Captive Management of Sumatran rhinoceros (*Dicerorhinus sumatrensis*) Tabin Wildlife Reserve

September - October 2016

Paddock Staff

1. Wilson Kuntil (Head Keeper)
2. Justine Segunting (Rhino Keeper - RIF)
3. Marikus Suyat (Rhino Keeper – RIF)
4. Samat Gubin (Rhino Keeper – RIF)
5. Ronald Jummy (Rhino Keeper - RQF)
6. Joseph Stimon (Rhino Keeper - RIF)
7. Rasaman Jaya (Rhino Keeper - RQF)

* RQF: Rhino Quarantine Facility
RIF: Rhino Interim Facility

Sumatran Rhinoceros

No.	Animal ID	Sex	Accession No
1.	Kretam	Male	SWD 002
2.	Puntung	Female	SWD 003
3.	Iman	Female	SWD 004

1. Introduction

Throughout the month of September 2016, the total rainfall fell to a low 102 mm. Rainfall was recorded on ten days, ranging from 5 – 16 mm. The total rainfall for 2016, ending 30th September, stands at 3,601 mm. However in October 2016, rainfall showed an increase trend with a total of ten days of rain over a 16 day period. The total rainfall was 137 mm, with rain mostly in the evening and night (KL – Kepong Sabah Sdn. Berhad, Ladang Tungku, September – October 2016 Rainfall Data). The wet season was excellent for rhino food plants and water supply. However, it also coincide with frequent visits by elephants and occasionally disruption of water supply. This occur whenever the poly pipes supplying water were damaged by elephants (Plate 1).

Plate 1. Sabah Wildlife Department staff repairing the poly pipe connector that was dislodged by elephants.

Water and electricity disruption was very bad for the month of September – October 2016. Currently electricity is limited to four hours in the day and 12 hours at night to 6 am. The gravity water problem were associated with the intake pipe system.

Similarly, the generator at the Rhino Quarantine Facility is spoilt once again, after two month of use. This is the fourth time the generator is being repaired. Apart from the staff welfare, the cleaning of the rhino night stalls are also affected.

The body score of Kretam, Iman and Puntung is maintained at 2.5 to 3.0 with very minor fluctuations within the month. All three rhinos showed increased in body weights and are healthy.

Iman showed a significant increase in body weight from August through October 2016. Her diet will be adjusted once again to try

and maintained her weight at between 520 – 530 kg. Currently, there was no serious bleeding from her uterine tumours and her behavior and appetite are normal.

Meeting with the staff were carried out at least four times a month, mainly to resolve immediate problems including rhino welfare and staff activities. Meetings were also held to discuss preparations for the Advanced Reproductive Technologies program.

2. Husbandry

2.1 Animal Management

All three rhinoceros are healthy and there was no management or welfare issues. With the onset of rainy season in October, there would be no issues of wallows in the paddocks. However, keepers must keep watch to ensure that wallows are not filled up with too much water.

Puntung was scanned at least twice weekly and her ovarian activities monitored and correlated with serum progesterone and behavioral estrus. Her estrus serum was collected for use with the maturation media for the oocytes. The ovum-pick-up (OPU) and *invitro* fertilization will be carried out in mid-November 2016. Puntung will also be given a synthetic GnRH analogue (Deslorelin) in a slow release implant to induce ovulation prior to the OPU procedure (Plate 2).

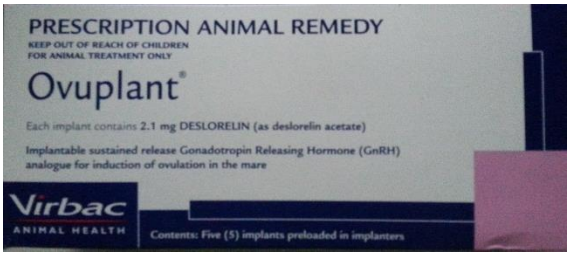

Plate 2. Synthetic slow release GnRH analogue to shorten estrus period

Iman's problem of hoof cracks and chippings on all four feet was resolved. The oral biotin supplement was stopped on the 15th September 2016. It took about six month to resolve. Currently, a rubber mat is placed in her chute as she spends about 4 – 6 hours inside it for her daily feeding.

Puntung was also observed for signs of estrus as reflected by Kretam's interest in her. This usually occurred by the fence and or at her night stall.

