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

October - November 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
RFP : Rhino Food Plantation

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

October through November has been the wettest months so far in 2016. It rained almost every day, mainly in the afternoon, night and early morning.

Throughout October 2016, the total rainfall was 338 mm over 18 days, 55% of it occurring in the afternoon, 23% in the night and the remaining, in the morning. The rainfall ranged from 3 – 75 mm in a day. The total rainfall for 2016, ending 31st October, stands at 3,939 mm. However in November 2016, the rainfall is more frequent, with 17 days of rain and 507 mm of rainfall. The rainfall ranged from 1 – 61 mm, with most of it in the afternoon and night.

Sungai Lipad and Sungai Badak were flooded and occasionally exceeded the river banks. Small streams flood the roads to the paddocks and across the Rhino Food Plantations (Plate 1 a - d). Many repair and maintenance work were also disrupted during the wet season. Tree and branches falling onto the electric fence were common.

Plate 1. (a) Heavy rain at RQF (b) Rain water coming through the gate and tyre bath (c) Flooded Sungai Badak and (d) Water along the road towards the paddock.

The wet season also signaled the increased sightings and signs of the elephants on Jalan Tabin, roads to the Borneo Rhino Sanctuary (BRS), RIF, RQF and RFP. Several herds were seen on the main Tabin road and roads towards the core area and mud volcano. Damages caused by the elephants also increased and not only limited to water pipes and fences. Some sinages and fence posts were also damaged by the elephants (Plate 2).

Plate 2. The sinage along KM 3, destroyed by the elephants

The issues with water supply and electricity were resolved in mid-November 2016. However, water pipelines are occasionally damaged by animals but were repaired almost immediately. The generator at the Rhino Quarantine Facility was finally repaired. The body weight of all rhinos fluctuated, quite markedly in Kretam. This is always the sequel to the ovum pick – up and electro ejaculation procedures performed on them under general anesthesia.

Iman showed a significant, gradual increase in body weight, reaching a peak (558 kg) on 26th August 2016. The body weight was gradually reduced to 536 kg in about one month. This was done to reduce the stress of her leiomyomas on her uterus.

Iman's condition was stable and no severe bleeding was observed from her vagina. She was also prepared for ovum pick – up on the 14th November 2016.

Staff meeting was done at least once a week to discuss and resolve problems related to rhinos, staff, paddocks and activities. Preparations were made for the scheduled ovum pick – up and electro ejaculation on the 14 – 16th November 2016. Similarly, preparation for the visit by Yang Amat Berbahagia, Tun Musa Hitam, the chairman of Sime Darby Foundation was also done in November itself.

2. Husbandry

2.1 Animal Management

Kretam, Puntung and Iman are in good condition, with body scores of ≥ 2.5. The only management issues were hoof chipping and occasionally abrasions. Iman had negligible bloody vaginal discharge on a few instances. The main issues during the rainy season are focused on the cleanliness and preventive measures for water and soil borne diseases. In addition, the keepers have to ensure that the wallows does not fill up with too much water.

In Puntung, scanning was carried out about twice weekly, except during the monitoring of the follicles during the deslorelin (Ovuplant®) treatment. Deslorelin, a synthetic GnRH analogue, in a slow release implant was to stimulate follicular development towards ovulation. This was done prior to the OPU procedures. During the treatment, ultrasonography was carried out on alternate days to determine the number of follicles and their sizes. Subsequently, serum was also collected from her for progesterone profiling. The ovum-pick-up (OPU) procedures were carried out on her on the 14th November 2016. *Invitro* fertilization will be carried out in 16th November 2016.

Observations were carried out by the keepers, mainly looking for interactions between Puntung and Kretam. These would be the signs of estrus or an approaching estrus. The most common aeas of

interactions are by the fence and or at her night stall.

2.2 Body Weight

Kretam and Puntung were weighed twice a month, (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. Sometimes, Iman has to be weighed out of the chute and along the passageway via the sliding doors. Due to her bloody vaginal discharge and the tumours, Iman was weighed each week. All rhinos were weight several times and averaged out and later tabulated.

All rhinos showed a stable body weight throughout the months with an average weight of 642 kg (Kretam), 528 kg (Puntung) and 536.5 kg (Iman). A comparative body weight trend (September – November 2016) was recorded for all the three rhinoceros in Tabin (Figure 1).

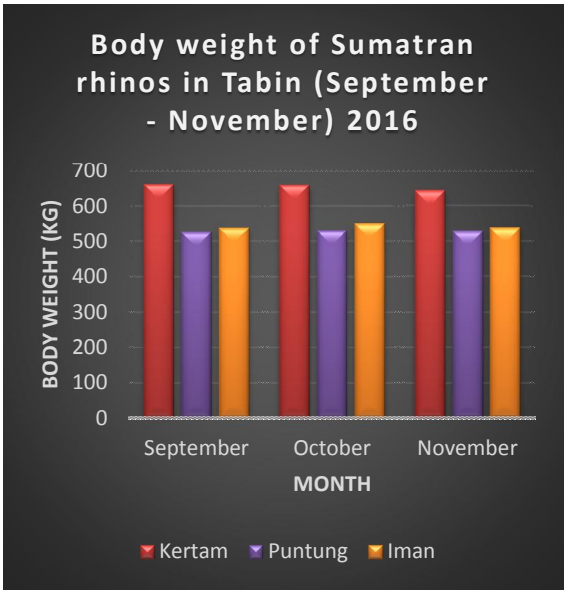


Figure 1. The body weights of all the rhinos (September – November 2016)

Kretam's body weight dropped by 12 kilograms. This is usual for him, after the general anesthesia during the semen collection. Puntung's bodyweight dropped slightly. However, Iman's body weight was deliberately reduced as it exceeded 530 kg. In October 2016, her average weight was 550 kg and gradually brought down to the present 536.5 kg. The trend in her body weight from September to November 2016 showed an increase to a maximum followed by a decrease and stabilizing at around 536 kg (Figure 2).

