

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

**October 2018**

**Paddock Staff**

1. Wilson Kuntil (Head Keeper)
2. Justine Segunting (Rhino Keeper - RIF)
3. Maslin Mohiddin (Rhino Keeper – RQF)
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5. Ronald Jummy (Rhino Keeper - RQF)
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\* RQF: Rhino Quarantine Facility  
RIF : Rhino Interim Facility  
RFP : Rhino Food Plantation  
BRS : Borneo Rhino Sanctuary

**Sumatran Rhinoceros**

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

**1. Husbandry**

**1.1 Animal Management**

It rained for seventeen days, starting from the 6<sup>th</sup> October 2018. Most of the rainfall occurred in the early morning or afternoon. The total rainfall is 211 mm as compared to 115 mm, in September 2018. Rainfall ranged from 2 – 37 mm per day, averaging 12.4 mm.

The moderately wet weather is excellent for both rhinos, which actively move and occupy most of their forested paddocks (Kretam in paddock 1 and Iman in paddock 3). Water source within the paddocks were adequate in puddles and streams. The mud wallows were in good condition and used by the rhinos. Currently, Iman has three mud wallows (all man – made) with Kretam using only one wallow, constructed by him in October 2018 (Plate 1).



Plate 1. Iman inside her mud wallow in the afternoon after being hand – fed in the night – stall

The concurrent fruiting of the laran (*Neolamarckia cadamba*) trees, provided an additional source of food for the rhinos, inside their respective paddocks. Laran fruits were collected from the RFP, RIF and along the Tabin road for the rhinos. Both the rhinos will consume 1 – 2 kilograms of laran each during hand – feeding (Plate 2).



Plate 2. Laran fruits in season in Tabin Wildlife Reserve

The major problem encountered is removal of metal pieces from the paddocks. Despite the use of metal detector and daily scavenging of the paddock substrate, these remnants of construction waste were found strewn all over the forest floor. This constitute rusty nails, metal rods, metal plates, BRC wire mesh, iron pipes, food cans and corrugated bricks. Most were present along the electric fence, adjacent to the night – stalls and in front of the staff quarters. These sharp metal parts have

caused lacerations on the foot pads of the rhinos (Plate 3).



Plate 3. The rusty nails and metal parts found in Kretam and Iman's paddocks (a and b). The large triangular laceration on Kretam's right hind feet (c).

Currently, the food source for the rhinos are more than adequate throughout the year. These were mostly gathered from the surrounding Tabin Wildlife Reserve and occasionally from the RFP and the RQF.

Kretam is in good condition with his weights gradually increasing. He comes back for most of the evening feedings. Iman's body weight slightly increased in October 2018 but are still abnormally low. The main factor attributing to this is **reduced feed intake** that is very likely caused by the enlarged leiomyoma in the uterus. This tumour puts pressure (and discomfort) on the colon, jejunum and other parts of the gastro intestinal tract adjacent to it, if too much food is ingested. This is more pronounced with her not coming back for all her hand – feeding routines.

The proximate analysis of the faeces from Kretam and Iman indicated that the percentage of dry matter in is 22.11% and 15.14% respectively. Iman's faeces contained more water. This is due to the occasional soaking of Iman's forage in water or solution of water – vitamins – minerals during feeding. The ash contents were similar in both rhinos. The crude fat in faeces was higher in Kretam (5.51%) than Iman (4.42%). In contrast, the crude protein is lower in Kretam (11.45%) as compared to Iman (13.77%). Previous analysis in Sumatran rhinos showed a crude protein level in faeces of between 10 – 12 % (Dierenfeld, et al., 2006). Iman could be losing crude proteins into the faeces or the volume voided is related to the high concentrate feed (horse pellets) offered to her. She was also suspected to have malabsorption syndrome or toxæmia (from the leiomyoma) which could be causing her weight loss.

Despite the clinical problem (weight loss and lethargy), her other parameters (appetite, vocalization and ethogram) remained normal.

The mucous exudate from the pyometra was observed almost every day, but void of blood. She was ultrasound twice weekly to visualize the leiomyoma and ovarian activity.