2.2 Body Weight

All the rhinos (except Iman) were weighed at twice monthly (15th and 30th) using an electronic weighing scale (TruTest®). The platform and load bar were placed inside the chute and the animal coaxed with food to stand on the scale. The rhinos were weight several times and averaged out and later tabulated (Figure 1).

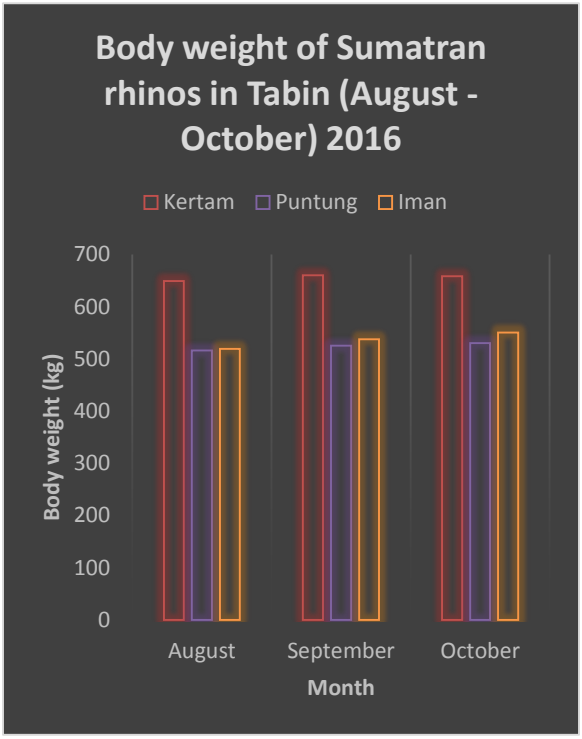

Figure 1. The body weights of all the rhinos (August – October 2016)

The body weights of the two female rhinos showed an increasing trend since August 2016. Iman and Puntung increased in body weight by 31 kg and 14 kg respectively over a period of three months. A slight drop of 2 kg in body weight was observed in Kretam.

Iman's body weight was observed to increase beyond the expected limits, reaching 550 kg (Figure 2). Her diet supplement (horse pellets) will be adjusted to lower her weight to between 520 – 530 kg in the next few month.

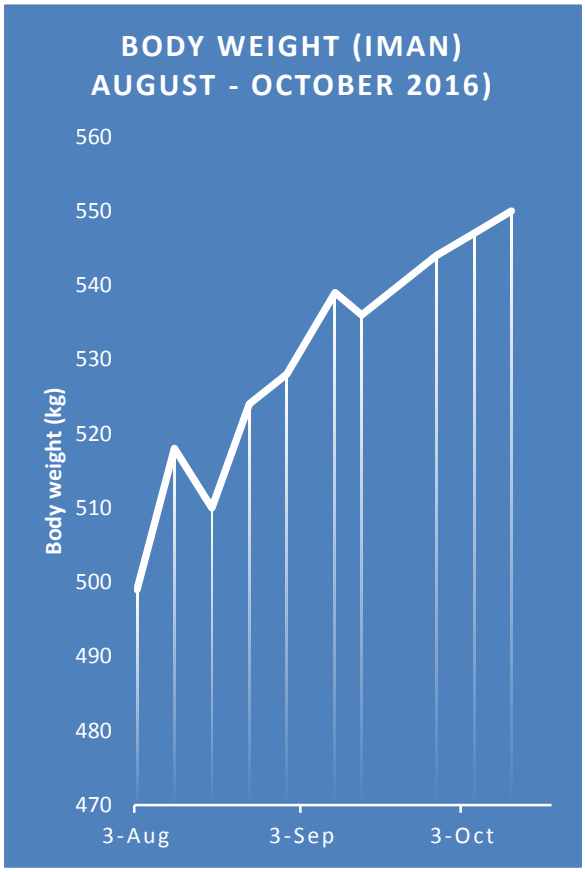

Figure 2. Fluctuation of Iman's body weight (August – October 2016)

The amount of concentrates (Horse pellets – Gold Coin®) will be reduced to 500 grams starting end of October 2016. Although, with the increased body weight, Iman does not show any discomfort from her tumours and cysts.

2.3 Animal Health

Throughout the month, all three rhinos are in excellent condition and showing good responses to previous treatments. Kretam had a hoof chip on his right hind. The successful treatment regime that was initiated for Iman was replicated for Kretam. The hoof problems in Iman had resolved completely through oral and topical medication.