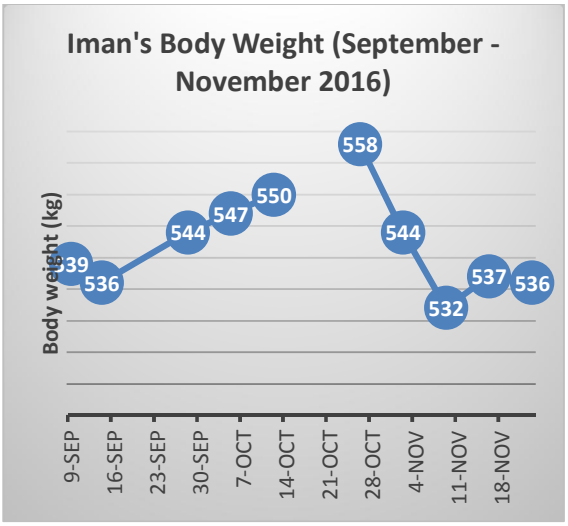


Figure 2. Body weight (kg) of Iman in September – November 2016

The amount of concentrates (Horse pellets – Gold Coin®) fed to Iman will be maintained at 500 grams.

2.3 Animal Health

In general, the condition of all rhinos are excellent despite small problems that always exist and will continuously be treated. Some examples include abrasions, small lacerations, hoof cracks, hoof chippings, weight loss and vaginal discharge.

The current issue are with monitoring the serum iron (UMOL/L) of all rhinos in Tabin, as these were known to affect the health and potentially damage the liver. Similarly, liver function test were concurrently conducted.

The success in treating numerous hoof cracks on all hooves of Iman prompted the same regime be implemented in Kretam. Some minor abrasions and lacerations were washed and sprayed with Povidone (Septidine®) or not treated at all.

Currently, the feed intake, body weight and behavioral parameters are within the normal range. Slight fluctuations in feed intake and appetite are acceptable.

Iman is always in a precarious condition as she constantly has the vaginal discharge. Occasionally, she bleeds from within her uterus. Treatment with hematinic was only administered when she has the bloody vaginal discharge and becomes anemic. This has to be done with care so as not to overload her with excess iron.

2.3.1 *Kretam*

a. Abrasions

Few abrasions were observed around her tail base. The cuts were small and need not be treated. Similarly, a small cyt was observed on her left neck. The wounds were cleaned with water, followed by Povidone (Septidine®) spray. This is done twice daily and monitored.

b. Hoof chipping

The hoof chipping of digit 1 on the right hind leg is still being treated. The treatment consisted of 10 grams oral biotin supplement, Hoofmaker TM®, usually incorporated in bananas. The chipped area is also cleaned with water and Stockholm tar painted over it.

c. Reduced appetite

On the 10th November 2016, Kretam was dull and refused to eat his usual amount of 15 – 18 kg browse per morning feeding session. One of the possible reason for such problem was the increased erections he had recently.

It was observed that the addition of Vita – E – Plus and Beta Carotene in Kretam's diet, in September 2016 had caused him to regularly (every 2 – 3 days) have erections inside the chute and presumably in the paddock (Plate 3 a – c).

Plate 3. Beta carotene and Vita E Plus supplements (a and b) and the erection (c)

These regular erections were observed after three weeks of oral supplementations. The supplements were initiated and recommended by IZW after his low sperm count and motility during the previous collection in June 2016.

Currently, both the supplementations were temporarily stopped to see if his appetite would improve.

The other possible cause of reduce appetite and subsequently, weight loss would be iron storage disease. All measures are being made to reduce the risk of such a pathology.

For some unknown reasons, all rhinos would lick at surfaces with exposed iron materials (rusted nails, rusted hinges, locks). Kretam's paddock had a similar area that he sometimes lick (Plate 4).

Plate 4. The three rusty bolt – nut on the wall of Kretam's night stall that he licks

Similar to Iman, these surfaces were covered and replaced with stainless steel material or covered with wood.

Serum was extracted via centrifuging the blood (5,000 RPM for 5 minutes) and send to the Pathology and Clinical Laboratory Malaysia (Pathlab) in Sandakan, for serum iron concentration. In addition, liver and kidney function tests were also performed.

A total of 10 mls of blood was also withdrawn from him using the digital plexus. A 21G hypodermic needle was used and blood was dripped into a plain vacutainer tube (Plate 5).

Plate 5. The blood dripping from Kretam into a vacutainer tube.

2.3.2 *Puntung*

a. Abrasions

Occasionally, Puntung comes back with some areas of redness or abrasion around the lateral aspect of her tail base and rump. It could have been caused by her, rubbing her rear against trees or the wooden wall of her night stall. These were usually untreated. Biting flies still caused some irritations and bleeding at the bite site.

b. Reproductive tract pathology

Ultrasound were conducted on Puntung regularly (at least twice a week) in the first week of November 2016 but reduced to about once weekly afterwards. The pathology observed frequently are numerous cysts, fluid and some focal areas

of fibrosis. There were several multilocular cysts and few fused, in the uterine body, varying in size from < 4 to > 20 mm. There were also some cysts adjacent to the right ovary (Plate 6).

