wetland exceeding half a million hectares (Chokkalingam et al. 2005). This includes Mesangat Lake, located at N 00°31'06'' E 116°41'47'' at elevation of 20m asl, or less. The lake is connected to several small river inflows and backflows from both the Kelinjau and Kedang Kepala Rivers. The lake expands into a large freshwater swamp during the wet season, with its surface covered by floating natural as well as exotic vegetation. Mesangat is home to populations of two freshwater crocodilians: *T. schlegelii* and *Crocodylus siamensis*, classified in the IUCN Red List as 'Endangered' and 'Critically Endangered' respectively. The area, owned by an oil palm company, is under threat from encroaching oil palm plantations (R. Stuebing, pers. comm.).

This research arises from the need for comprehensive, quantitative studies on *Tomistoma* biology and ecology, as well as to resolve uncertainties surrounding the species' abundance and status, derived from preliminary short-term surveys in Mesangat Lake and the Mahakam River region (Muin and Ramono, 1994, Kurniati et al. 2005, Indraswari and Staniewicz, 2009).

OBJECTIVES

1. Assess the population size and crocodile distribution in the area.
   Determine whether there is habitat partitioning between the two species.

2. Obtain data on crocodile location in the dry season for comparison with wet season data and further studies of potential seasonal movements.

3. Obtain information on nesting habitat, biology, behaviour and feeding ecology of *T. schlegelii*.

MATERIALS AND METHODS

Study area

Mesangat Lake lies in the wetland between Kelinjau and Kedang Kepala Rivers and is fed by several small river backflows and inflows. These are known by the local fishermen as Mesangat, Abang, Senyun, Sekgoy and Nusa Palong rivers (Fig. 1). The area has been heavily logged since the 1970s and some of the forests around Mesangat Lake were burnt during the forest fires in 1982-83 and 1997-

98 (Chokkalingam et al., 2005). The remaining forests are predominantly peat swamp of *Lophopetalum sp.* and *Gluta wallichii*, with *Hanguana malayana* in Bakung and Loah Preng. Most of the open areas, especially in Abang and Long Balau are covered in floating mats of grasses and sedges. Additionally, exotic floating plant species: *Eichornia crassipres*, *Salvinia cucullata* and *Ipomea aquatica* cover large parts of both forested and open areas of Mesangat.

Dry season lasts from May to August, and rainy season from September to April. The water level in Mesangat varies throughout the year both within and between the seasons (Staniewicz and Behler, 2010; Fig. 3). The floating vegetation cover limits boat access to many areas, which is further restricted during the dry season when the water level drops and dry patches of peat and grass vegetation mats appear. Due to the varied thickness of peat and mud these areas are not safe to walk on.

The research raft-house is situated on Mesangat River at N 00°30'06'' E 116°41'54'' and is the last house downstream from a dozen of raft-houses used by the local fishermen. Of these, approximately half are occupied full time throughout the week.

People in Mesangat respect crocodiles and do not hunt them. Crocodiles accidentally caught while fishing are usually released immediately. According to local beliefs *T. schlegelii* is "the good crocodile" and it is bad luck to catch or kill it. However, this does not include crocodile eggs, which are used in traditional medicine and consumed by local people.

Abiotic data

Air temperature, humidity and rainfall were measured and logged using Davies Vantage Pro2 weather station installed at survey raft-house. The water level near survey raft was recorded daily from a graduated (cm) indicator erected at the site.

Crocodile surveys

We carried out 66 spotlight surveys over 44 nights in Mesangat Lake from 27th June to 7th September 2011. We used one or two boats going to different locations every night, usually between 20:00 and 02:00hrs (Fig. 1). Additionally, we conducted two nest search trips on 3rd and 10th August during daylight hours. Interviews with local fishermen provided information on nest and regular crocodile sighting locations. Furthermore, the fishermen were hired each night to help the survey teams, supplying the longboats and navigating through the forest.

In order to observe possible parental behaviour during *T. schlegelii* hatching, we set three camera traps near the nest in Loah Preng.