The appetite, body weight and behavioral parameters are within the normal range. Some minor cuts and abrasions were just sprayed with Povidone (Septidine®) or not treated (Plate 3).

Plate 3. Treatment of minor cuts and abrasions on the inter-digits of Kretam

Iman is still being monitored daily for signs of a bloody vaginal discharge and anaemia.

2.3.1 *Kretam*

a. Lacerations

A small laceration is seen on his left front feet, between digit 1 and digit 2. The foot pads are sometimes seen to slough off but

are only treated if it goes beyond the dermis. The wounds were cleaned or sprayed with water followed by Povidone (Septidine®). This is done twice daily and monitored.

b. Hoof chipping

The hoof of digit 1 on the right hind leg showed a small area that was chipped off. The treatment comprised 10 grams of oral biotin supplement, Hoofmaker TM®, incorporated in fruit (Plate 4). The chipped area is also cleaned with water and Stockholm tar painted over it.

Plate 4. The biotin supplement is added into a banana and fed to the rhino.

c. Low sperm quality

This was diagnosed during the previous electro ejaculation on 25th June 2016. It was suggested that Kretam be supplemented with beta carotene and Vitamin E to boost his fertility before the next electro ejaculation. A total of 50 grams of Vita – E Plus is added to the horse pellets and fed to Kretam each morning, starting on the 18th September 2016.

The supplementation did show a positive response in Kretam with regards to frequent exposure of penis and erection (Plate 5).

Plate 5. Exposure of penis and erection seen when Kretam was inside the chute.

2.3.2 *Puntung*

a. Abrasions

It's common to see Puntung coming back with some areas of redness or abrasion around the lateral aspect of her tail base. These were usually untreated. Biting flies still cause some minor bleeding from the bite site.

b. Reproductive tract pathology

Ultrasound were conducted on Puntung regularly (at least twice a week) and assessments made on the status of her uterine pathology, particularly the cysts and some areas of fibrosis or tissue mass which is echogenic. The cysts varies in size from 4 to >20 mm in diameter and are located in the uterus and uterine horns. Some of the cysts are multilocular and few are fused. There were also some cysts adjacent to the right ovary (Plate 6a and 6b).

Plate 6a. The multilocular cysts observed in the uterus

Plate 6b. A cyst (CY) near the right ovary

These pathologies did not seemed to cause any discomfort or affect her health. Her two ovaries are functioning normally and she still comes into estrus once a month or between 21 – 28 days.

2.3.3. *Iman*

a. Vaginal discharge

The vaginal discharge observed was thick, copious, whitish – yellowish coloration. It is not frequent and rarely in large volumes. The amount seen is between 20 – 40 ml and sometimes seen just after she defecated (Plate7).

Plate 7. Vaginal discharge from Iman as seen on the rubber mat, just after defecation

The last and third Improvac® (Gonadotrophin Releasing Factor) vaccine was given on the 26th June 2016. The effect has dramatically reduce the discharge volume and bleeding. Currently she has two follicles on her left ovary and none on her right.

c. Reproductive tract pathology

Iman's reproductive pathology consisted of cysts, fluids, leiomyomata and hydrosalpinx that are distributed from the cervix to the oviduct. The fluids and edema could be seen during the ultrasound examination. These pathologies are not improving or resolving with time and presumably getting worse. Areas showing high echogenicity or

hyperchoic structures could also be seen in the uterus. The hydrosalpinx in the right oviduct measured 3.8 cm in diameter and is anechoic due to the fluids inside (Plate 8).

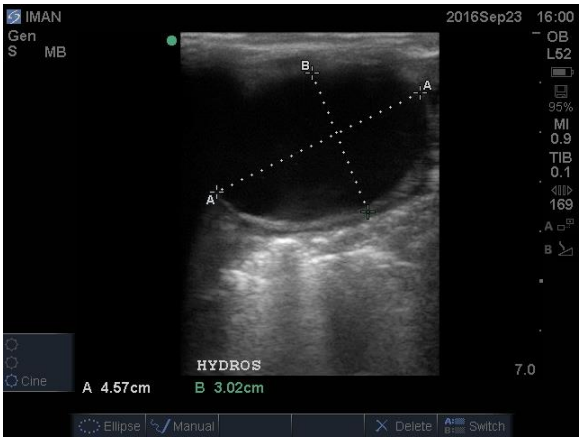

Plate 8. The hydrosalpinx located inside the right oviduct

There were several uterine tumours or leiomyomas and ranged from 2 cm to > 7 cm in diameter and is seen as hypoechoic structures or mass in the uterus and uterine horns (Plate 9).

