

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

August - September 2016

Paddock Staff

1. Wilson Kuntil (Head Keeper)
2. Justine Segunting (Rhino Keeper - RIF)
3. Marikus Suyat (Rhino Keeper – RIF)
4. Samad Gubin (Rhino Keeper – RIF)
5. Ronald Jummy (Rhino Keeper - RQF)
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* 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

The trend of rainfall showed an increase from June (421 mm) and July (178 mm), reaching 269 mm in August. Although the number of rainy days in August is less than 50% (6 days) as compared to July 2016, the volume of rain is 30% more. During the six days of rain, the volume of rain ranged from 6 – 154 mm as compared to 2 – 61 mm in July 2016. Up to mid-September, there were only three days of rain totaling 126 mm. Most rainfall occurred in the evening or at night. The wet month will certainly have a positive impact on the food plants that were

collected from the surrounding forests and fringes of the adjacent oil palm plantations (mainly KL – Kepong Sabah Sdn. Berhad, Lahad Datu and Tradewinds Plantation Berhad). The total rainfall for the year is 3697 mm (Rainfall Record Ladang Tungku, KL – Kepong: August - September 2016). The high rainfall in August – September 2016 did not cause any flooding of the Lipad River.

The increase of rainfall did see an increase number of elephants coming out towards the Borneo Rhino Sanctuary and its surroundings. The damage caused by the elephants is mainly to the water pipes (polypipes) that supply the gravity water to staff quarters and rhinos in Tabin (Plate 1).



Plate 1. The elephants pulling out the polypipes that supply water to the rhinos and staff at the quarantine facility

The generator at the Rhino Quarantine Facility is spoilt once again and effort is being made to get it repaired in Tawau. Such incidence does disrupt a lot of activities especially with cleaning up of the rhino night stalls and security.

The body score of Kretam, Iman and Puntung had increased from 2.5 + to 3.0 with very minor fluctuations within the month. All three rhinos had increased body weights and remain healthy.

Iman showed an increase in body weight throughout August and September to reach 528 kg. This is due to the change in diet plan for her and balancing between her bloody vaginal discharge and iron supplementation to treat for anaemia. She also gets a better selection of food plants (Grade 1 and 2) so as to encourage her to consume more. At the same time, her food are generally better in quality. Iman's pathology is still visible and sometimes were expressed as bloody vaginal discharge. Despite that, her appetite and behavior pattern remained normal and she is very active and vocalized a lot.

2. Husbandry

2.1 Animal Management

In general, all rhinos were in good condition. The wet weather, although short, had some positive impact on the food supplies and rhinos. However, the amount of rainy days had impacted negatively on the wallows that's available for the rhinos. The wallows become more watery with more rain, and not conducive to the rhinos.

Puntung finally decided to use a wallow that was constructed for her, next to her night stall. This wallow is also easily maintained by adding water (via pipes or carried in water containers) when its mud is too thick or dry. Similarly, the wallows for Kretam and Iman is maintained by use of polypipes to add water when necessary.

Scanning were carried out with the Sonosite M – Turbo for both females. More ultrasound were carried out in Puntung as there is a need to collect estrus serum from her to enrich the maturation and fertilization media during and after *in vitro* fertilization (IVF) in November 2016.

The problem with Iman's hoof cracks and hoof chips had improved significantly with the biotin supplements. Treatment will be stopped in about two weeks.

Puntung was scanned and blood was also collected for progesterone profiling. Her "estrus" behavior, time and location in the paddock was recorded whenever there is interaction with Kretam.

2.2 Body Weight

All the rhinos were weighed at least 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. The weights were averaged out and tabulated (Figure 1).

