

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

October 2017

Paddock Staff

1. Wilson Kuntil (Head Keeper)
2. Justine Segunting (Rhino Keeper - RIF)
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* 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.	Iman	Female	SWD 004

1. Husbandry

1.1 Animal Management

The management of Kretam and Iman emphasized on minimizing stress and onset of diseases. Apart from hygiene, some of the husbandry factors that lead to the incidence of diseases includes the overused paddocks and soil compaction. This is made worse with the heavy rain, erosions and tree fell. Several areas within the paddocks were also waterlogged and posed great danger to the rhinos' feet and hooves.

Due to its smaller size, Iman's paddock is severely eroded and the present wallow is located at the base of a slope. The rain and erosions will negatively impact the wallow. The trails towards the night stall is markedly deepened by the constant use and compaction by the rhino and often filled with water.

The deep trenches put a lot of physical stress on her as she approaches the night stall for her twice daily feedings. This sometimes resulted in bleeding from her leiomyomata (Plate 1).



Plate 1. Iman walking from her night stall towards her wallow. Noticed the deep trenches she had to pass through daily

Kretam experienced hoof cracks about two months ago, located on his hind feet and some chippings on the front hooves.

This is frequently attributed to softening of the hoof matrix that resulted when the wallow is watery for a long period of time. Such husbandry problem was observed in Ragunan Zoo, Indonesia in the 1980s.

The old wallow reused by Kretam is very watery and the keepers needed to drained of the water each day using buckets. However, on the 24th October 2017, after a heavy downpour, Kretam made a new wallow. This has thick and smooth mud inside it. It was also located in a shady area and blocked by a fallen tree for safety. A perfect

wallow! He spends a lot of time soaking and resting in the wallow (Plate 2).



Plate 2. Kretam coming out of his new wallow. Noticed the good quality mud

However, in several locations, the muddy trails and main path into the exercise yard and night stall is heavily eroded. The one-meter deep mud pool had to be filled up with sand bags every few months (Plate 3).



Plate 3. The sand bags near the entrance to the exercise yard

1.2 Body Weight

Weighing was carried out twice a month, using a TruTest® electronic weighing scale. The rhinos were usually weight after being coaxed to go inside the chute.

Kretam and Iman averaged 660.5 and 555 kilograms respectively. The diet for both rhinoceros were maintained with no change in amount and variety. Both rhinos maintained their body weights with minor fluctuations throughout the year (Figure 1).

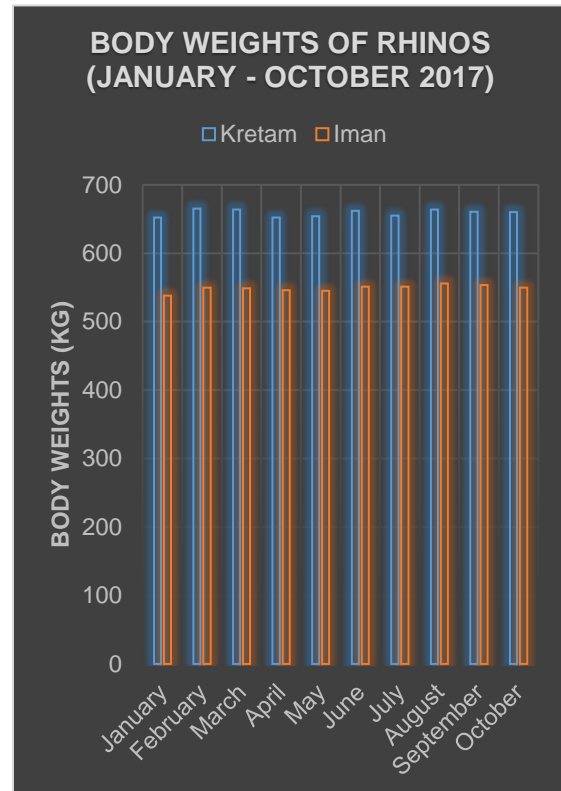


Figure 1. Bodyweights of Kretam and Iman (January – October 2017)

1.3 Animal Health

The body scores of the two rhinoceros were maintained at around 2.5 – 3.0. The main worry are the deteriorating conditions of the paddocks. This is due to the frequent heavy rainfall and uprooting of trees within the paddocks. The two rhinos returned for the daily feeding periods, with Kretam being at varying times. The minimum daily consumption of browse remained unchanged.

Kretam was still observed to mount the log or earth mount within his enclosure.

Iman had vaginal discharge on one occasion in early October. However, the discharge was mucoid and whitish (Category 4) and did not require any treatment. All other parameters were normal.

Soil sampling around the night stalls, floor swabs of the night stalls, blood sample, urine, feces and water from water tanks

were done on the 22nd October 2017. The samples were transported at 2.00 am on the 23rd October 2017 from Tabin Wildlife Reserve to the Veterinary Diagnostic Laboratory and Public Health Laboratory in Kepyayan, Kota Kinabalu. Except for the coliform counts, which would take about a week, the other analysis took between 1 – 3 days.