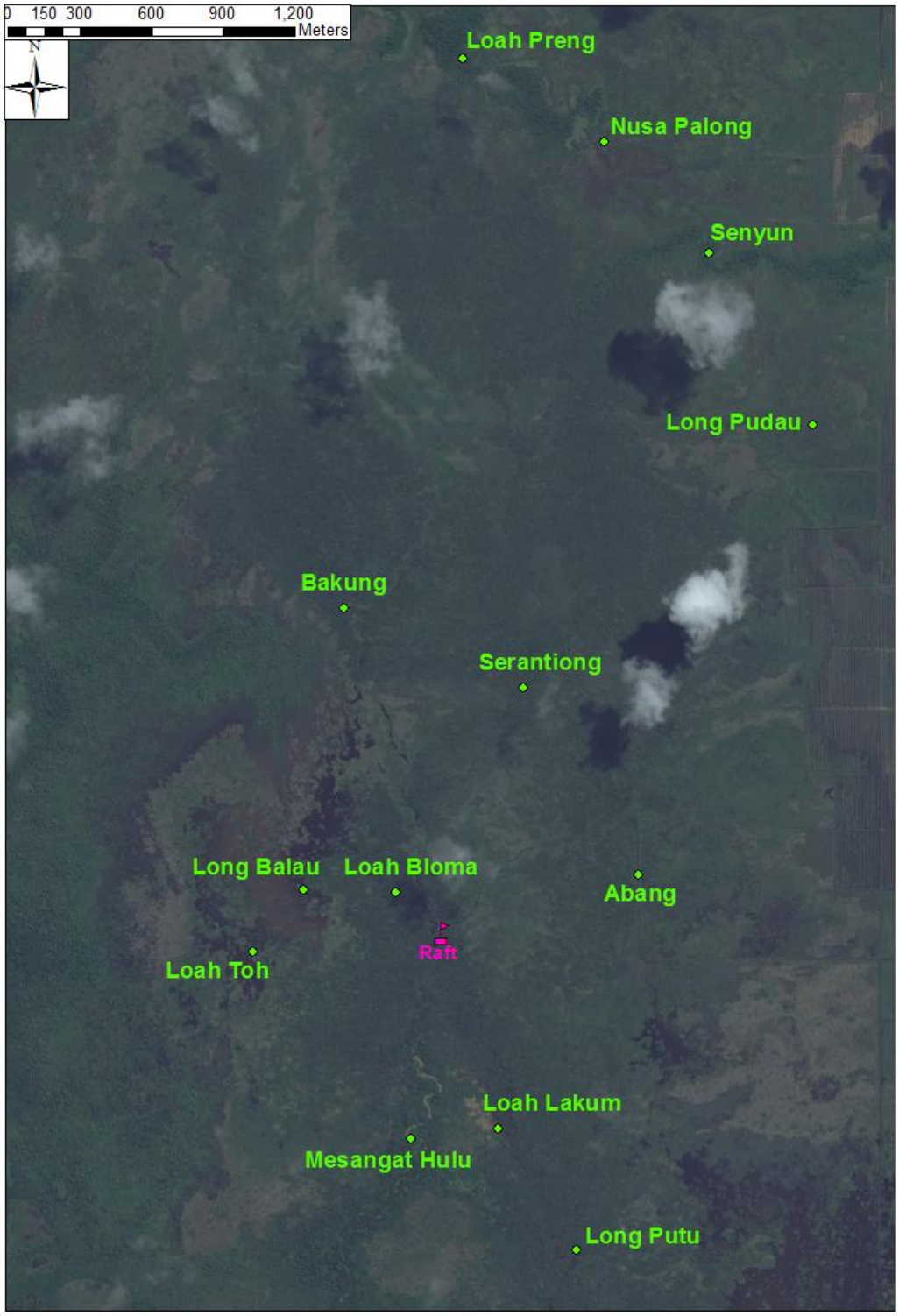


Fig. 1: Survey locations in Mesangat Lake area. Rivers with land banks: Loah Preng, Nusa Palong, Senyun and Mesangat Hulu. Flooded forest: Nusa Palong, Long Pudau, Serantiong, Bakung, Loah Bloma, Long Putu. Open areas with floating vegetation: Long Balau, Loah Toh, Loah Lakum and Abang. The research raft-house is marked in pink. (ArcMap, background satellite picture: Bing Maps Aerial).

Crocodile sighting, capture and examination

When an eye shine was spotted, the crocodile was approached and if possible captured either by hand or with a snare pole. Successfully caught animals were taken back to the raft for examination. If the crocodile escaped, it was identified to species (*T. schlegelii* or *C. siamensis*) or classified unidentified individuals as "eye shine". We also noted the GPS point, water level, habitat (type of floating vegetation, forest or open water) and estimated size of the animal (±10 cm).

All crocodiles captured during night surveys were kept on the raft overnight and released the next day at the point of capture. Standard morphometric measurements (total body length, snout-vent length, snout length, head width) to the nearest mm were taken using a measuring tape. Body mass was measured using Jason Pro kitchen scale (sensitivity 50g).

Crocodiles were individually tagged with external tags made from 2-3cm long plastic fasteners with several small (2 mm diameter) coloured beads coding the individual crocodile number. They were placed on the right posterior side of the nuchal rosette, to allow for easy spotting when the animal is in the water (Fig. 2). Additionally, one or two tail scutes (with individual number) were clipped from each animal.