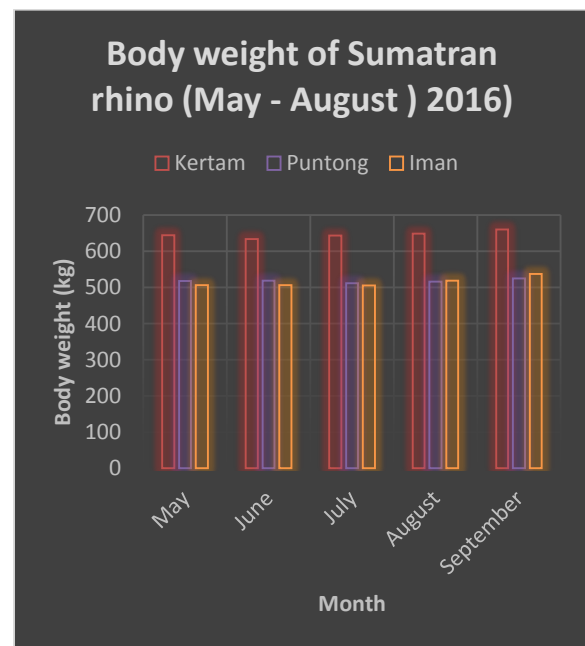


Figure 1. Average body weights of Sumatran rhinos in Tabin (May - September 2016)

The body weights of all rhinos increased in August 2016, with Kertam weighing 660kg (increase of 11 kg), Puntung weighing 525 kg (increase of 9 kg) and Iman weighing 537.5

kg (an increase of 18.5 kg). However the small fluctuations of body weight does occur every month due to various factors, including defecation (amount of feces voided ranged from 1 – 8 kg), feeding (amount fed and consumed) and mud from wallow (amount of mud on the body ranged from 1 – 2 kg). Usually the rhinos are washed and clean before weighing.

Due to the bleeding and treatment for anemia, Iman's body weight were monitored once every week. The bleeding lowers her appetite significantly and her body weight. Similarly, the treatment for anemia will increase her chance of succumbing to iron storage disease which will also lower her body weight.

Iman's body weight increased significantly by 14 kg, from July and August 2016. Currently with reduced ovarian activities due to the Improvac[®] vaccine, her bleeding has stopped completely. Currently, her body weight is more stable and increased to 539 before decreasing to 536 kg (Figure 2).

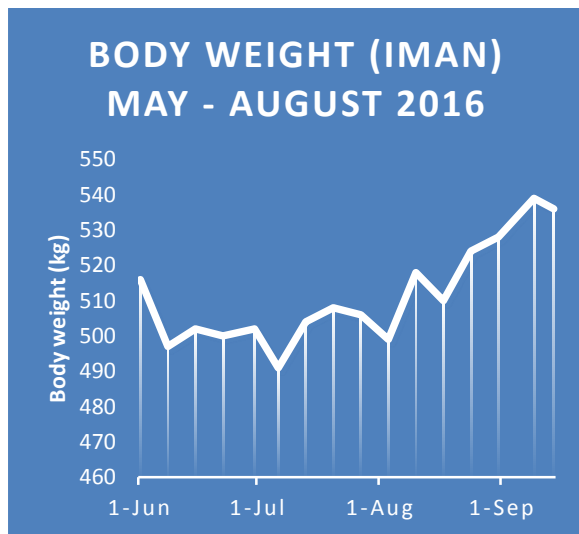


Figure 2. Fluctuation of Iman's body weight (May – September 2016)

When and if she has blood in her vaginal discharge, the protocol is to temporarily reduce her feed intake slightly by about 5 – 8 kg daily. This is to reduce the pressure on her uterine tumors and eventually lessen the discharge and pain.

2.3 Animal Health

All the rhinos are in good condition and the health parameters are within normal range. Apart from the slow healing process of Iman's cracked hooves, there are no immediate worry on the rhinos. The appetite and body weights are stable and within normal range. Abrasions and minor cuts are fairly common and usually untreated.

However, Iman is still being closely monitored for any change in color and volume of her vaginal discharge.

2.3.1 *Kretam*

a. Lacerations

A small laceration is seen on his right hind foot, close to the coronary band of the second digit. Such wounds are cleaned and sprayed with povidone (Septidine[®]), twice daily and monitored.

2.3.2 *Puntung*

a. Abrasions

Puntung's common abrasions at the rump and near the tail base are not treated as the wallow would be sufficient to heal the wounds. The cause is usually her rubbing against the tree or fence post after wallowing.

Sometimes the Tabanids (biting flies) cause bleeding from the skin at their bite site.