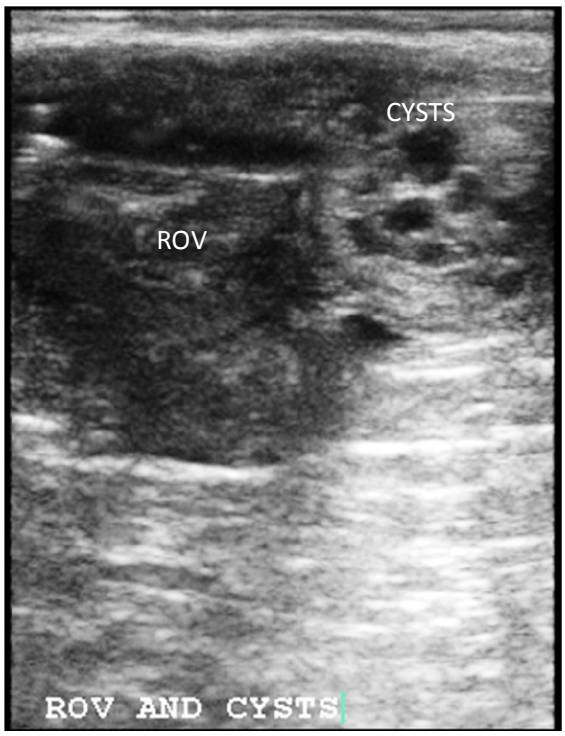


Plate 6. The right ovary (ROV) and the adjacent cluster of cysts next to it

The anechoic fluid filled cysts could be seen in the uterus, as early as the cervix – uterine junction to as far up the uterine horns, next to the right ovary. The severity were observed more in the right than the left uterine horns.

The number and sizes of the cysts varies. However, over the last few years, their numbers does not seemed to increase markedly. To date, there were no leiomyoma observed in the reproductive tract. Focal areas of fibrosis were observed in small numbers and sizes, represented by round echoic images.

The pathologies in her reproductive tract does not impact her clinically. The left ovary was observed to be more active and would usually have a follicle. Without hormonal treatment, she cycles regularly, once every 21 – 24 days. The treatment (synchronization and stimulation) and the OPU procedures normally resulted in a shift of her ovarian activities towards dormancy for several weeks.

2.3.3. *Iman*

a. Vaginal discharge

The bloody vaginal discharge was observed on the observed on the 7th November 2016. Small amount was seen on the floor of the night stall. The 10 ml discharge was thin, watery and red. Subsequently, more of the bloody discharge was observed inside her wallow (Plate 7a and b).

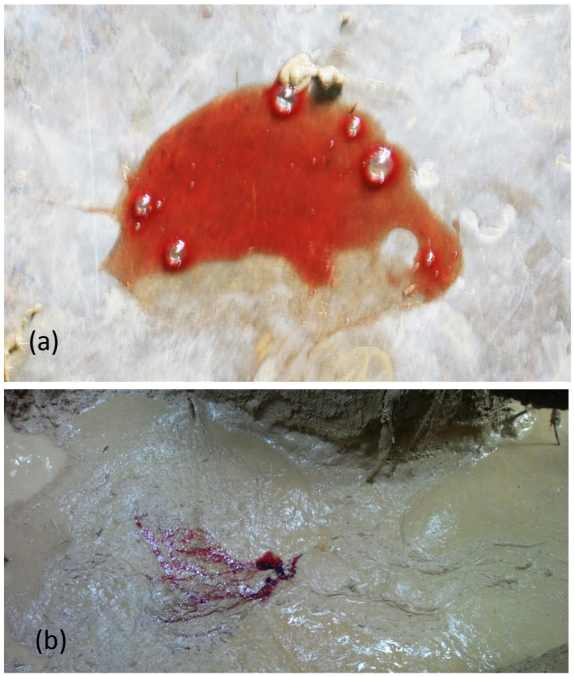


Plate 7. The bloody vaginal discharge in the night stall (a) and in the wallow (b)

She was observed for a few days to see if the bleeding increased or continues. Fortunately it stopped and no treatment was administered.

Iman was given another dose of 3 mls Improvac® (Gonadotrophin Releasing Factor) vaccine, subcutaneously on the 14th November 2016. This is to reduce ovarian activity and subsequently reduce the activities in the uterus which would reduce bleeding and discomfort.

c. Reproductive tract pathology

Iman's reproductive pathology remained unchanged, perhaps increasing every month. They still consisted of cysts, fibrosis, fluids, leiomyomata and hydrosalpinx that are seen from the cervix to the oviduct. Large amount of fluids and edema were observed in the cervix and uterus during routine ultrasound examinations. The 4.0 cm diameter hydrosalpinx is a large and rounded fluid filled sac inside the oviduct or fallopian tube. The distal occlusion of the oviduct leads to the accumulation of fluids and the dilation of the tube. The hydrosalpinx in the right oviduct is anechoic due to the fluids inside (Plate 8).