Fig. 2: Colour-coded bead tag placed on the right posterior side of the nuchal rosette.

We removed the stomach contents by holding the animal vertically (head-up). The mouth was kept open using a small PVC tube held in place with rubber bands. A 6 mm flexible plastic hose was carefully inserted down through throat into the stomach, allowing for injection with about 0.5l of water from a wash bottle to suspend and lubricate passage of food contents (Stuebing, pers. comm). When the stomach was noticeably expanded, the crocodile was inverted over a bucket and its stomach squeezed gently to force out water containing the stomach contents. We repeated the process until only clear water came out. Stomach contents were preserved in 5% formalin and later analysed.

Seven *T. schlegelii* were captured by the fishermen during night time fishing. The animals were brought to the raft and examined on the night of capture. The fishermen were paid compensation for each animal (Rp 20,000; approx. US$ 2).

Stomach contents analysis

Preliminary stomach content analysis was carried out in the Yayasan Ulin office in Belayan. We separated the contents and categorized it into 'land invertebrates' (insects and spiders), 'fish', 'amphibians', 'mammals' and 'plants'. We measured the total wet mass of prey items using a Radwag WTB 2000 lab scale (sensitivity 0.01g).

RESULTS

Abiotic data

The water level ranged from depth of 110 cm to 30 cm over the period of the study (Fig. 3). The mean temperature was 26.6 °C, with mean high temperature 34.9 °C and mean low 22 °C (Fig. 4). Total rainfall measured from 22 July until 8 September was 123 mm (July: 20.2 mm, August: 39 mm, September: 63.8 mm). Mean water temperature was 28 °C.

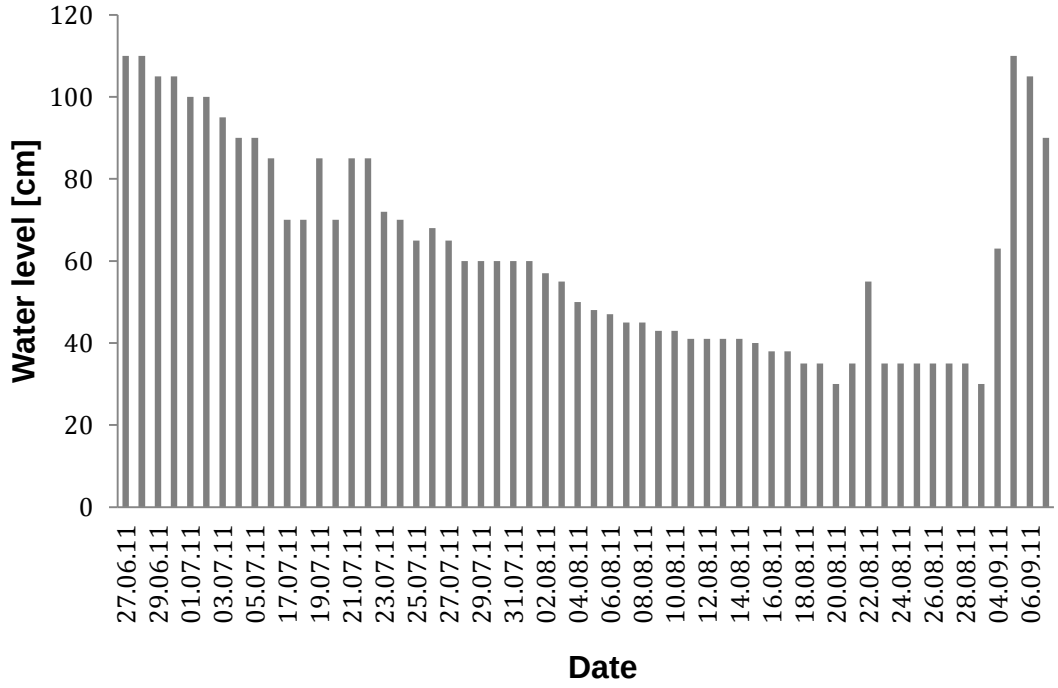


Fig. 3: Water level measured at the Mesangat raft-house between 27 June and 7 September 2011.