These attracts flies especially screw – worm fly with tendency to cause maggot wounds. Usually the dried blood were removed from the skin by washing. Wallowing helps prevent Tabanids from biting the rhinos (Plate 2).



Plate 2. Puntung in her wallow (inset: bleeding from a Tabanid bite)

b. Reproductive tract pathology

Ultrasound were conducted on her regularly to monitor her estrus cycle and the pathology. Correlations with serum progesterone was also done to look at ovarian activities.

Currently, except for 1 – 2 small hypochoic – hyperechoic areas of fibrosis, the cysts (anechoic) has not really increase in numbers and size. The endometrial cysts ranged from 4 – >20 mm diameter (unilocular and multilocular), distributed mainly in the uterus and small numbers could be seen at the uterine horns and cervix – uterus junction. These pathology does not cause any discomfort to Puntung or affect her feed intake or body weight. However, the monitoring would indicate if at all there is a need to intervene via laparoscopy.

A mass represented by a hyperechoic image was also observed in the uterus during the ultrasound exams (Plate3).



Plate 3. Numerous cysts and a mass in the uterus

Several cysts were also observed adjacent to the right ovary, which can resemble the follicles. These are circular anechoic structures with thickened walls. (Plate 4).



Plate 4. Right ovary and a cyst

2.3.3. Iman

a. Vaginal discharge

The vaginal discharge were observed almost every day, especially when she lies on her lateral. The volume ranged between 20 – 40

mls and clear to yellowish coloration. No blood or solids were seen in those discharge. Once in a while the discharge has a light pinkish coloration (Plate 5).



Plate 5. Vaginal discharge from Iman as seen on the rubber mat in her night stall

The last Improvac® (Gonadotrophin Releasing Factor vaccine) was given on the 26th June 2016 (Plate 6). Apparently the vaccine had reduced the ovarian activities with very few follicles developing and a dramatic drop in the bleeding.



Plate 6. Improvac® vaccine was given three consecutive times to Iman since 2015.

The vaginal discharge is directly correlated to the ovarian activities. Currently, only the left ovaries is active with three follicles.

c. Reproductive tract pathology

The cysts, fluids, leiomyoma and hydrosalpinx are still visible on ultrasound but it had not deteriorated. The areas of fibrosis (possibly scarring) could be seen in the uterus and uterine horns. Large masses (leiomyoma) could also be seen in the uterus and uterine horns, with some measuring ≥ 5 cm (Plate 7).

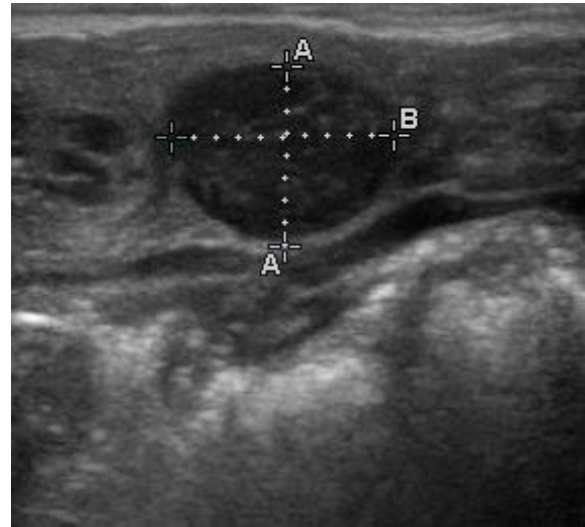


Plate 7. A 1.8 cm mass on the right uterine horn of Iman

b. Hoof cracks

The problem with hoof cracks in Iman had almost resolved with the daily supplementation of biotin (Hoofmaker TRM®) and regular cleaning of the hooves. 37.5 mg of Hoofmaker TRM® powder is mixed with water into a paste and fed to the rhino in banana or papaya.

The daily routine involved thoroughly brushing the affected hooves with water and flushing with topicals (3% hydrogen peroxide wash and 2% formaldehyde) into the cracks. This is done twice daily. Stokholm® coal tar was finally used to cover all the crack

The number of hooves affected had reduced remarkably. Some of the cracks were less obvious and layers of “new” hoof lamella could be seen ventral to the coronary band (Plate 7a and 7b).