The hoof cracks and lacerations in both rhinos, were constantly present due to the many waste materials (metals and corrugated cement/bricks) from previous construction of the facility. The lesions were treated daily and had showed good progress.

## 1.2 Body Weight

The body weights were taken using TruTest® electronic weighing scale. Kretam was weighed, twice a month (15<sup>th</sup> and 30<sup>th</sup> of September 2018). Iman was weighed once a week to allow close monitoring of her body condition and weight loss that was observed in August and September 2018.

Kretam showed a slight increase (8kg) in body weight as compared to September 2018, but lower than his average for the first six month of 2018 of 672 kg. This loss in bodyweight is attributed to the more physical activities within his forested enclosures and failing to come back for his hand – feeding (Figure 1).

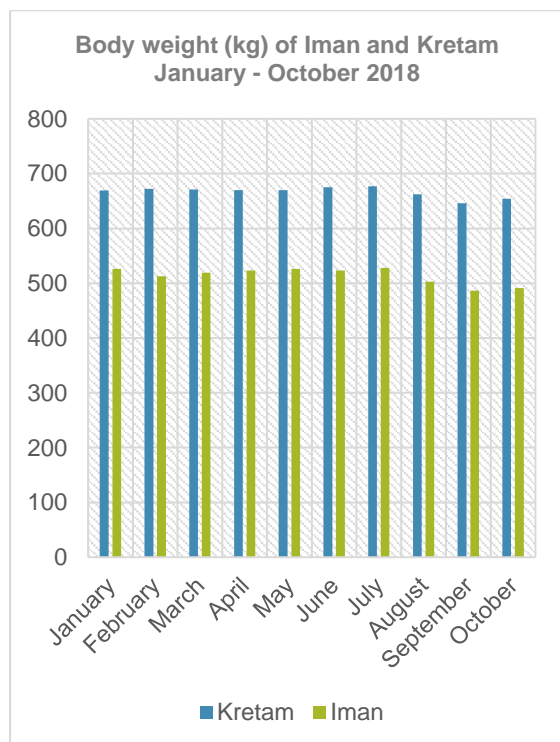


Figure 1. The body weights of both rhinos for January – October 2018

Iman gained slightly in bodyweight but is still grossly underweight when compared to her average (522.6 kg) for the first six month of 2018. She was 480 kg on the 14<sup>th</sup> October 2018 and gained 15 kg by end of the month (Figure 2).

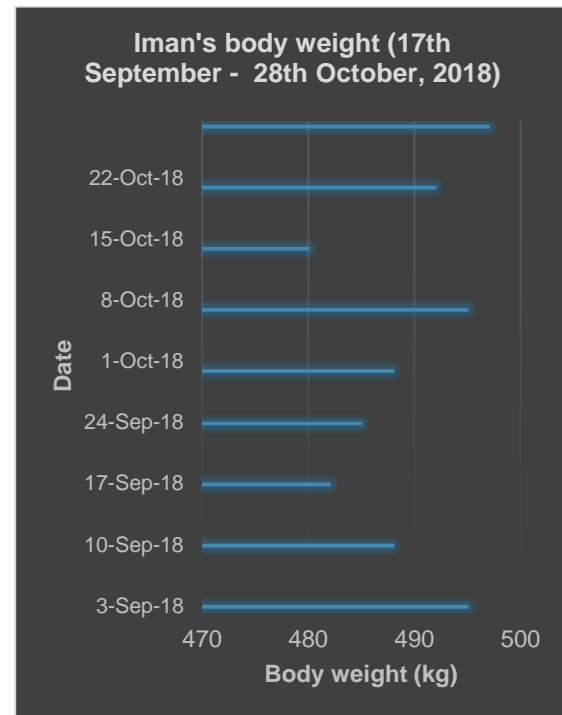


Figure 2. Iman's bodyweight for the month of October 2018

The tentative reasons for the drop in her bodyweight are reduced feed intake (leiomyoma putting pressure on her hind gut; she was absent on five occasions for hand - feeding), malabsorption and possible toxemia from her tumors.