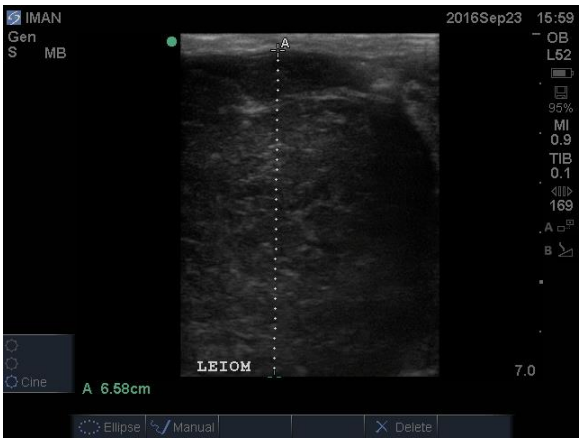

Plate 9. A large leiomyoma occupying the entire width of the uterus.

The cysts, both unilocular and multilocular could be seen in the uterine body and uterine horns. They measured between 0.5 to more than 2.0 cm in diameter and are sometimes located near a leiomyoma (Plate 11).

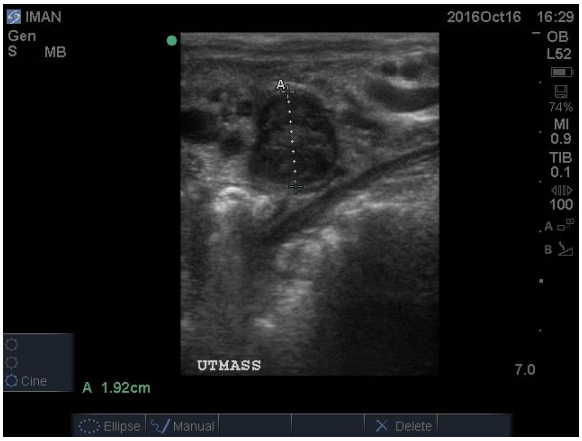

Plate 11. The cysts as observed near a leiomyoma

The cervix could be seen as edematous and the annular folds are not intact as compared to Puntung. The areas are a mix of hypoechoic and hyperechoic structures (Plate 12).

Plate 12. The ultrasound image of the cervix showing the annular folds

b. Hoof cracks

The oral supplement, Hoofmaker TRM® was stopped on the 15th September 2016 after about six months. The hooves healed completely. All topical treatments of the

hoof cracks were discontinued. She will be monitored for any signs of recurring problems.

Feed and feeding

The total amount of browse collected by the BORA keepers for the month of September – October 2016 was 5623 kilograms. These were mainly collected from the fringes along the Tabin road and forest fringes within the oil palm plantations (KL – Kepong Sabah Sdn. Bhd and Tradewinds). A total of 65% of the foliage offered, were eaten by the rhinos. The amount consumed by each individual is represented in Figure 3.

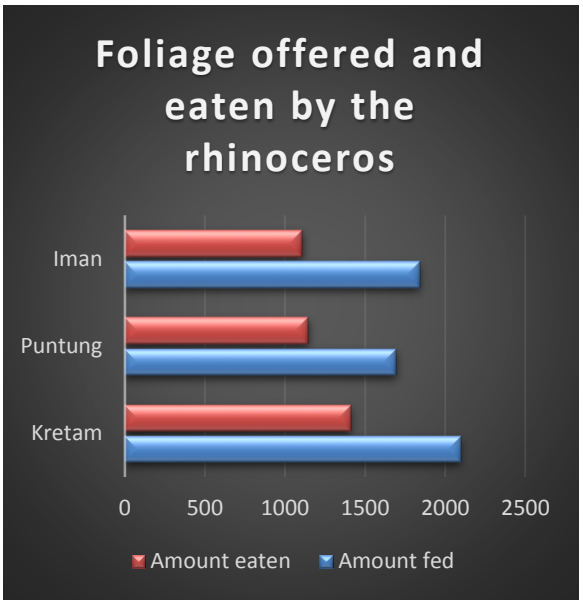

Figure 3. The amount of food plants eaten by the rhinos each month

The number of species collected in daily ranged from 8 to 17, with an average of 14 species. The most common includes *Ficus spp*, *Artocarpus spp* (mainly *A. heterophyllus*), *Merimia spp, Uncaria spp, Neonauclea spp* and *Leucosyke capitellata*. The rhinos were supplemented daily with concentrates (horse pellets, Gold coin®) that was mixed with water and fed as boluses. Kretam and Iman received 500 grams daily while Puntung was given 400 grams. Iman was given 1000 grams daily until the 24th of September 2016 where it was reduced to half. This is to try and maintain her body weight at around 520 – 530 kg. Currently, her bodyweight is 550 kg.