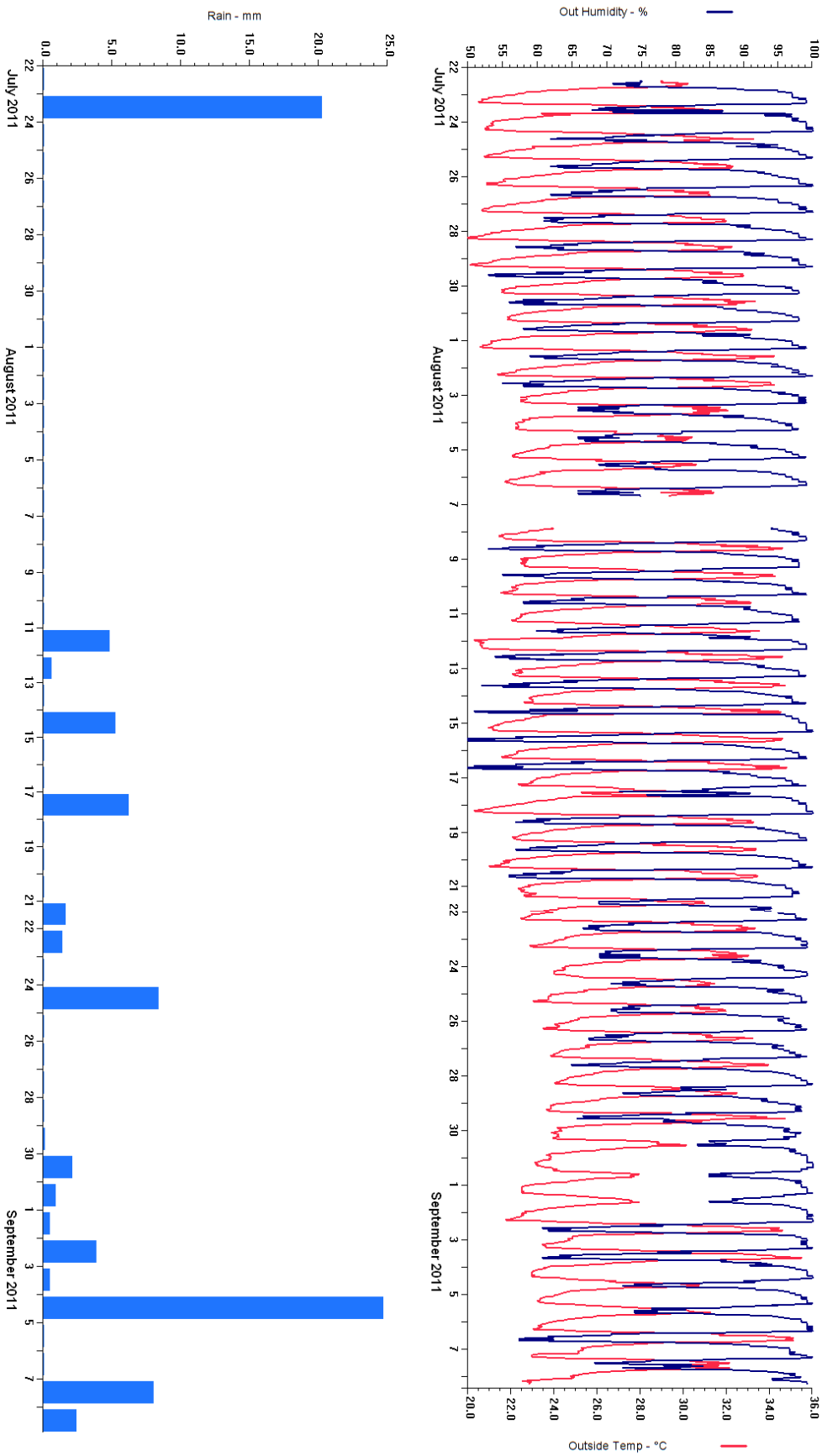


Fig. 4: Air temperature, humidity and rainfall measured at the Mesangat raft-house between 22 July and 8 September 2011.

Crocodile distribution and demography

A total of 58 eye shines (ES) was recorded during night surveys, of which 5 were identified as *C. siamensis* and 45 as *T. schlegelii.* Additionally, 8 individuals of *C. siamensis* and 7 *T. schlegelii* were caught by local fishermen during the survey period. Three *T. schlegelii* were recaptured throughout the study period. None of the four *T. schlegelii* individuals captured and marked in 2010 were seen or recaptured during the study period.

All *T. schlegelii* were spotted in Mesangat and Nusa Palong rivers or in the peat swamp forest, whereas *C. siamensis* were mainly seen in floating grass mats in Abang and Long Balau (Fig. 5).

Body length of the observed animals was estimated whenever possible, based on the snout length or the full body length seen. Estimated sizes of 53 crocodiles identified to species, including crocodiles captured and measured, were classified into size ranges (Fig. 6). The median body length of the captured *T. schlegelii* was 78 cm. The median estimated size of observed *T. schlegelii* was 80 cm, same as of *C. siamensis*. All captured crocodiles were juveniles. An adult *Tomistoma* was found near the nest in Loah Preng.