The average bodyweight for Kretam and Iman for 2018 were 667 and 514 kilograms respectively. The most significant loss in bodyweight is failure of the rhinos to return for their two times daily, hand – feedings. On the average, Kretam would receive about 18 kg of browse, 500 grams of horse pellets and 6 kg of fruits per hand – feeding. Similarly, Iman would be fed 11 kg of browse, 800 grams horse pellets and 4 kg fruits.

## 2. Animal Health

The body scores of Kretam was maintained at around 2.5 – 3.0 and Iman at 2.0 (modified from Body Condition Scoring for Horses, Henneke et al., 1981).

The main reason for the rapid decline in the weights of the rhinos were their refusal to return to the night – stall for hand – feeding. In Iman, it also relates to the smaller quantum of food ingested. The minimum amount of browse for Iman and Kretam were 11 and 18 kg respectively, fed twice daily.

The vaginal discharge is still observed every day but almost all, without blood. The open pyometra still persisted in her.

The most common observation for both rhinos is the high number of lacerations and abrasions seen on their body, particularly the feet and hooves. These were apparently caused by some of the metal pieces and sharp concrete, scattered in the paddocks which surfaced after heavy rain. **Puncture by rusty nails, if occurred, would be the most devastating injury to the rhinos.**

Occasionally, Kretam would mount a small earth outcrop inside the paddock, near the fence. In October, this occurred on two occasion. This usually coincides with Iman's reproductive cycle, transferred to Kretam via her feces, placed inside the passageway around the smaller paddocks.

The routine monthly sampling for health and environmental checks for pathogens, were carried out for both rhinos and their surroundings. The samples were collected on the 14<sup>th</sup> October 2018 (Sunday) and submitted to the Veterinary Diagnostic Laboratory, JPHPT and Public Health Laboratory in Kepyayan, Kota Kinabalu on the 15<sup>th</sup> October 2018, before noon.

The samples included soil from around the night - stalls, mud from two wallows, water from the tanks, 21 floor swabs, horse pellets, feces, urine and blood. All these

samples except blood, were analyzed for bacterial contamination, particularly *E.coli*, *Salmonella sp* and *Bukholderia psedomalleie*.

### 2.1 Kretam

#### a. Lacerations and hoof chippings

The 2.5 cm laceration was observed on the plantar region of the right hind feet. The laceration, through the epidermis would have been caused by a sharp piece of metal or concrete block inside the paddock. A 2.0 cm chipping was seen on the right fore feet, digit 3 (Plate 4).

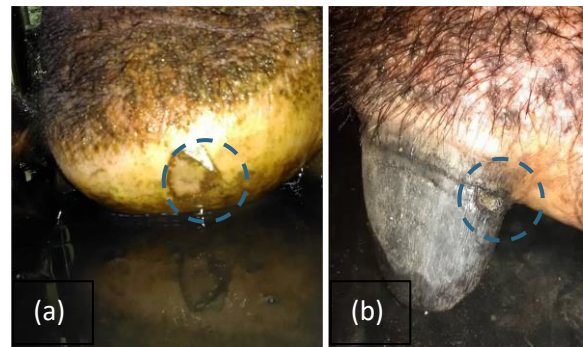


Plate 4. The laceration on the right hind feet (a) and the hoof chipping on the left fore (circles)

The lacerations were clean with flowing water and povidone applied into the cuts. Both lesions have healed completely.

#### b. Abnormal posterior horn growth

The posterior horn was damaged previously due to Kretam rubbing it against the door ledge. It was treated for fungal infection in 2017 and recovered. However, there were two depressions that always accumulates water and mud and softens the horn matrix. Horn growth in these areas were slow and often difficult.

Closure of these depressions with silicon rubber was attempted and it showed positive results. However, the silicon came off after three months. Currently, several depressions were seen on the horn. Treatment would consist of cleaning of the

horn, removing mud and debris from the grooves. Povidone would be applied before drying and cover with Stockholm coal tar (Plate 5).



Plate 5. The horn matrix with several depressions and filled with mud

## 2.2 *Iman*

### a. Reproductive tract pathologies

Several leiomyomas within the uterus and uterine horns were visualized through the ultrasonography examinations and via rectal palpations. Other pathologies observed included cysts, fluids, fibrosis, calcifications and hydrosalpinx. These pathologies have contributed to the low feed intake and vaginal discharges seen each day. The growing tumor presses against the caecum, colon and part of the small intestines, creating discomfort when the bulk of forage passes through.