Plate 7. Hoof cracks before (7a) and after it healed completely with the current treatment protocols (7b)

d. Weight loss

Iman's body weight had showed a remarkable increase over the past two months. However there is a need to monitor closely the weekly fluctuations and relate them to levels of serum iron. Currently, her serum iron level is 21.6 $\mu\text{mol/l}$ (120 $\mu\text{g/dl}$) as compared to 33.1 $\mu\text{mol/l}$ (184.69 $\mu\text{g/dl}$) in April 2016.

However to note, the levels of serum iron in Suci, the Sumatran rhino in Cincinnati Zoo maintained around 35.8 $\mu\text{mol/l}$ (200 $\mu\text{g/dl}$) for about three years before it increased to more than 72 $\mu\text{mol/l}$ (400 $\mu\text{g/dl}$) in six years. She subsequently died of iron storage disease.

Feed and feeding

The total amount of browse collected in August – September 2016 was 5837 kilograms (almost 200 kg daily), mainly from the forest fringes and small amounts from the Rhino Food Plantation. The amount consumed by Kretam, Puntung and Iman were 1463 kg, 1181.5 kg and 1134 kg respectively (Figure 3).

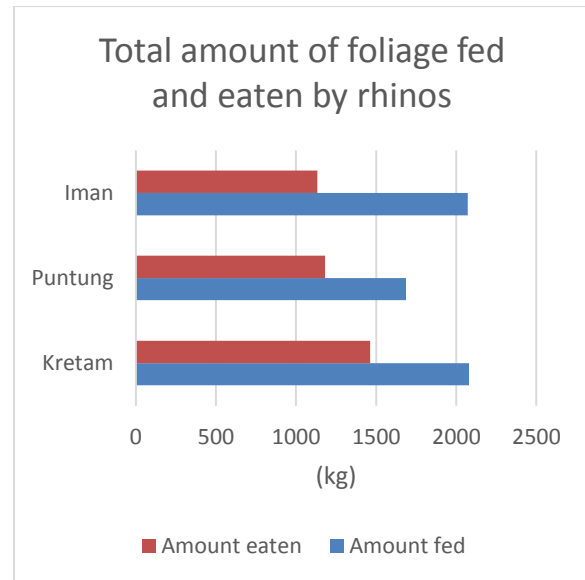


Figure 3. The total amount fed to the three rhinos and amount consumed.

A total of 9 – 17 species of plants were fed to the rhinos daily. Currently, Iman was fed 14 species daily followed by Puntung and Kretam (average 13 species each). The more common plant species include *Ficus spp* (6 – 8 species), 2 – 3 *Artocarpus species* (mainly *A. heterophyllus*), *Merimia spp*, *Uncaria spp*,

Neonauclea spp and *Leucosyke capitellata*. The rhinos were supplemented with varying amount of horse pellets (Gold Coin®) daily. *Puntung* received 400 grams in the morning. The amount fed to *Kretam* is maintained at 500 grams daily. *Iman* was given 1000 grams (500 grams in the morning and 500 grams in the evening). Her pellets was reduced to 500 grams as of 22 September 2016. This is related to her body weight which was above her intended weight.

The rhinos were also fed 5 - 6 kg of banana or papaya daily, half in the morning and half in the evening. Papaya 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 were fed to the rhinos for veterinary procedures including blood withdrawals and ultrasonography. Papaya or mango were also used in administering oral medication to *Iman*, especially Hoofmaker TRM®.

Voluntary Feed Intake for *Kertam*, *Puntung* and *Iman* ranged from 39 - 60 kg ($\mu=49.5$ kg), 18.5 – 45.5 kg ($\mu= 32$ kg) and 30 - 38 kg ($\mu= 34$ kg) respectively. *Puntung* did not return twice for her morning feeding and once in the evening. *Kretam* and *Iman* came back for both feedings.

Iman's feed regime was maintained at a minimum of 15 kg of browse per morning and evening feedings. Additional foliage were hung in the night stall.

3. Biosecurity and health monitoring

Soil samples, water from the water tanks, water samples from tyre baths, soil from the wallows, floor swabs from the night stalls, feed samples and vaginal discharge were taken for isolation of pathogens.