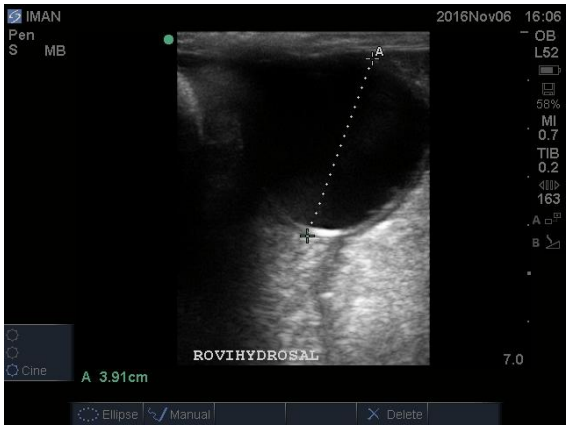


Plate 8. Hydrosalpinx in the right oviduct

The cervix is frequently filled with fluids which corresponds to the discharge whenever Iman lies on her lateral. The cervix is edematous and the annular folds consisted of hypoechoic and hyperechoic structures (Plate 9).

Plate 9. The ultrasonographic image of the cervix showing hypoechoic structures

The leiomyomas varies in size from 1.5 – 10 am or more and distributed in the uterus and uterine horns. Similarly, the numerous cysts of varying sizes were seen in the reproductive tract. They comprised unilocular and multilocular anechoic structures (Plate 10).

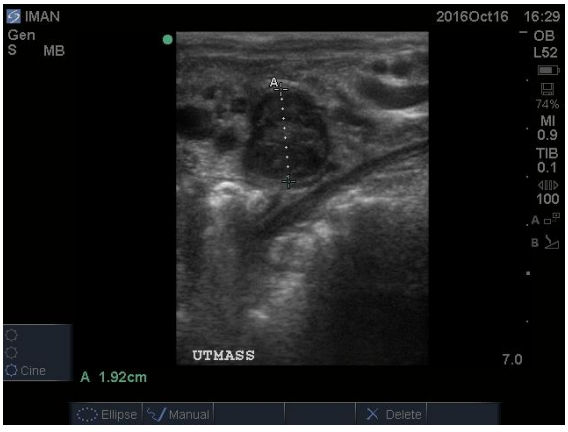


Plate 10. Ultrasonograph of the leiomyoma and various multilocular cysts in the uterus

3. Feed and feeding

The total amount of browse collected for the period 15th October to 30 November 2016, totaled 5628 kg. The browse were of good quality and fresher due to the cooler and wetter weather. More than 80% of the browse were collected from along the Tabin road, forest fringes along the oil palm plantations (KL – Kepong Sdn Bhd and Permai plantation, Tradewinds) and from those cultivated by BORA.

3.1 Voluntary Feed Intake (VFI)

The amount consumed varies with individuals, ranging from 57.2% (Iman) – 79.7% (Kretam), of the amount offered (Figure 3).

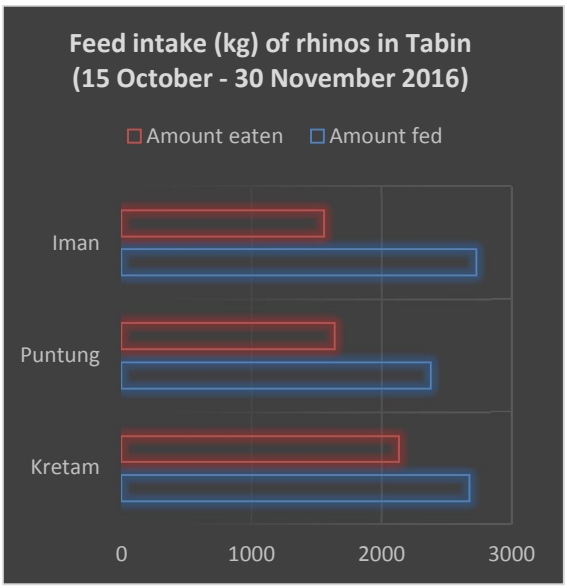


Figure 3. The amount of foliage offered and consumed by the three rhinoceros

The variation in feed intake also varies with the plant species and age of the foliage. The young and newly cut foliage are preferred to an older one. Certain *Ficus sp* (Ara manga, Ara Epal, Ara Ajinomoto) are favored over other species of *Ficus* (Plate 11).

Plate 11. Keeper Ronald Jummy beside the most favored Ara Mangga

The local "BORA named" species collected for the rhinos include, Ara Mangga, Ara Ajinomoto, Ara manis – manis, Ara epal, Ara diala, Ara belimbing, Ara lipan, Ara daun halus, Kemanchi, Gatal gatal berbulu, Nangka, Nangka air paya, Nangka air pasir, Nangka air bukit, Ludai susu, Maitap daun besar, Maitap bergetah, Pulai dau besar, Putih sebelah, Nangka air, Sadaman, Seringkalang, Meremia, Binuang, Buluh basah, Kelawit berbulu, Hijau sebelah, Bendera berbulu, Tambirok, Terosot rebung and Gatal gatal kopi. The number collected daily averaged 13 species (12 – 14 species).

They were also 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.

All rhinos received a 5 - 6 kg of banana or papaya daily. Usually, half were given in the morning and half in the evening. In addition they were also fed pumpkins daily (500 grams each for Puntung and Kretam). Iman gets 2 kg of pumpkin daily. Additional fruits were used during veterinary procedures including blood withdrawals and ultrasonography. Fruits were also used in administering oral medication, especially Hoofmaker TRM® and anthelminthic.