20 *T. schlegelii* individuals were captured during the survey period (Table 1). Out of those, four (20%) were subsequently recaptured.

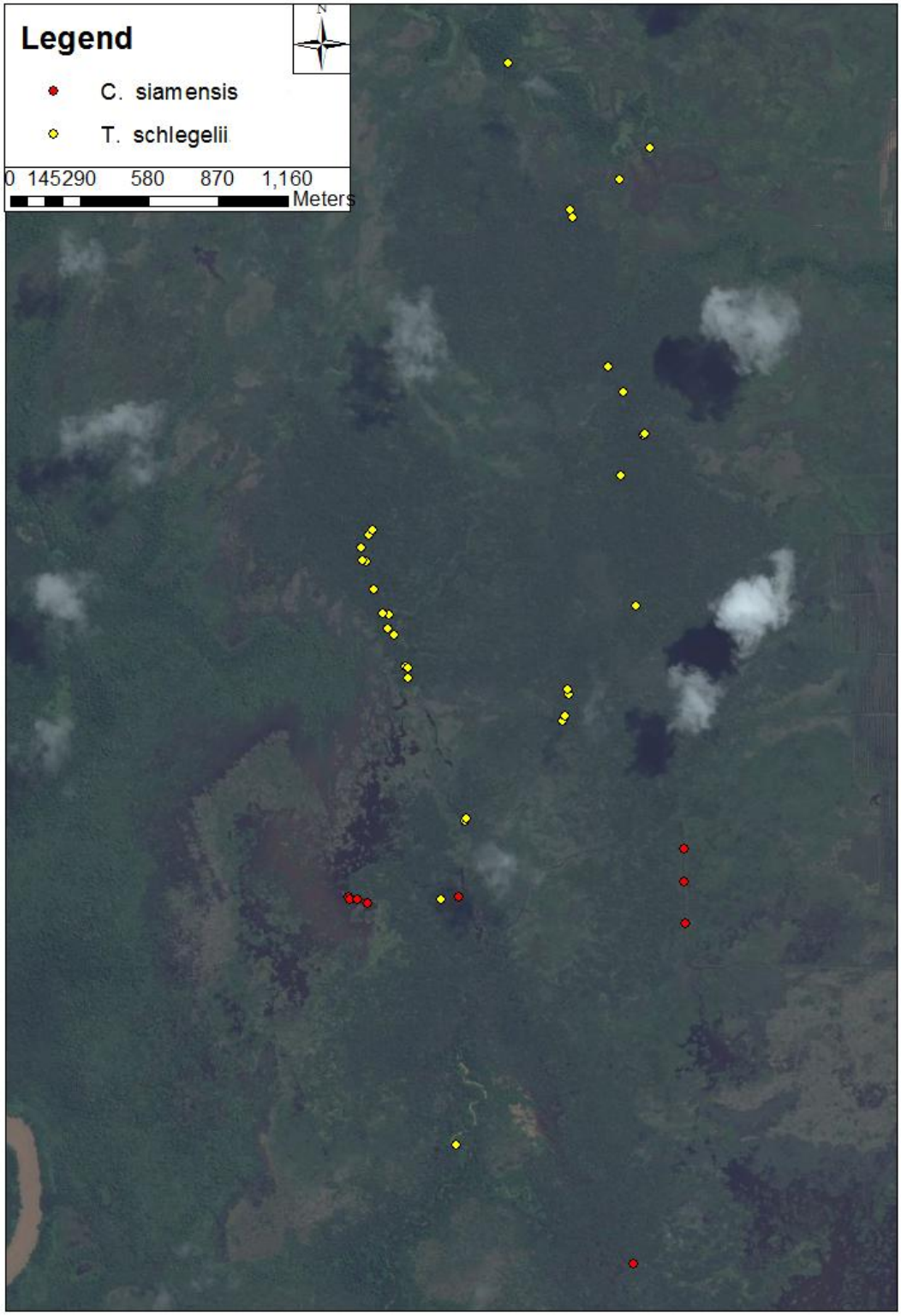


Fig. 5: General distribution of crocodiles in Mesangat Lake area in 2011 (ArcMap, background satellite picture: Bing Maps Aerial).

Table 1: Morphometric measurements of captured *T. schlegelii*.