Rectal examination indicated a large firm mass of the leiomyoma inside the uterus that occupies the right side of the pelvis. Ultrasonography of the uterus presents the whole range of pathologies, mainly cysts and leiomyoma. The endometrial cysts ranged from a few millimeters to almost 2 cm. They consisted of unilocular and multilocular structures. Similarly, the leiomyomas vary from a few centimeters to more than 8 cm diameter. These tumours were observed in the uterine body and horns of the uterus (Plate 6).



Plate 6. The 2.4 cm leiomyoma adjacent to the right ovary (o)

At the end of October 2018, a scan revealed the absence of follicle (follicular atresia) on both ovaries. The right ovary showed several large blood vessels, remnants from the ovum pick – up procedures (Plate 7).



Plate 7. The 2.8 x 1.6 cm right ovary with anechoic vessels.

The vaginal discharge was seen almost every day, more frequently, floating inside the wallow. Sometimes the discharge was seen in her night – stall, after defecation or urination. The mucoid discharge was often clear but sometimes whitish or white in colour. The latter is thicker in consistency.

The more frequent observation of the discharge in the wallow is due to her sternal position that ease the flow from the uterus – cervix – vagina (Plate 8).



Plate 8. The clear vaginal discharge was observed floating inside the wallow when used by Iman

### b. Weight loss

The underlying problem of Iman losing weight since August were multifaceted as mentioned earlier. The amount that she could consumed per feeding is about 11 kilograms as compared to a minimum of 15 kilograms in the past. This is directly due to the physical growth of the leiomyoma that had started to press against the hind gut and perhaps the caudal jejunum. The position and size of the tumors also puts pressure on the urinary bladder, sometimes causing frequent micturation

Her blood picture showed normal range of blood cells (red and white blood cells) and no generalized or systemic infection.

The proximate analysis of the feces from the two rhinos showed a higher dry matter content in Kretam (22.11%) as compared to Iman (15.14%). This indicated more water content in Iman's feces, likely due to the occasional soaking of Iman's forage in water or solution of water – vitamins – minerals during feeding. The ash contents were similar in both rhinos. The crude fat in feces was higher in Kretam (5.51%) than Iman (4.42%). In contrast, the crude protein is lower in Kretam (11.45%) as compared to Iman (13.77%). Previous analysis in Sumatran rhinos showed a crude protein level in feces of between 10 – 12 % (Dierenfeld, et al., 2006). Iman could be

losing crude proteins into the feces or the volume voided is related to the high concentrate feed (horse pellets) offered to her.

Iman spends a lot of time moving about her forested paddock and sometimes had to be called back to her night – stall for hand – feeding. However, on some occasions, she would rather go into her wallow (Plate 9).



Plate 9. Rasaman, the keeper, coaxing Iman with mango

The amount of horse pellets (Gold Coin®) was increased to almost 2.5 kilograms each day. This is to counter her smaller volume of forage eaten daily. Her appetite and behavior remained normal. The amount of soaking was also reduced to increase the fecal dry matter to a normal level.

More checks will be carried out to monitor the blood parameters and serum chemistry. The fecal samples will be sent for review at the end of the month.

### 3. Feed and feeding

Most of the rhino forages were collected from the KL – Kepong (Sabah) plantation and the forest fringes. Similarly, the harvest of food plants was also carried out from the Tabin road fringes, extending to the 6<sup>th</sup> kilometer towards the core area. Smaller amounts were obtained from the rhino food plantation and Ladang Permai, Tradewinds. About 20 % of the forage, used for hand – feeding Iman, comes directly from the RFP and RQF. However, for certain species

such as the Ara Ajinomoto (*Ficus minahassae*) are only found in the Ireton area in KL – Kepong. Although three trees were planted inside the RFP (Plate 10).