The rhinos were hand fed twice daily, between 0800 – 1000h and 1430 – 1700h. The Voluntary Feed Intake (VFI) for Kertam, Puntung and Iman ranged from 22.5 – 53.5 kg (μ=40.4 kg), 19 – 48.5 kg (μ= 28.4 kg) and 22 – 43.5 kg (μ= 30 kg) respectively.

In addition, the foliage were also hung inside the paddock for them. The amount ranged from 14 – 28 kilograms. On the average, the range consumed by Kretam, Puntung and Iman were 4 – 12 kg, 3 – 14 kg and 4 – 8 kg respectively.

Kretam did not come back for feeding on one occasion. This is due to the electro ejaculation procedures, a day before. However, this is not unusual for Kretam. On the other hand, Puntung did not return for feeding on eight occasions in the morning and seven for the evening feedings. Iman did not come back on the morning of 24th October 2016 due to the presence of elephants around her paddock.

In mid-November 2016, Puntung was observed to consume most of the entire foliage offered without cutting off a section as she normally does. It was observed that her left over from hand feeding is negligible. In contrast with the other individuals, there would be substantial amount of left overs during feedings (morning and afternoon). It was observed that the food plants given, if too coarse or hard would be half crushed and removed (Plate 12).

Plate 12. The half chewed food plant spat out by Puntung

3.2 Rhino Food Plantation

The amount of rhino food plants, particularly the *Ficus spp* and *Artocarpus heterophyllus*, increased significantly in the nursery at the RFP and around the night stalls and paddocks. New seedlings and marcotted plants were produced throughout the month of November 2016 (Plate 13).

Plate 13. The *Artocarpus* seedlings (a) and the marcotted *F. francisi* (b) in the nursery

The plan for the following month would be to increase the Grade 1 species including the Ara Mangga and Ara Bendera Berbulu. In addition, the 100 *A. heterophyllus* seedlings will be planted on the ground at the age of four months.

4. Biosecurity and health monitoring

The onset of the rainy season at the end of the year coincides with higher incidences of disease outbreaks, particularly water borne ones. Higher emphasis were given to minimizing contamination through soil or water. The routine prophylaxis and avoidance of such incidence were handled urgently. As an example, a staff was seen using of the vehicle meant for food collection for transporting rubbish. A warning was issued to all staff, following that. 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 once a month. Subsequently blood, urine, and feces from the three rhinos were also taken for screening. These were subsequently send to the Kepayan Veterinary Diagnostic Laboratory in Kota Kinabalu for analysis and isolation of pathogens. Blood and serum samples were also analyzed at the Pathology and Clinical Laboratory (M) Sdn. Bhd in Sandakan.

4.1. Hematology

Blood was only collected from Kretam as the rain had disrupted collection from Puntung and Iman which was back later than usual. The complete blood counts were within the normal values when compared to past analysis and other Sumatran rhino records. There were no blood protozoa isolated from the samples (Table 1).

Table 1. Complete blood count (CBC) for Kretam (SWD 002)

Parameters	Puntung	Kretam	Iman
Hemoparasites		neg	
RBC (X10^12/L)		5.84	
WBC (1000/ul)		7.81	
Hb (g/dl)		14.0	
PCV (%)		44.0	
Seg. Neutrophils (%)		59.0	
Eosinophils (%)		19.0	
Lymphocytes (%)		19.0	
Monocytes (%)		3.0	
Basophils (%)		0	

4.2 Bacteriology

The horse pellets (Gold Coin®) were negative for pathogens including Salmonella. The Kepayan Veterinary Diagnostic 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 *Neisseria animaloris zoodegmatisi.* Tyre bath 1 (RIF) and 2(RQF) had moderate *Enterobacter cloacae complex*.

The water samples from 13 tank were tested for coliform contamination. All samples were negative for Salmonella. However, all 13 tanks had a total bacterial counts of 450 – 800 cfu/ml. The *E. coli* colonies were absent in Tanks 4, 10 and 13. The other tanks

had counts of between 10 – 200 cfu/ml (Table 2).

Table 2. The total bacterial, coliform and *E.coli* counts in 13 water tanks (cfu/ml)

Tank	Total bacteria	Total coliform	*E.coli*
1	450	40	10
2	400	80	80
3	650	180	140
4	450	0	0
5	500	240	200
6	480	140	100
7	500	100	80
8	800	120	90
9	500	240	180
10	350	0	0
11	600	100	80
12	700	240	100
13	500	0	0

The water tanks affected (≥ 100 cfu/ml) were from Tank 3 (Puntung's night stall close to the forest), Tank 5 (Kretam's water for cleaning his night stall), Tank 6 (inlet tank at RQF), Tank 9 (water for the bathroom at RQF) and Tank 12 (base camp). These tanks are treated with chlorine solution (1L/10000 liters water).

The main source of water to the entire facility in Tabin (staff quarters, office and rhino facilities) came from the Lipad River via gravity intake. Some water were harvested from the rain via gutters and tanks.

The water is initially filled up in two 10,000 liter tanks, situated along the road towards the BRS, just beyond the telecommunication tower. Prior to channeling the water to the rhino facilities, a single 4,800 liter tank, is filled up. Once the tank is full, it is then pumped to two 4,800 liter tank at RQF and subsequently to RIF.

The twenty floor swabs had few *Bacillus sp*.

Fecal samples from *Puntung* and *Kretam* had abundance *E.coli* while that of Iman had moderate *E. coli*. The urine samples from all the rhinos had no bacterial growth.

4.3 Parasitology

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

4.4 Routine prophylaxis

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.