Subsequently blood, urine, and feces were also taken for health evaluation. All samples were collected on the 14th August 2016 and sent to the Kepayan Veterinary Diagnostic Laboratory in Kota Kinabalu, early morning on the 15th August 2016.

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 rhinos. There were no blood protozoa isolated from the samples (Table 1).

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

Parameters	<i>Puntung</i>	<i>Kretam</i>
Hemoparasites	neg	neg
RBC (X10 ¹² /L)	4.72	5.82
WBC (1000/ul)	8.59	8.83
Hb (g/dl)	10.50	12.90
PCV (%)	36.00	41.00
Seg. Neutrophils (%)	64.00	54.00
Eosinophils (%)	4.00	22.00
Lymphocytes (%)	25.00	17.00
Monocytes (%)	6.00	7.00
Basophils (%)	1.00	0.00

Bacteriology

The horse pellets (Gold Coin®) were negative for pathogens. The laboratory in Kota Kinabalu could do fungal isolation.

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 *E. coli*. Both tyre baths had few *E.coli* isolated from them.

The bacteriology results for water samples from the 12 water tanks in Tabin for August – September, 2016 showed moderate bacterial and *E.coli* count (cfu/ml or colony forming units) and negative for *Salmonella*. The tanks affected were number 4 – 9 with *E.coli* counts of 10 – 80 cfu/ml (Table 2). These tanks are 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	<i>E.coli</i>
1	2500	0	0
2	300	10	0
3	1750	0	0
4	2400	20	10
5	800	100	80
6	1300	120	80
7	2400	100	80
8	1500	170	70
9	320	240	60
10	400	0	0
11	2000	10	0
12	2400	0	0

Most of the floor swabs had few *Bacillus sp* and *Staphylococcus sp*. *Kocuria kristinae* was isolated from swab number 20.

Fecal samples from *Puntung* and *Kretam* and *Iman* had moderate *E.coli*. The urine samples from all rhinos had few *E.coli*. However, the low levels are tolerable.

4.2 Parasitology

Fecal samples from all rhinos were negative for endoparasites and parasitic egg count. Routinely, these checks were done once a

month at the veterinary laboratory in Kepadayan, Kota Kinabalu.

Routine disinfection and liming of the rhino facilities were carried out twice monthly, focusing mainly on sumps, dung piles, *Kretam's* 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 and procedures

Puntung is ultrasound routinely to evaluate her ovarian activity which is correlated with serum progesterone, and behavioral interactions. Routine ultrasound and blood collection is done twice a week. Behavioral interaction between her and the bull is observed daily and recorded.

Iman was not scanned as regularly, mainly due to the tumours (leiomyoma) in her uterus and her frequent vaginal discharge. Blood was sometimes collected from her for progesterone evaluation.

Kretam was sometimes scanned (testis and accessory sex organ) to get him used to the manipulations and subsequently train him for manual semen collection.

5.1 Hormone profile

Puntung

Results from the progesterone profiling for August – September 2016, indicated low, near baseline values ranging from 0.28 – 0.4 ng/ml and rising to 0.97 ng/ml over more than a month. The prolong period of low progesterone was seen in *Puntung* on several occasions and could relate to her older age or previous stimulation prior to ovum pick up procedures. The low levels of

progesterone on day 16 – 18 did coincide with behavioral estrus. Kretam showed interest in Puntung on day 16, 18, 20 and 21 (Figure 4).