All rhinos received a 5 - 6 kg of banana or papaya daily. Usually, half were given in the morning and half in the evening. Papaya are sometimes hard to get and was only given if it's available. In addition they were also fed pumpkins daily (500 grams each for Puntung and Kretam). Iman gets 2 kg of pumpkin daily. Additional banana or jackfruits were fed to the rhinos for veterinary procedures including blood withdrawals and ultrasonography. All of these fruits were also used in administering oral medication, especially Hoofmaker TRM®.

The Voluntary Feed Intake (VFI) for Kertam, Puntung and Iman ranged from 31 – 40.5 kg (μ=37.6 kg), 21.5 – 36.5 kg (μ= 30.1 kg) and 15.5 – 32.5 kg (μ= 31 kg) respectively. Puntung did not return on seven occasions for her morning feeding and once in the evening. Kretam came back for both feedings and Iman was absent on one evening feeding.

3. Biosecurity and health monitoring

The emphasis in rhino management is preventing disease occurrence. The main focus is identifying the threats (pathogens) and removing it from the environment. Sampling of soil from around the night stalls, water from the water tanks, samples from tyre baths, soil from the wallows, floor swabs from the night stalls and feed samples were carried out routinely once a month.

Subsequently blood, urine, and feces from the three rhinos were also taken for health evaluation. These were taken to the Kepayan Veterinary Diagnostic Laboratory in Kota Kinabalu for analysis and isolation of pathogens.

4.1. Hematology

Blood were collected from Kretam and Puntung for complete blood count. All parameters (haemoglobin, packed cell volume, red blood cells and white blood cells) were within normal range as compared to baseline data from captive Sumatran rhinos. There were no blood protozoa isolated from the samples (Table 1).

Table 1. Complete blood count (CBC) for Puntung and Kretam

Parameters	Puntung	Kretam	Iman
Hemoparasites	neg	neg	
RBC (X10^12/L)	4.2	5.75	
WBC (1000/ul)	9.25	7.9	
Hb (g/dl)	11.4	15.8	
PCV (%)	34	44	
Seg. Neutrophils (%)	69	55	
Eosinophils (%)	7	24	
Lymphocytes (%)	16	19	
Monocytes (%)	8	1	
Basophils (%)	0	1	

Bacteriology

The horse pellets (Gold Coin®) were negative for pathogens. The laboratory in Kota Kinabalu could not do fungal isolation. In the future, it would be essential to analyze the horse pellets for fungal contamination.

All 17 soil samples were negative for *Bukholderia pseudomallei*. Similarly, eight samples from the wallows inside the paddocks were also negative for *Bukholderia pseudomallei*. The water samples from the sump had few *Acinetobacter baumannii.* Tyre bath 1 (RIF) had scanty *Aeromonas hydrophila* and scanty amount of Acinetobacter *baumannii were* isolated from Tyre bath 2 (RQF).

The water in the 12 tanks were used for various activities including cleaning the night stalls, as drinking water for staff and rhinos, keeper's bathrooms and toilets and also cleaning of rhino food. The main source is from the Lipad River via gravity intake. The water is initially filled up in two 10,000 liter tanks before being channeled to a single 4,800 liter tank. Once the tank is full, it is then pumped to two 4800 liter tank at RQF and subsequently to RIF (Figure 4).