The chlorination of water tanks were only carried out with those having high *E.coli* counts of ≥ 100 cfu/ml.

5. Reproductive assessments and hormonal treatment

5.1 Puntung – treatment prior to OPU

Puntung was examined twice a week using the Sonosite M – Turbo® to determine her ovarian activities and correlate that to her hormonal profile (P4) and behavioral interactions with Kretam. However, prior to the OPU, she was also treated with 2.1 mg Deslorelin acetate (Ovuplant®). During the three days treatment, her ovaries were scanned for follicles and their growth. This implantable sustained release Gonadotropin Releasing Hormone (GnRH) analogue functions to induce ovulation (Plate 14).

Plate 14. The implanter and implant (arrow) in the 12G needle

The treatment were given on the 7th, 9th and 11th November 2016 at 0900H. The sites for the implant were rotated between the front and hind feet, at the ventral part of the shoulder and pelvic folds, respectively. Subsequently, she was scanned and her blood take for serum progesterone (Table 3).

Table 3. The treatment protocols and monitoring procedures before OPU

Date	Ultrasound	Serum P4	Ovuplant
6.11.2016	√	√	
7.11.2016	√	√	√ 0900
8.11.2016			
9.11.2016	√	√	√ 0900
10.11.2016			
11.11.2016	√	√	√ 0900
12.11.2016			
13.11.2016			
14.11.2016	Ovum pick – up (1100)		

To enable the injections to be administered to the hind leg, the chute was modified. The second last wooden post was removed, one foot above the floor and a metal bracket was attached to the column to allow reattachment of the post when needed to. This temporary replacement of a part of the wooden post allows complete viewing of the pelvic folds and the injection site, otherwise blocked by it (Plate 15).

Plate 15. Puntung in her chute with the rear leg exposed by removal of the second last wooden post (arrow)

Once the fold was exposed, Emla® cream was rubbed around the injection site, before local anesthetic (Lignocaine HCL) administered. Finally, the implant was injected into the site (Plate 16).

Plate 16. The implant being injected into the anesthetized site of the pelvic fold

Any bleeding was stopped by applying thumb pressure on it.

5.2 Iman – treatment prior to OPU

Iman was given a single subcutaneous injection of 2.1 mg Deslorelin acetate (Ovuplant®) on the 12th November 2016 (1730H) to try and stimulate growth of the follicles. In contrast to Puntung, she was given at the tail base, after a local anesthetic injection. Iman was also scanned prior to the Ovuplant® injection.

5.3 Kretam – treatment prior to semen collection

Kretam was started on a supplement consisting of 50 grams Beta carotene and 50 grams Vita Plus (Vitamin E and Selenium). Three weeks into the oral supplement, he was showing signs of erection which increase in intensity with time. The supplement was continued for almost three month. It was stopped on the 7th November 2016, a week before the scheduled electro ejaculation.

5.4 Hormone profile

5.4.1 Puntung

Blood was collected for serum progesterone, whenever an ultrasound examination was conducted on Puntung. The frequency of blood collections depended on the status of the follicle (s) and if hormonal treatment was administered. The serum progesterone (P4) for October – November 2016 did not show a high peak level. The highest recorded was 0.91 ng/ml and the lowest, 0.34 ng/ml. The treatment with deslorelin acetate were carried out on the 7th, 9th and 11th November 2016 (Figure 4).

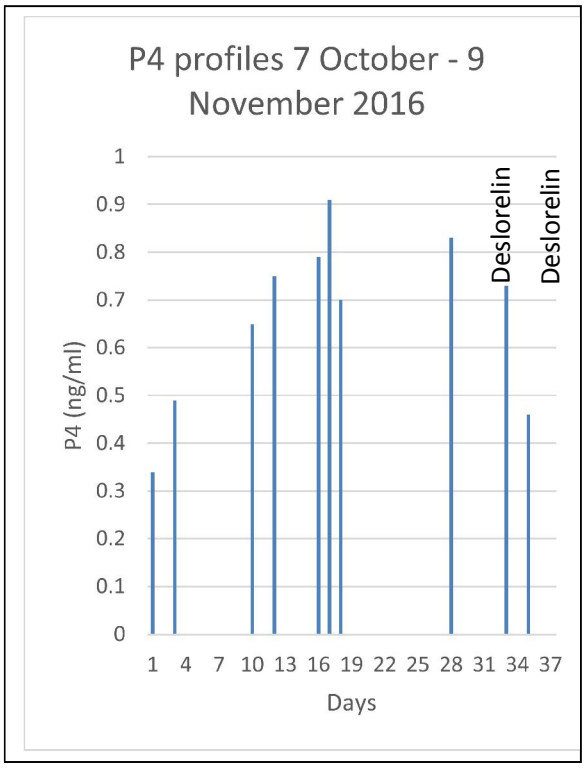


Figure 4. The progesterone levels (ng/ml) for October – November 2016. Deslorelin was given on the 7th November 2016