Date	Name/Tag	Location	SL [cm]	SVL [cm]	TL [cm]	HW [cm]	BM [g]
03.07.11	Albert/26	Serantiong	14.5	37.3	36.7	3.1	650
03.07.11	Borys/27	Serantiong	10.2	29	29.1	2.6	300
25.07.11	Charlie/28	Loah Bloma	11.4	29.3	31.3	2.7	450
27.07.11	Diego/30	Loah Bloma	17.5	44	42.6	3.5	1150
03.08.11	Eric	Long Pudau	23.3	63.9	60.4	5.1	4600
03.08.11	Felix/37	Serantiong	17.5	47	45.1	3.7	1400
03.08.11	Grażyna/32	Loah Bloma	13.1	34.1	33.7	2.9	500
03.08.11	Horacy/36	Loah Bloma	10.2	25	26	2.6	200
06.08.11	Igor/38	Bakung	13.5	37	37.9	3	850
17.08.11	Janeczka/40	Bakung	19	49.1	51.4	4	1950
17.08.11	Kisiel/39	Bakung	21	56.7	54.3	4.2	2500
20.08.11	Lucek/41	Bakung	14.9	39.6	39.4	3.2	750
21.08.11	Mouthie/42	Bakung	12.7	31.3	30.5	2.9	400
23.08.11	Norman/43	Bakung	10.3	25.9	25.8	2.5	150
23.08.11	Oscar/47	Bakung	15.5	39.5	37.5	3.2	700
25.08.11	Peanut/48	Bakung	18.6	47.3	46.5	3.8	1300
03.09.11	Quentin	Bakung	12.5	32.4	34.1	3	600
04.09.11	Rudolf/22	Bakung	18	46.5	47.3	3.8	1350
04.09.11	Sylvia/23	Bakung	17	42.7	41.7	3.5	950
06.09.11	Tuco/24	Bakung	17.8	46.3	45.5	3.7	1400

Snout Length (SL), Snout – Vent Length (SVL), Tail Length (TL), Head Width (HW), Body Mass (BM)

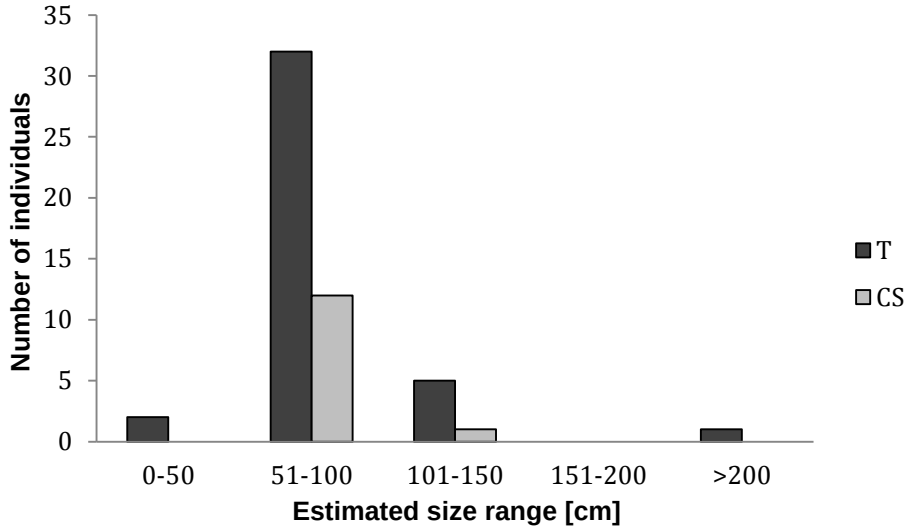


Fig. 6: Estimated sizes of 40 identified *T. schlegelii* (T) and 13 *C. siamensis* (CS) observed or captured throughout the survey period.

Diet

Tomistoma stomachs contents contained different prey items, including vertebrates, invertebrates and plant material (Table 2). All individuals examined

had insect or arachnid remains in their stomachs, classified together as 'land invertebrates'. Fish remains were found in 50% of the animals. Only the two individuals of more than 1 m total length had mammal remains in their stomachs. Plant material was found in 55% of the animals examined. Three animals examined had nematode parasites in their stomachs.

Table 2: Preliminary analysis of stomach contents of captured *T. schlegelii*. WM – wet mass [g] of the stomach contents extracted; *data not available.

				Stomach contents				
N/Tag	TTL [cm]	BM [g]	WM [g]	Land invertebrates	Fish	Amphibians	Mammals	Plants
H/36	51	200	14.84	x		x		
N/43	51.7	150	0.83	x				x
B/27	58.1	300	0.57	x	x			x
C/28	60.6	450	5.26	x	x			x
Q	66.5	600	*	x	x			x
G/32	67.8	500	2.38	x	x			x
A/26	74	650	0.30	x				
I/38	74.9	850	0.18	x				x
O/47	77	700	1.05	x				
L/41	79	750	1.82	x	x			
S/23	84.4	950	*	x	x			x
D/30	86.6	1150	7.25	x	x			x
T/24	91.8	1400	*	x				x
F/37	92.1	1400	0.07	x				
P/48	93.8	1300	0.56	x				
R/22	93.8	1350	*	x	x			x
J/40	100.5	1950	4.79	x	x		x	
K/39	111	2500	14.91	x			x	