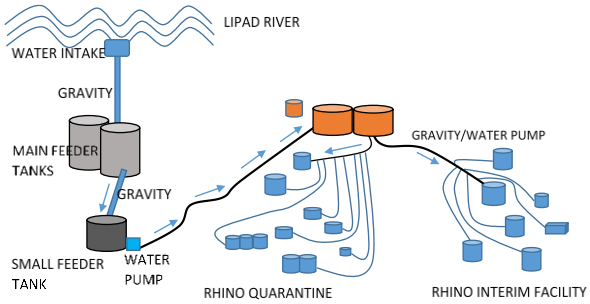

Figure 4. Diagrammatic representation of water supply from Lipad River to RIF & RQF. Note: Orange tanks represents Tanks 6 and 7

The bacteriology results for water samples from the 12 water tanks in Tabin showed moderate bacterial and *E.coli* count (cfu/ml or colony forming units per ml) and negative for *Salmonella*. The tanks affected were number 6 and 7 with *E.coli* counts of 40 and 100 cfu/ml (Figure 4 and Table 2). These

tanks are subsequently treated with chlorine solution (1L/10000 liters water).

Table 2. The total bacterial, coliform and *E.coli* counts in 12 water tanks (cfu/ml)

Tank	Total bacteria	Total coliform	*E.coli*
1	40	10	0
2	210	50	0
3	120	0	0
4	50	20	0
5	120	20	0
6	80	60	40
7	220	240	100
8	120	10	0
9	80	50	0
10	100	20	0
11	130	20	0
12	80	40	0

Nineteen of the floor swabs had few *Bacillus sp* while swab 4 had no bacterial growth.

Fecal samples from *Puntung* and *Kretam* and Iman had abundance *E.coli*. The urine samples from Iman had abundant *Streptococcus sp*. Those from Puntung had moderate *Staphylococcus sp* while Kretam had moderate *E.coli*. However, these bacteria are acceptable in feces and tolerable in the urine samples.

4.2 Parasitology

Fecal samples from all rhinos were negative for endoparasites and parasitic egg count.

Routine disinfection and liming of the rhino facilities were carried out twice monthly, focusing mainly on sumps, dung piles, exercise yards and drains. However, the liming were carried out with supervision by the head keeper so as not to place it too close to the rhinos.

5. Reproductive evaluation through ultrasonography and hormones

Ultrasonographic examinations were carried out on Puntung regularly to monitor her ovarian function and estrus. More frequent evaluations were done as she approaches estrus and correlated with her behavior and interactions with Kretam. These are then compared to her progesterone profiles. Scanning of Iman was done once a week to determine the ovarian activities and correlate it with the uterine pathology, particularly the vaginal discharge.

Kretam was also scanned to look at the condition of the testes and accessory sex glands, particularly the prostate and seminal vesicles. The recent images indicated no pathology except for some fibrin/calcification in the testes due to aging.

5.1 Hormone profile

Puntung

The serum progesterone in September – October 2016 does not show any high peaks and ranged from 0.34–0.65 ng/ml (Figure 5).

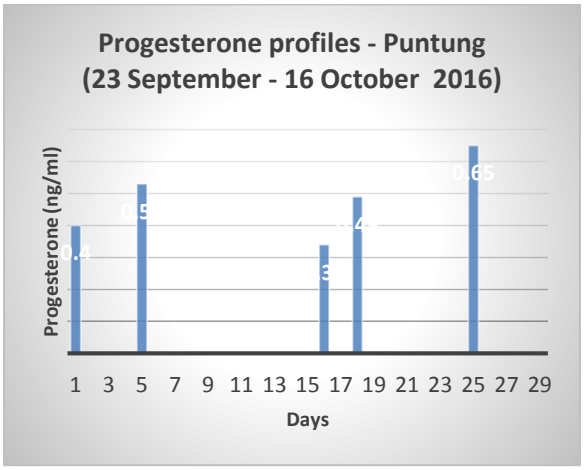

Figure 5. Puntung came into estrus 1-2 days (14–15 October) before P4 = 0.65 ng/ml

5.2 Ultrasonography

5.2.1 Puntung

In mid-September 2016, the left ovary showed a 0.7 cm follicle while the right ovary has a 1.0 cm diameter follicle. A luteinizing follicle (1.2 cm) was also seen on the left ovary. The follicle growth were monitored until the formation of a luteinized follicle (Table 3 and Plate 13).

Table 3. The follicle diameter (cm) and growth rate (14.09.2016 – 16.10.2016).