Plate 10. One of the three *F. minahassae* in the Rhino Food Plantation

The other species gathered each month included Nangka air pasir, Nangka air paya, Nangka air bukit (*F. fistulosa*) Ara manga (*F. annulata*), Mas cotek (*F. deltoidei*), Ara Kapal (*Ficus montana*), Ara Gatal berbulu (*F. francisci*), Putih sebelah ((*Leucosyke capitellata*), nangka (*Artocarpus hetrophyllus*), Pau (*Ficus calosa*), Maitap (*Neonauclea spp*) and Putih Sebelah (*Leucosyke capitellata*). Occasionally, apart from nangka leaves, other *Artocarpus* species were also collected for the rhinos. These included *A. altilis* (breadfruit), *A. elasticus* (terap togop), *A. camansi* (Kamansi) and *A. odoratissimus* (tarap). The preferred part by the rhinos would include the stem and shoots. The leaves are not always favored.

The total amount harvested daily (2660.5 kg) were divided into two parts; one for hand – feeding and the other to be hung out for the rhinos to feed at night. Apparently, the amount of forage hung out, consumed by Kretam (28.3%) is significantly higher than that consumed by Iman (4%). Similarly, Kretam consumed 3% more, hand – fed foliage every day as compared to Iman (Figure 3).

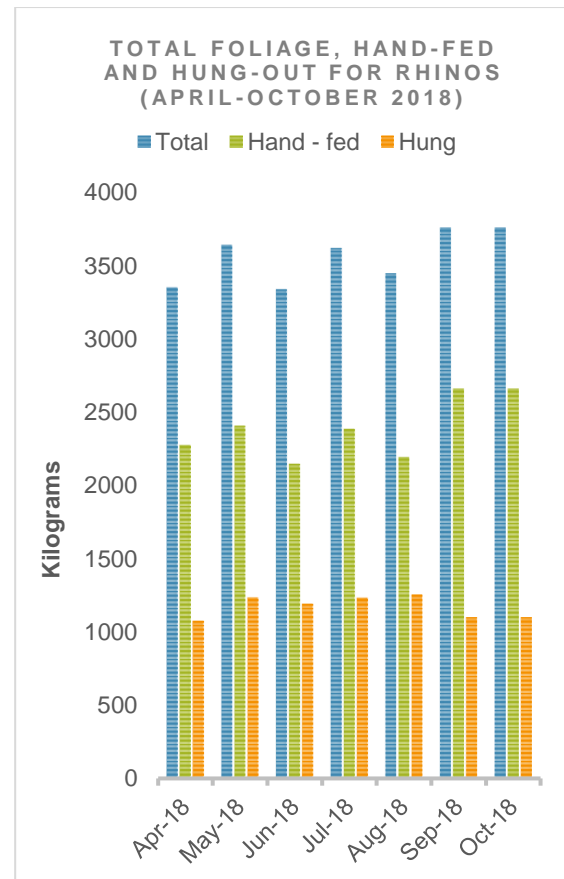


Figure 3. The total foliage collected monthly (April – October 2018), hand – fed to the rhinos and those that are hung out for the rhinos to feed on at night

The fruits fed to the rhinos were mainly banana (3 – 4 varieties), mango (3 - 4 varieties), papaya and cempedak (*Artocarpus intiger*). Half a kilogram of pumpkin was also fed to the rhinos daily. However, only Kretam consumed the full amount, as usual, being himself, a voracious eater. Iman took only two kilograms, reluctantly, for the month of October 2018. Sweet potato was occasionally given to the rhinos. The amount will be increased in November 2018.

Currently, with the fruiting season for laran, the rhinos spend more time foraging the forest floor sniffing out and devouring the fruits. Their acute sense of smell is demonstrated with them locating the laran in puddles or mud.

### 3.1 Forages

The total amount collected for the two rhinos in October 2018 is 3760.5 kilograms. The total amount consumed by the two rhinos constitute 48.2% (1812 kg). Of this, Kretam consumed 62% and the balance was eaten by Iman. Iman's daily forage intake ranged from 10.5 – 23 kilograms.

Twenty nine percent (1110 kg) of the total forage collected was hung out for the rhinos. 59% was allocated for Kretam and 41% for Iman. Of this, the total consumed by both rhinos is only 17.5% (194 kg), mostly by Kretam (Figure 4).