Tomistoma eggs and nest discovery

A fertile *T. schlegelii* egg from a nest raided by the fishermen was given to us upon our arrival in June (Table 3). The egg had a 3 cm white band, suggesting it was between one to five weeks old (Simpson, 2006). We discovered an occupied *T. schlegelii* nest on 3 August 2011 in Loah Preng and a large *Tomistoma*, most likely the female, was heard escaping into the water upon our approach. The nest was a 2.27 m basal diameter and 0.55 m high mound composed of dried leaves and vegetation, built at the base of a tree 4 m from the water's edge (Fig. 7). The water was overgrown with *Hanguana malayana*, which probably provided cover for the adult crocodile. Large slide marks were visible on two sides of the bank next to the nest, with foot prints 15 cm and 12 cm long. The nest was later found pulled open in early September, with shell remains scattered around, suggesting it has been raided by an animal, yet we found no photos of this event on camera traps. We recovered one intact egg from the site (Table 3).



Fig. 7: *T. schlegelii* nest found in Loah Preng.

Table 3: Dimensions of *T. schlegelii* eggs recovered from destroyed nests: one raided by people before our arrival and the nest found in Loah Preng.

Date	Origin	Length [cm]	Width [cm]	Circumference [cm]
29.06.11	Raided nest	9.5	5.6	18.7
10.09.11	Loah Preng nest	9.3	6.2	17.5

DISCUSSION

Crocodile distribution and demography

T. schlegelii were only found in areas with flooded forest or in rivers with dry banks, while most of *C. siamensis* were in open areas with floating vegetation in Abang and Long Balau. This provides some evidence for space partitioning between the species, consistent with literature and results from the preliminary study during the rainy season (Stuebing et al. 2006; Cox and Photitay, 2008; Staniewicz and Behler, 2010). However, the effects of water level on the habitat selection are not clear due to restricted boat access to many open areas and thus unequal sampling between the habitats, with majority of the surveys carried out in the flooded forest. Additional effects of water level and the crocodile age on habitat preference also need to be considered. Current results suggest low water level conditions increase the space division between *T. schlegelii* and *C. siamensis,* which unlike during the rainy season surveys, were only found in different locations. A quantified habitat preference study is needed to for both species to identify key crocodile conservation areas in Mesangat Lake.

The 20% recapture rate throughout the study period most likely reflects the limited area of flooded forest accessible by boat in which most survey efforts were concentrated. As no marked animals from the 2010 study were recaptured

it is difficult to obtain reliable population size estimates at this point. Crocodile density calculated from survey transects and DISTANCE sampling (Buckland et al., 2001) should be used in addition to mark-recapture to obtain population size estimates.

Furthermore, all the captured animals were juveniles and means of catching subadult and adult *T. schlegelii* need to be developed in order to determine the size of the Mesangat Lake breeding population. The number of animals caught during the study indicates low water level as most favourable conditions for capturing *T. schlegelii.* The species prefers to rest on the bottom in blackwater rivers and streams, so can be easily caught if the water is low enough to allow visibility.

All *T. schlegelii* captured were juveniles, with median size 78 cm. Since no animals measured and marked in 2010 were recaptured in 2011, direct growth rates data are not available. However, no animals below 50 cm total length were seen throughout the period of the study. As the median body length of *T. schlegelii* captured in 2010 was 44 cm (Staniewicz and Behler, 2010), the growth rate of hatchlings over the 8 month period can be expected to be about 10 cm. Crocodilian growth rates vary between individuals and depend on age, sex, and many environmental factors including temperature and food availability (Chabreck and Joanen, 1979; Pérez and Escobedo-Galván, 2009), thus it is difficult to accurately determine the age of *T. schlegelii* captured and measured in 2011. Moreover, there are currently no data on wild *Tomistoma* hatchling size at birth. Future surveys and recaptures of animals marked during this study will allow us to determine and model growth rates of wild *T. schlegelii* in Mesangat and estimate age of individuals more accurately (Eaton and Link, 2011). The data will then be used to estimate survival rates and model population viability in the area.

Nesting

The presence of nests and eggs found confirms the nesting period reported by the local fishermen as May – August, with hatching in September – October. The nesting habitat was similar to that described in previous reports (Bezuijen et al. 1997; 2001; 2002; 2004). Since the adult crocodile fled the nest site upon our approach and was not spotted again, there is little evidence present for parental care in *T. schlegelii.* However, as the species is naturally shy, presence of a group of people may have forced the animal from the nest area.