Date	Left Ovary	Right Ovary	Event
14.09.2016	0.7	1.0	Luteal phase
23.09.2016	1.3	1.6	Luteal phase
27.09.2016	1.6	1.8	Luteal phase
07.10.2016	1.8	-	Luteal phase
09.10.2016	1.9	-	Luteal phase
10.10.2016	NE	NE	
11.10.2016	NE	NE	
12.10.2016	NE	NE	
13.10.2013	NE	NE	Estrus?
14.10.2013	NE	NE	Estrus? Behavioral estrus. Male female interest
15.10.2013	NE	NE	Estrus?
16.10.2016	0.7	-	Large luteinized follicle and one new follicle. Male female interest

*NE=Not Examined

The estrus cycle was erratic for Puntung as seen from the progesterone levels and ultrasonographic images. However, the closest indicator (estrus) based on the 1.9 cm follicle diameter and interaction between Kretam and Puntung (behavioral estrus) was 14 – 15 October 2016.

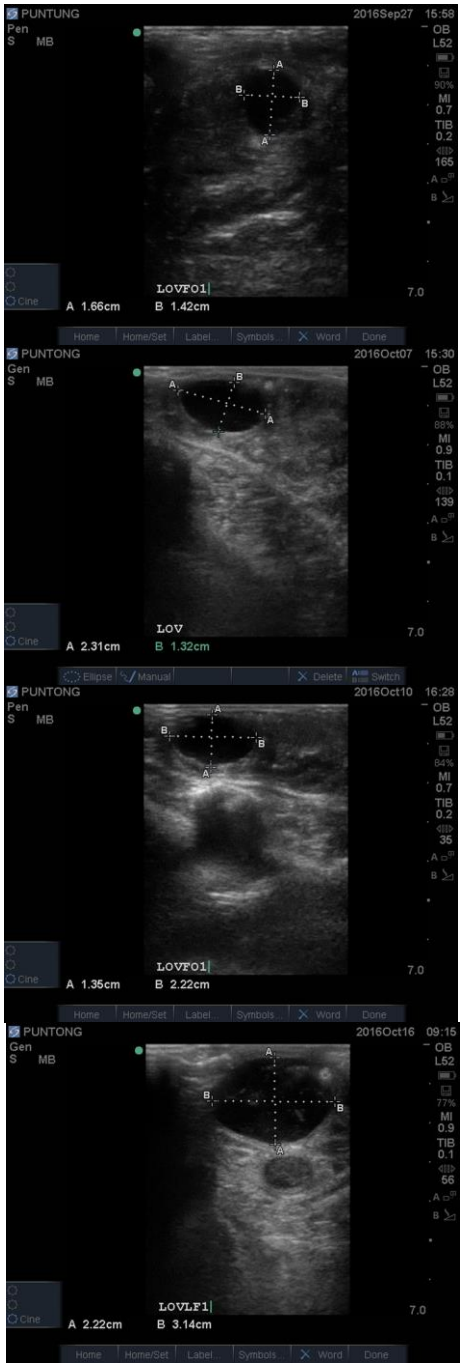

Plate 13. The follicular growth and the development of the luteinizing follicle

5.2.2 Iman

Ultrasonograph of Iman's ovaries on the 23rd September 2016 revealed two follicles on the left (0.9 and 0.8 cm diameter) and one on the right ovary (0.9 cm diameter).

Examination of the ovaries on the 22nd October 2016 showed two follicles on the left (1.5 and 0.5 cm) with none on the right.

5.2.3 Kretam

Ultrasonograph was performed on Kretam to examine his accessory sex glands and ampulla. It was done inside his chute. The seminal vesicle and prostate gland was hypoechoic (Plate 14).

Plate 14. Ultrasound image of the ampulla (A), seminal vesicle (SV) and prostate (P)

5.3 Behavioral estrus

Kretam showed interest in Puntung on the evening of the 14th and 16th October 2016. Both incidences occurred in the forest, close to the middle intersection of their paddocks (Plate 15).

Plate 15. Kretam and Puntung interacting during her estrus

6. Electric fencing

The fences (RIF and RQF) were routinely checked by the rhino keepers and staff working in the Rhino Food Plantation. The fences were also randomly checked from time to time to ensure high voltage of at least 9.0 kV.

The current voltage for the electric fence ranged from 9.0 kV to 10.4 kV. The Rhino Interim Facility (RIF) recorded a range of 9.2 – 10.2 kV while the Rhino Quarantine Facility (RQF) ranged from 9.0 – 9.3 kV. The Rhino Food Plantation (RFP) recorded a low of 9.4 kV and a high of 10.4 kV.

The fence were more frequently checked during heavy rain or thunderstorm for tree fells and broken branches that dropped on to the fence (Plate 16).