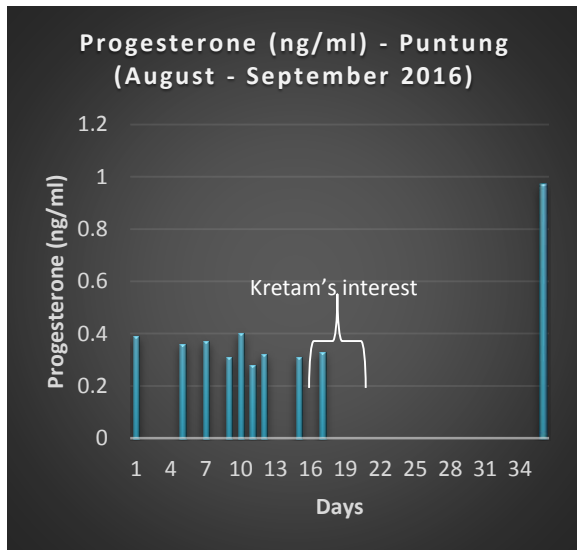


Figure 4. Puntung's progesterone profile and behavioral estrus

5.2 Ultrasonography

Puntung

Ultrasonography was carried out regularly on her to determine her estrus, starting early July 2016. Serum will then be collected during estrus, frozen and later, use in the media to keep oocytes for maturation. The suggestion was to use the estrus serum from Puntung in the maturation media for oocytes from Iman. The amount of serum needed was about 20 mls. However, blood was collected from Puntung when her follicle was between 1.9 – 2.0 cm diameter. The procedures for ovum pick up will be carried out in November 2016.

The left ovary showed one follicle (0.4 cm diameter) on the 11th July 2016 and reached 2.0 cm diameter, 20 days later (Plate 8).



Plate 8. The left ovary with a mature graafian follicle and one luteinizing follicle

A second follicle was observed ventral to the dominant follicle and measured 0.8 – 1.0 cm diameter. The luteinizing follicle and a corpus luteum were clearly visible throughout the period. On the 1st August 2016, the dominant follicle regressed slightly to 1.75 cm diameter and signs of luteinizing was recognized. The smaller follicle was seen to slightly enlarge. The luteinizing follicle and a corpus luteum could be viewed clearly on the ultrasound (Plate 9).

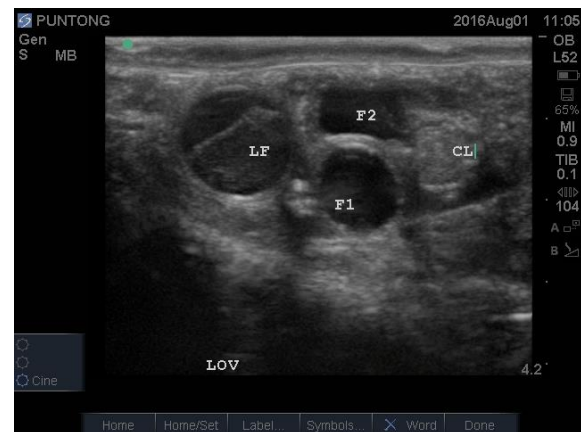


Plate 9. The regressed follicle (F2), luteinizing follicle (LF), corpus luteum (CL) and the new emerging follicle (F1)

On the 22nd August the ultrasonography examination showed one luteinizing follicle on her left ovary, measuring 1.25 cm diameter. On the 27th August, a small 0.5 cm follicle had emerged on the same ovary (Plate 10).



Plate 10. The small 0.5 cm follicle cranial to the luteinizing follicle

An ultrasound examination on the 14th September 2016 showed the follicle increased had increased to 0.69 cm. In addition, a 1.0 cm follicle was also observed on the right ovary (Plate 11).



Plate 11. The follicle on the right ovary measuring 1.0 cm diameter

Iman

On 27th August 2016, a 1.2 cm diameter follicle was observed on the left ovary of Iman. The right ovary is quiet without any follicles. Subsequently, a luteinized follicle was seen on the 14th September 2016, in addition to one new 1.1 cm follicle (Plate 12).



Plate 12. Ultrasound image of the follicle

This lowered ovarian activity is due to the Improvac[®] vaccine given to her in June 2016.

5.3 Behavioral estrus

Kretam showed interest in Puntong on the 2nd and 4th August 2016, near to Puntong's night stall. Both incidence occurred in the evening. In addition, on the morning of 6th and 7th August 2016, another interaction occurred in the forest along the partition fence. These coincides with the ultrasound images of Puntong's follicle.

6. Electric fencing

The voltage on the electric fence ranged from 9.2 kV to 10.2 kV. The Rhino Interim Facility (RIF) recorded a range of 9.4 – 10.2 kV while the Rhino Quarantine Facility (RQF) ranged from 8.9 – 9.2 kV. The Rhino Food Plantation (RFP) recorded a low of 9.8 kV and

a high of 10.2 kV. The RIF and RQF fences were checked by the keepers before the rhinos were let out, after their morning and evening feedings. RFP always recorded the higher voltage due to its open areas with very little canopy cover and ease of checking the fence.