Both nests from which eggs were recovered have failed, one raided by wild animals and the other by humans. Estimating nest success rate in Mesangat may not be possible, as help from the local people who find crocodile eggs valuable in traditional medicine is necessary to locate crocodile nests. Implementing a head-starting or nest-guarding programme that compensates local people for successfully hatched nests may help decrease the pressure of increased human presence on *T. schlegelii*.

Diet

Prey items found in *T. schlegelii* stomach were predominantly insects and small fish, related to the crocodile body size and consistent with the data from 2010. Crocodilians show ontogenetic shift in prey choice (Taylor, 1979; Magnusson et al., 1987; Tucker et al., 1996; Borteiro et al., 2009) and evidence for this trend is also visible in Mesangat *T. schlegelii*. Prey items identified in stomach contents ranged from only invertebrates in 40-45 cm long crocodiles, to fish and mammal remains in 70-80 cm and 100 cm long animals respectively, suggesting the species is an opportunistic feeder. However, more data from larger animals are still needed to determine the feeding preferences of adult *T. schlegelii* and the potential uses or limitations of its snout morphology in peat swamp forest environment.

In contrast to 2010 surveys, *T. schlegelii* and *C. siamensis* found were of similar body size (Behler, 2011 – unpublished data) and occurred in different habitats. This may suggest competition between the species. Preliminary results indicate the stomach contents wet mass of *C. siamensis* was greater than of *T. schlegelii*, which may be caused by the habitat differences, behavioural differences and/or different snout morphology. Further studies comparing the diet of both species are still needed.

Benefits for Indonesian development programme

Valuable information, knowledge and cultural exchange between local people, visiting researchers and staff of Yayasan Ulin will facilitate development of conservation management plan for Mesangat beneficial to both the crocodiles and local community. Additionally, local people benefit financially from supporting research activities in the area and future plans for head starting, nest guarding and eco-tourism projects would provide further profits for the local communities, while also promoting conservation.

CONCLUSIONS

The two crocodile species living in Mesangat are found in different habitats, *T. schlegelii* in the flooded forest and *C. siamensis* in open areas with floating vegetation. Using radio-telemetry can help determine the preferred habitat and range of individuals from both species, as well as provide information on possible seasonal movements and the effect of environmental factors, such as water level or moon phase, on crocodile activity in Mesangat.

T. schlegelii appear to be opportunistic feeders. Competition between species is unclear as dietary differences are visible; however more samples from larger individuals are still required.

Crocodile nests are raided by wild animals and local people and nesting success can be increased by implementing a head-starting or nest-guarding programme involving the local community.

In terms of fieldwork activity, dry season with low water level is the preferred time for *T. schlegelii* captures, but habitat and *C. siamensis* surveys should be

carried out with higher water level (>1 m), that enables access to more areas. Additionally, surveys in Sekgoy river, which has been inaccessible so far but is reported to have large crocodiles, need to be carried out.

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FINANCIAL OVERVIEW

IUCN SSC/CSG Student Research Assistance Scheme Grant: 1,000 USD
IUCN SSC/CSG Grant: 3,100 USD

Category	Item	Date	Price (USD)	Original price	Receipt number
Equipment	MDC Exports Heavy Duty Dog pole, 1m	02.06.11	142.18	89.78 GBP	1
	LED Lenser H7R headlamp/spotlight	15.07.11	66.08	50.77 EURO	2
Visa/Permit	RISTEK Research Permit fee	16.06.11	150.00	150.00 USD	3
	Police Registration fee	20.06.11	10.88	100,000 IDR	4
	Immigration Registration card	16.06.11	44.08	405,000 IDR	5
	Embassy visa fee	06.06.11	79.18	50 GBP	6
Local transport	Garuda flight Jakarta - Balikpapan	22.06.11	185.43	1,704,000 IDR	7
	Garuda flight Balikpapan - Jakarta	06.09.11	82.50	758,000 IDR	8
Hotel accommodation	Hostel Wisma Tujuh, Jakarta	14-22.06.11	250.75	2,300,000	9
	Swiss-Belhotel Borneo Samarinda	22-24.06.11	90.52	830,780 IDR	10
	Hotel Istana Ratu Jakarta	09-11.09.11	54.48	500,000 IDR	11
Field costs	Yayasan Ulin: field accommodation, food, boat rental and transport	26.06-09.09.11	2,861.10	2,861.10 USD	12
International transport	Emirates return flights London-Jakarta	13.06/11.09.11	849.82	536.51 GBP	13
TOTAL			4,867.00		

Conversion rate (according to www.xe.com, 16.04.2012):

USD	Currency
1.52	1 GBP
1.30	1 EURO
1.08	10,000 IDR