Plate 16. Tree fell that damaged the fence and being repaired by BORA staff

7. Other activities

7.1 Malaria Eradication Program – Health Department Sabah

The program is carried out routinely in Tabin Wildlife Reserve, including areas occupied by the Tabin Wildlife Resort, Sabah Wildlife Department (SWD), Orang Utan UK Appeal and Borneo rhino Alliance (BORA). The last Malaria case in 2016 was reported in a hunter that encroached through Ladang Tungku, KL – Kepong. The areas that was sprayed with insecticides only involved the staff quarters (Plate 17).

Plate 17. Health Department personal spraying insecticide inside the staff quarters

7.2 Treatment and eradication of Jackfruit (*Artocarpus heterophyllus*) trunk borer beetle

A dozen Jackfruit trees were affected by the borer beetle which resulted in the tree or branches dying and production lowered. The holes created by the larva or beetles often becomes necrotic and exposed. The usual signs of their presence are the saw dust or fresh bleeding sap that is seen from the holes.

The holes were first scraped with a sharp knife and a syringe filled with Nurelle DC505C (Class II) insecticide and sprayed inside and around the hole.

Plate 18. The affected Jackfruit plant showing the trunk borer beetle hole (Inset: Nurelle DC505C

The affected trees were marked clearly so that keepers do not use these plants to feed

the rhinos. The problem with the trunk borers was resolved after a week.

7.3 Tree fell

Due to the heavy rain and strong wind, several trees were either uprooted or branches broken. Frequently, these trees and branches dropped onto the electric fence and disrupt the flow of current (Plate 19).

Plate 19. A tree uprooted during the recent thunderstorm in Tabin

The keepers are always on the lookout for falling trees around the paddocks and roads to the rhino enclosures and the Borneo Rhino Sanctuary (BRS). Dead trees sometimes fell across the road and has to be removed immediately (Plate 20).

Plate 20. A dead tree across the road to BRS

7.4 Replanting of oil palm trees in KL – Kepong Plantation

Recently, the KL – Kepong plantation start in stages the mass felling of aged oil palm trees throughout its plantation in Tabin. Most of the trees are above 22 years of age and uneconomical.

Large excavators were used to fell and chop the trees (Plate 20 and 21). The felling of old trees and replanting of new oil palm trees had a big impact on gathering of food plants by BORA. Most of the rhino food plants were located in areas where the trees are above 15 years.

Plate 20. A section in Ladang Bukit Tabin that is being felled

Plate 21. The new oil palm seedlings

7.5 RTM filming of the rhinos

On the 7th October, the film crew from RTM Sabah came to Tabin to do a follow – up on the current activities with the rhinos, including the latest addition, Iman (Plate 22).

Plate 22. The crew from RTM Sabah outside RQF

7.6 Tabin Wildlife Reserve Management meeting

The meeting was held on the 21st October 2016 and chaired by Sumbin Gadas, the wildlife officer from Sabah Wildlife Department (SWD). The stakeholders present included SWD, Tabin Wildlife Resort (TWR), Borneo Rhino Alliance (BORA), Orang Utan Appeal and the Bornean Sun Bear Conservation Center (BSBCC).

Issues raised included the use of KM 8 road towards the core area by TWR for their bird watching activity, construction of a new facility by BSBCC, encroachment and Borneo Rhino Sanctuary by BORA.

The meeting was held at the office of Sabah Wildlife Department (Plate 23).

Plate 23. Tabin Wildlife Reserve management meeting

7.7 Monitoring of progress at the Borneo Rhino Sanctuary (BRS) facility

The BRS facility is at the final stages of completions with few areas that need to be resolved before the three rhinos could be moved to their new enclosures.

Some of the floor in the night quarters pooled water (Plate 24). This will provide a loci for the propagation of harmful bacteria, especially so as the floor would be laden with rubber mats.

Plate 24. The areas where water pooled. The picture was taken a day after the night stall was cleaned with water.

The electric fencing voltage is still fluctuating and not maintained at above 9000kV. The danger posed by low voltage is the

encroachment by elephants and escape by rhinos.

The paddocks still contained the building material waste that need to be removed. These includes, metal rods, high tensile wires, concrete blocks, plastic bottles, wooden planks and rubbish (Plate 25). The rusty metal rods and wires would endanger the health and live of the rhinos.

Plate 25. Pieces of rusty metal rods were still found in the paddocks