RIF and RQF are mainly under canopy and exposed to falling branches, leaves and twigs. Creepers are fast growing and will lower voltage if unchecked (Plate 13).



Plate 13. Creepers climbing up the fence

7. Other activities

7.1 KI – Kepong Corporate Social Responsibilities (CSR) Program

The two day program (8 – 9 September 2016) involved various activities, mainly in the Rhino Food Plantation (Plate 14). These included, weeding, road maintenance,

constructing two sheds for keepers and one nursery for rhino food plants. They also fertilized the rhino food plants and planted several jackfruit saplings. Apart from RFP, the work also involved road repairs and clearing the site for disposal of waste from rhino feedings.



Plate 14. Preparation of polybags for planting jackfruit seeds

During the CSR program, the Regional Director, General Manager from Lahad Datu and Tawau, Managers, Asst. Manager and harvesters were present. Sabah Wildlife Department was also represented at the ceremony (Plate 15).



Plate 15. The team from KL – Kepong, BORA and Sabah Wildlife Department.

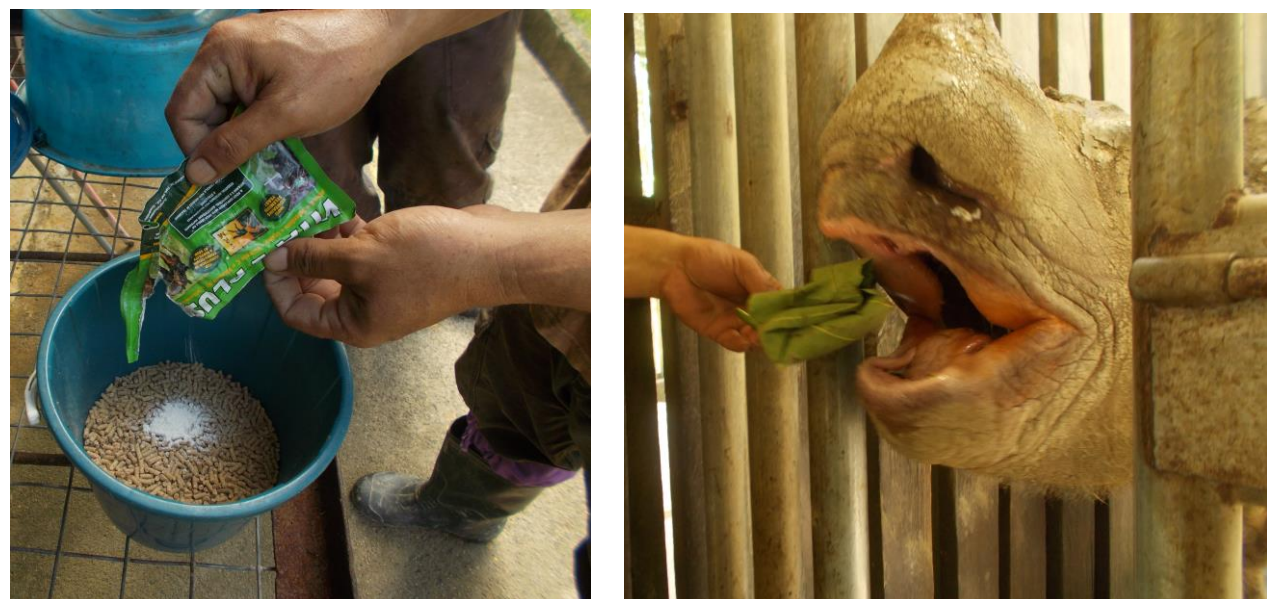
ACTIVITIES BORNEO RHINO ALLIANCE – TABIN (AUGUST – SEPTEMBER 2016)



Kretam being weighed using an electronic weighing scale. He weighs 660 kg



Deworming the rhino using anthelmintic paste (inset) which is inserted into bananas



Vitamin and mineral supplementation to boost reproduction



Fence damaged by tree fall



Repairs of fence by BORA staff



Preparation of polybags for seedlings



BORA staff planting seedlings into polybags



Some seedlings planted in the Rhino Food Plantation



Washing and scrubbing the wooden wall of Kretam's night stall



Cleaning the floor inside (including the rubber mats) and outside Iman's night stall



BORA staff cutting grass along the fence of the rhino paddocks



Iman in her wallow at the Rhino Quarantine Facility



Ronald and Iman in her paddock



Puntung in her mud wallow inside her paddock.