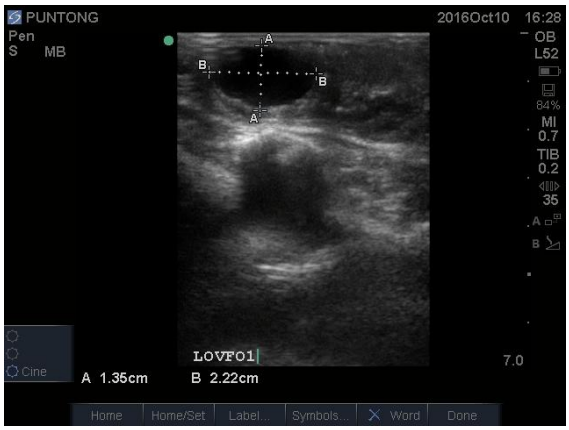
5.5 Ultrasonography

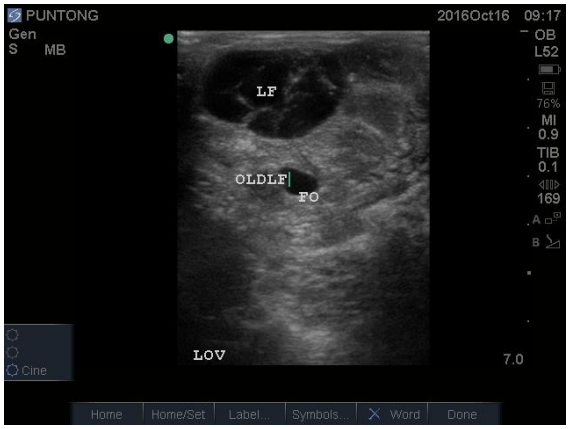
5.5.1 Puntung

The development of the follicles were closely monitored during the Ovuplant® administration (7 – 11 November 2016). More activities were observed in the left ovary as compared to the right.

On the 7th October 2016, the left ovary showed a single follicle (18mm diameter) and one luteinizing follicle. The follicle grew slightly on the 9th However, examination on the 16th revealed a large luteinizing follicle measuring 2.42 cm diameter and a previous smaller 1.1 cm luteinizing follicle. On the 24th October, the left ovary had two luteinizing follicles and a 1.6 cm follicle. In addition, there were two 0.5 cm follicles on

the right ovary. On the 27th October, the follicles on the right ovary grew to 1.7 cm. Prior to the Ovuplant injection, the left ovary showed a single 1.4 cm follicle. On the 9th November, there were two follicles (0.7 and 1.3 cm diameter) on the left ovary and none on the right (Plate 17).





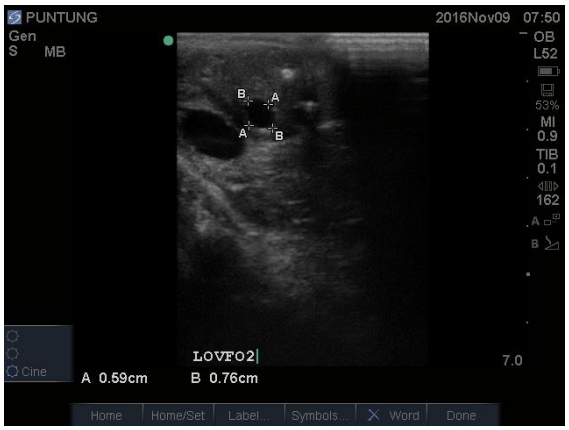


Plate 17. The sequence of follicular development over a month on the left ovary and during the Ovuplant® treatment..

5.5.2 Iman

Ultrasonograph of Iman's ovaries on the 22nd October 2016 showed two follicles (1.5 and 0.5 cm diameter) on the left ovary and none on the right. A 1.8 cm follicle was observed on the left ovary on the 6th November 2016. A 1.6 cm diameter luteinizing follicle was also present. On the 12th November 2016, a 1.0 cm follicle was observed on the right ovary and two (1.9 and 1.4 cm diameter) were scanned on the left ovary.

5.2.3 Kretam

Ultrasonograph was performed on Kretam after the electro ejaculation to view the prostrate and the bulbo urethral glands. The

testis were also scanned. The accessory sex glands and the testes showed marked improvement.

5.6 Behavioral estrus

Kretam showed interest in Puntung on the evening of the 14th and 16th November 2016. Both incidences occurred in the forest, close to the middle intersection of their paddocks but does not coincide with any ovarian activity or P4 hormone profiles.

6. Electric fencing

A more regular check was carried out during the recent months due to the heavy rain. There were more incidence of tree fall, branches dropping down and potential damage by elephants.

The current voltage for the electric fence ranged from 8.9 kV to 9.8 kV. The Rhino Interim Facility recorded a range of 8.9 – 9.6 kV while the Rhino Quarantine Facility, ranged from 8.9 – 9.8 kV. The Rhino Food Plantation recorded a low of 9.2 kV and a high of 9.8 kV.

7. Other activities

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

Thirteen more Jackfruit trees were treated with Nurelle DC505C (Class II) insecticide. The previously treated trees showed excellent progress. However, two trees were given repeat treatment due to reinfection. The trunk borers were collected for further identification (Plate 18).

Plate 18. The different variety of trunk borer beetles from the Jackfruit trees in Tabin

Constant look out and checks need to carried out on the jackfruit plant as the species is very prone to trunk borer beetles as compared to the other rhino food plants.

7.2 Sinages for tree planting

This activity started with KL – Kepong Sabah Sdn. Bhd planting some Jackfruit trees inside the BORA RFP in September 2016.

With the visits by several VIPs to Tabin to see the much endangered Sumatran rhinos, it was decided that BORA would encourage planting of the rhino food plants to support their food bill as well as create an awareness of the importance of food plants for the rhinos.

One BORA staff was assigned to prepare the sinages with basic tools and paint. The names of each planter would be written on the belian (*Eusideroxylon zwageri*) wooden planks, together with the names of plant species and date of planting (Plate 19).