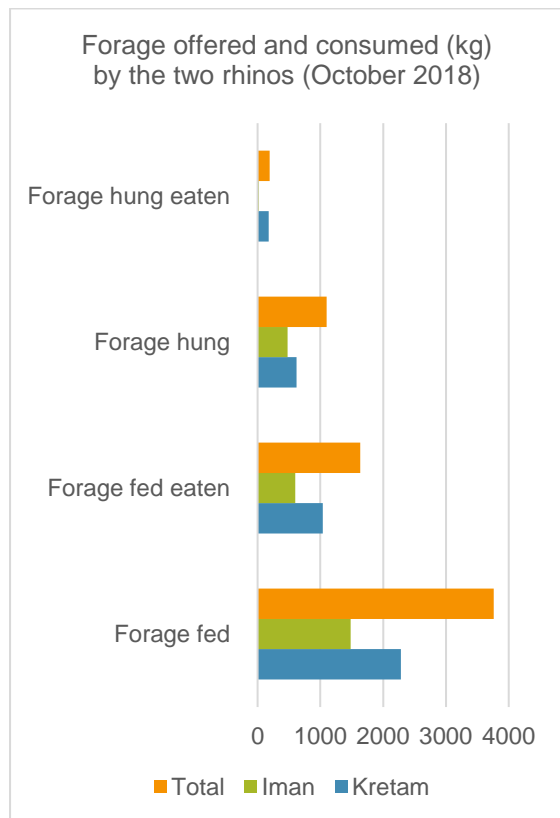


Figure 4. The amount of forages collected and fed to the rhinos

In September 2018, the amount of forage hung – out that was consumed was 174.5 kg, 100kg was consumed by Iman.

Currently, Iman will be housed in a smaller paddock and forage would also be hung inside the night – stall as previously in the RQF.

### 3.2 Voluntary Feed Intake (VFI)

As mentioned earlier, each feeding constitutes 11 kg of browse, 800 grams horse pellets and 4 kg fruits for Iman and higher for Kretam. In October 2018, Iman did not come back on six occasions. The impact is significant on body weight. Kretam was absent on four occasions.

The minimum, maximum and average amount of forage consumed daily by Kretam is 17, 41 and 33.5 kg respectively. In contrast, Iman consumed 10.5, 23 and 19.3 kg per day.

Iman was fed about 16 species comprising mainly, *ficus*, *arthocarpus*, *uncaria* and *leukosyke*. The amount consumed per feeding ranged from 10.5 – 13.5 kg. Her appetite remains good and feed intake, consistent. *A. elasticus* was readily consumed by Iman whenever available (Plate 11).



Plate 11. Tarap togop was hand fed to Iman inside the chute.



However, her discomfort (slowing down on her intake) could be seen after consuming about 6 – 8 kilograms of forage. Iman consumed only 18.5 kg (4%) of the 480 kg hung -out for her. Her total feed intake is 616.5 kg as compared to 632 kg in September 2018. There is a need to keep her in a smaller enclosure to ensure she feeds on the browse that is hung for her each night.

The total amount of fruits consumed by the rhinos represents 16% (353.5 kg) of total food intake. Half of the fruits were fed in the morning and the remaining in the afternoon or evening.

Horse pellets (Gold Coin ®) were given as supplement to both rhinos. Kretam receives 500 grams each day, fed in the morning feeding. Iman was given about 2.5 kg each day, divided into two feedings. This is a temporary measure to boost her bodyweight and counterbalance he reduce forage intake. The pellets were mixed with water and soften before feeding the rhinos.

Supplementation with mineral and vitamin (Stress Pack®) were added to the drinking water (5 grams to 8 liters water). A small amount is used to entice Iman to consumed the last 2 or 3 kilograms of forage.

#### 4. Biosecurity/health monitoring

The biosecurity measures were mainly to ensure zero introduction of pathogens or diseases into the BRS complex, particularly the rhinos and keepers.

Water from the tanks (two for rhinos and one for keepers) at BRS were tested for total coliform counts and the presence of *E.coli*. Soil samples were sampled for bacteriology analysis. Floor swabs were taken for microbial cultures and identification. Blood sample was taken from Kretam for a complete blood count (CBC). Samples from the vaginal discharge was taken from the floor of the night - stall for bacterial isolation and sensitivity tests.