Puntung leaving the night stall and heads towards her paddock while keeper stand watch



Kretam in his exercise yard



Kretam heading out to his paddock and into a wallow



Collaboration work with KL – Kepong Sabah Sdn. Bhd in Tabin to improve the Rhino Food Plantation



Repair and built new sheds in Rhino Food Plantation



Repair of disposal site for rhino waste

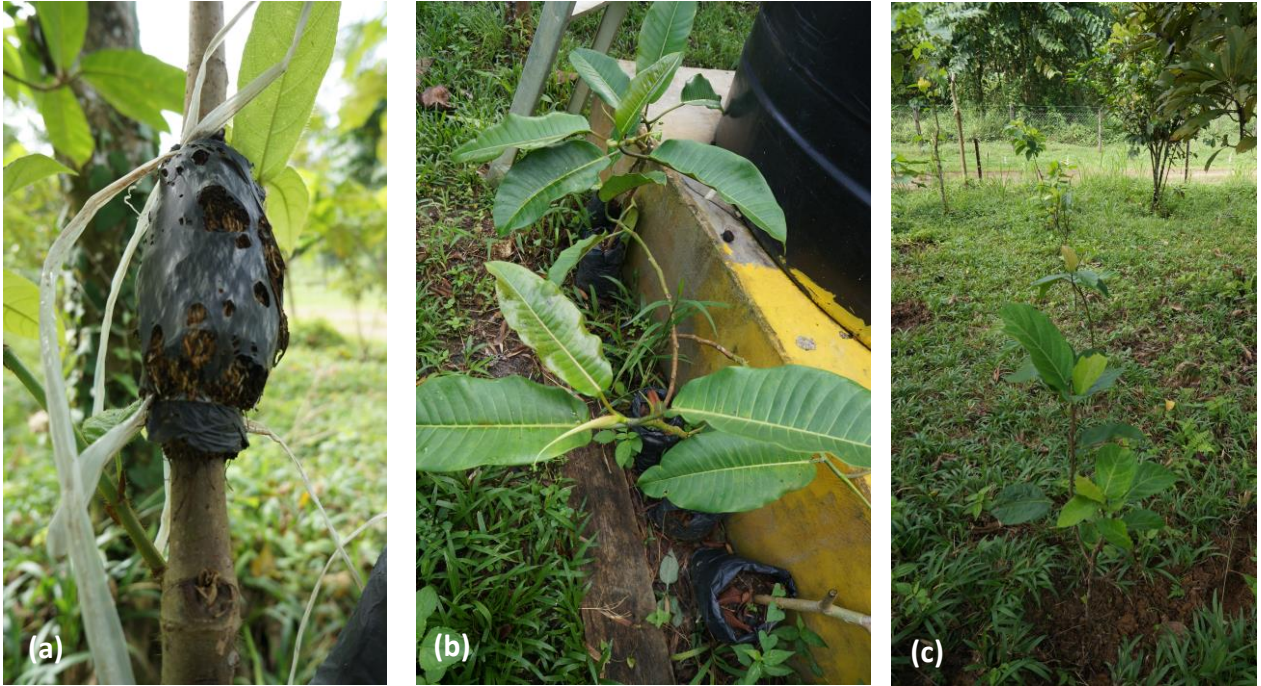


Enlarging the pond inside the plantation as water source



Lunch with KL – Kepong and BORA staff

ACTIVITIES BORNEO RHINO ALLIANCE – TABIN (AUGUST – SEPTEMBER 2016)



Marcotting *Ficus* spp (a) and replanting them in polybags (b) before transferring them to the ground (c)



BORA staff collecting rhino food from forest fringes (a and b) and loading onto the truck (c)



Keeper feeding the rhino with *Artocarpus* leaves (a and b) and followed by fruits (c)