Plate 19. Hasan Sani preparing the plank and the ready signage

The staff from the Institute for Zoo and Wildlife Research, Germany planted some *Ficus sp* inside the Rhino Food Plantation in mid-November 2016 (Plate 20).

Plate 20. Prof. Thomas Hilderbrandt next to a Ficus spp that he planted in the RFP

7.4 Cleaning – drying all the water tanks at RQF and RIF

With the recent spate of *E.coli* manifestations in most of the water tanks at RQF and RIF (both for human and rhino consumption), BORA had to empty all tanks and clean them with high pressure water jet. The tanks were inverted to remove all remaining water and subsequently dried (Plate 21).

Plate 21. Joseph and Rasaman cleaning the tanks with high coliform counts

Water samples will be continuously taken every month to ensure that there is no contamination by coliform bacteria.

7.5 Repair or change OPU probe holder

The Sonosite C11x® curvilinear probe, needle guide and the OPU system had to be send back to Minitube® as it was found that there is a gap between the two casings (Plate 22). Although the cost is borne by the company, it is time consuming and risky.

Plate 22. The gap (arrow) is seen when the transducer is placed together with the needle

The whole set of OPU tools, including the Sonosite curvilinear CX 11 probe, were send to Minitube GMBH, Germany (Plate 23).

Plate 23. The complete set of OPU probes and CX 11 probe

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

The progress to rectify current issues with the BRS remained slow despite several discussions and site visits. The main problems include the removal of all the remnants of construction materials from the paddocks; ensuring the flow of current on the hot – wires around the perimeter fence and the repairs of the agreed slopes inside the night stalls.

Due to the delay in activating the electric fencing, the damage caused by elephants are inevitable. Similarly, the fence was not maintained and this allows the growth of weeds which further complicate the whole process.

The evaluation in November 2016 showed unresolved problems in BRS (Plate 24 – 28).

Plate 24. Broken top of the electric fence post.

Plate 25. The black shade netting removed by elephants

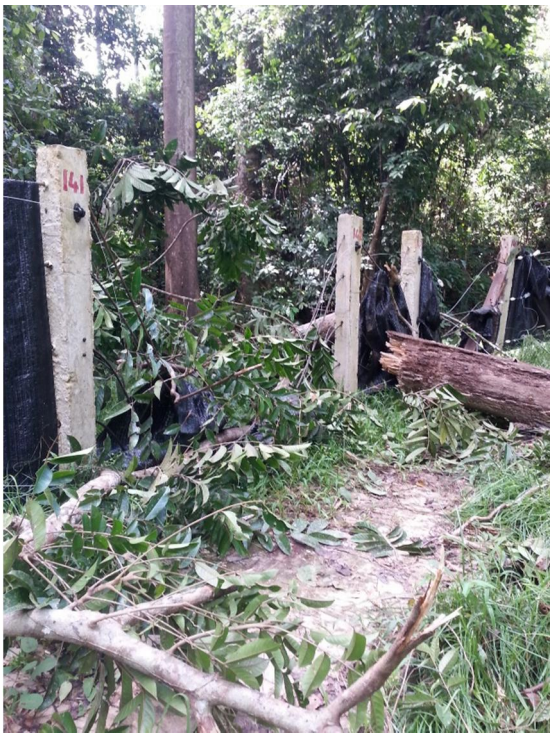


Plate 26. Tree fell onto the fence

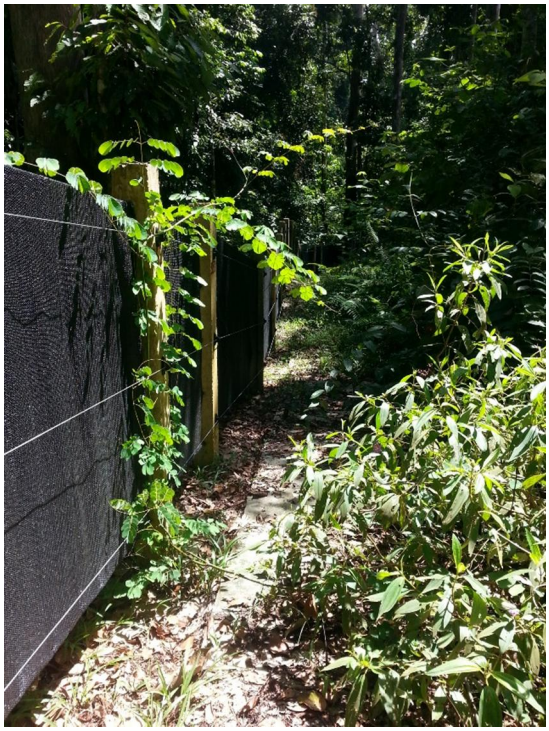


Plate 27. Weeds growing onto the fence

Plate 28. Elephant dung in rhino paddock

7.7. Training on handling of ovaries and manipulations for ovum pick – up

The training will be conducted in another Jabatan Perkhidmatan Haiwan dan Perushaan Ternak (JPHPT) farm in Kalumpang, Sempoerna 17 – 19th December 2016.

These will include handling, rectal examinations, pregnancy diagnosis and reproductive anatomy. This is to familiarize the operator in handling Banteng or Tambadau for future OPU. The training will involve BORA staff (Dr. Zainal Zahari Zainuddin and Mr. Yap Keng Chee) and a few from JPHPT.