#### 4.1 Hematology

Blood was collected Kretam into EDTA tube from the digital plexus, for a complete blood count (CBC). (Table 1).

Table 1. The complete blood count for Kretam in September and October 2018.

Parameters	(Kretam)	
	24 Sep	15 Oct
Hemoparasites	Nil	Nil
RBC (X10 <sup>12</sup> /L)	5.24	4.6
WBC (1000/UL)	10.8	5.7
Hb (G/DL)	12.5	13.7
PCV (%)	44	49
Seg. Neutrophils (%)	51	52
Eosinophils (%)	32	34
Lymphocytes (%)	17	10
Monocytes (%)	0	2
Basophils (%)	0	0
MCV (FL)	NA	NA
Platelets (G/L)	NA	NA
MPV (FL)	NA	NA
MCH (PG)	NA	NA
MCHC (G/L)	NA	NA

The blood parameters were compared to previous records and publications on the Sumatran rhinoceros. The CBC showed the variables were within normal limits for Kretam.

#### 4.2 Bacteriology

Swabs 1, 3, 4, 5, 14, 15 and 16 were positive for *Staphylococcus sp*. Swabs 2, 10, 11, 12, 17, 18 and 21 were positive for *Bacillus sp*. The rest had *Spingomonas paucimobilis*, *E. coli*, *Acinetobacter haemolyticus* and *Stenotrophomonas multophilia*. However, none are considered pathogenic.

The 17 soil samples taken from various locations surrounding and inside the rhino enclosures were negative for *Bukholderia pseudomallei*. The two samples from the mud wallows were also negative for *Bukholderia pseudomallei*.

Water from the sump was positive for *Acinetobacter iwoffil*.

The water samples taken from 5 tanks at BRS had a total bacterial count ranging from 40 – 1110 cfu/ml. The total coliform count ranged from 10 – 110 cfu/ml. Only one water tank (no. 4) had an *E.coli* count of 110 cfu/ml (Table 2).

Table 2. The total bacterial, coliform and *E.coli* counts in 5 water tanks (cfu/ml) for the month of October 2018.

Tank	Total bacteria	Total coliform	<i>E.coli</i>
1	270	50	0
2	40	20	0
3	450	0	0
4	1100	110	110
5	610	0	0

There were no *Salmonella sp* isolated from the water samples.

Sample from the vaginal discharge was positive for *Streptococcus agalactiae*. The drug of choice was Amoxicillin, Norflocacin, Vancomycin, Erythromycin and Penicillin G (Table 3).

Table 3. The antibiotic sensitivity test for *Streptococcus agalactiae* from the vaginal discharge

No.	Antibiotic	Sensitivity
1.	Amoxicillin 25mcg	Sensitive
2.	Gentamycin 30mcg	Resistant
3.	Norfloxacin 10 mcg	Sensitive
4.	Sulphonamide 300mcg	Resistant
5.	Erythromycin 15mcg	Sensitive
6.	Neomycin 30mcg	Resistant
7.	Penicillin G 10iu	Sensitive
8.	Vancomycin 30ug	Sensitive

There were no pathogens isolated from the urine and feces of both rhinos.

The total coliform counts from the horse pellets (Gold Coin®) was 0 cfu/gm, and negative for *E. coli*.

### 4.3 Parasitology

The fecal samples from both rhinos were negative for endoparasites and parasitic egg count.

### 4.4 Routine prophylaxis

Routine liming (application of calcium/magnesium – rich materials) was carried out mostly around the rhino dung piles (composting area) located within the walled passage near paddock 3. Liming were also carried in the sumps. The tyre baths were monitored and maintained with proper disinfectants and concentration

### 5. Reproductive assessments

Iman was scanned on the 21<sup>th</sup> and 27<sup>th</sup> October 2018. Apart from the obvious uterine pathology, her left ovary was inactive.

The routine placement of Iman’s feces in the concrete passage was done daily to stimulate Kretam’s libido. He was observed to mount a small earth outcrop on two occasions in October 2018.