1.3.1 *Kretam*

a. Fungal infection of posterior horn

The posterior horn showed improvement after the antifungal Terbinafine (Lamisil®) treatment. The lesion was clean and scrubbed and let to dry, before applying the medication. The oral Hoofmaker TRM® administered to treat hoof cracks, would also have a positive effect the growth of the horn matrix. Treatment with Terbinafine was temporarily stopped to allow the horn matrix to regenerate (Plate 4).



Plate 4. The posterior horn is thoroughly scrubbed clean before the application of the antifungal Terbinafine

b. Hoof cracks

The more serious hoof problem were cracks below the coronary dermis that were seen to cut laterally across digit 1 on both the right and left hind legs. The crack is about 5 cm in length (Plate 5).



Plate 5. The hoof cracks on the hind legs of Kretam

There was improvement on the crack observed on right feet. It is narrower and less deep than before. Apart from the local treatment (antiseptics, 2% formalin and coal tar), the rhino was also given a supplement of biotin and methionine (Hoofmaker TRM®), once daily in the afternoon (20 grams). This long-term treatment would require about six months to resolve.

Rubber mats for the floor of the night stall were increased in numbers to reduce the tension of the affected hooves on the concrete flooring (Plate 6).



Plate 6. Wilson adding more rubber mats inside Kretam's night stall

2.3.2. *Iman*

a. Vaginal discharge

The only vaginal discharge observed was on the morning of 1st October 2017. The discharge was observed to come out just

after she defecated inside the night stall. It was mucous and white in color, 10 – 20 mls in volume and without any purulent odor (Plate 7).



Plate 7. The white vaginal discharge that was extruded just after defecation

This Grade 4 vaginal discharge did not require any treatment. In comparison, there were vaginal discharge (some with blood) on four occasions in September 2017, a Grade 3 which required treatment. Such traumatic causes of the discharge are not within our control as the paddock condition deteriorated quite badly with time and weather.

c. Reproductive tract pathology

The GnRH analogue (Improvac®) lessens the activity of the ovaries and does help in controlling the severity of the discharges. The cause of the discharges in September 2017, was traumatic origin due to the bad paddock condition leading to excessive physical exertion. This occurred when she returns to her night stall twice daily and back to her wallow afterwards.

She was scanned three times in October 2017. The pathologies observed included leiomyomas of varying sizes (3 – 7 cm), numerous cysts (multi and unilocular), a

hydrosalpinx in the right oviduct and fluids within the uterus (Plate 6).



Plate 8. The hypoechoic fluids and anechoic fluid filled cysts inside the uterus (a), The anechoic hydrosalpinx inside the oviduct of Iman (b) and the hypoechoic leiomyoma with hyperechoic streaks (c).

In my opinion, the tumors had increased in size and perhaps numbers. Although the Improvac® did reduce the ovarian activities but it did not totally stop folliculogenesis. The discharge is correlated to the amount of fluids inside the uterus as seen during ultrasonography.

The other pathologies are related to the ovum pick – up procedures, with increased vascularization of the ovaries

Feed and feeding

The rainfall is very consistent in September – October 2017 with large amount of lush rhino foodplants. However, totally a menace is the weed that grows rapidly around the paddocks and in the rhino food plantation. The wet season is also good for marcotting plants from the forest. Apart from collecting the Grade 1 plants from the forest fringes, some were brought back for replanting (Plate 9).



Plate 9. Hasan Sani holding on the marcots of *Ficus brunneoaurata* to plant inside the RFP

The rhinos were fed a minimum of ten species (average 16 species/month) each day. A large amount consisted of various *Ficus spp* and Jackfruit leaves (*Artocarpus heterophyllus*). Currently, about 20% were harvested from the Rhino Food Plantation while the other food plants were collected from the nearby plantations and forest fringes.

The total amount fed to the rhinos in October is 3560.5 kg, most of which consisted of *Ficus spp* and *Artocarpus spp*. The common species collected includes Gatal berbulu (*Ficus francisi*), Putih Sebelah (*Leucosyke capitellata*), Maitap (*Neonauclea spp*), Nangka (*Artocarpus heterophyllus*), Kemansi (*Artocarpus camansi*) Sadaman (*Macaranga spp*), Daun akar (*Merremia spp*), Binuang (*Octomeles sumatrana*), Ludai (*Balakata baccatum*), Ara Ajinomoto (*Ficus spp*), Ara kapal (*Ficus spp*), Ara piring (*Ficus brunneoaurata*), Nangka Air (*Ficus spp*) and Kelawit (*Uncaria spp*).

The amount of rhino food plants harvested (June – October 2017) from Tabin Wildlife Reserve, Rhino Food Plantation (BORA), Permai plantation and KL – Kepong plantations totaled 19, 294 kg (SD: 245 kg). The amount of browse consumed by the rhinos in was 12, 086 kg (Figure 2).

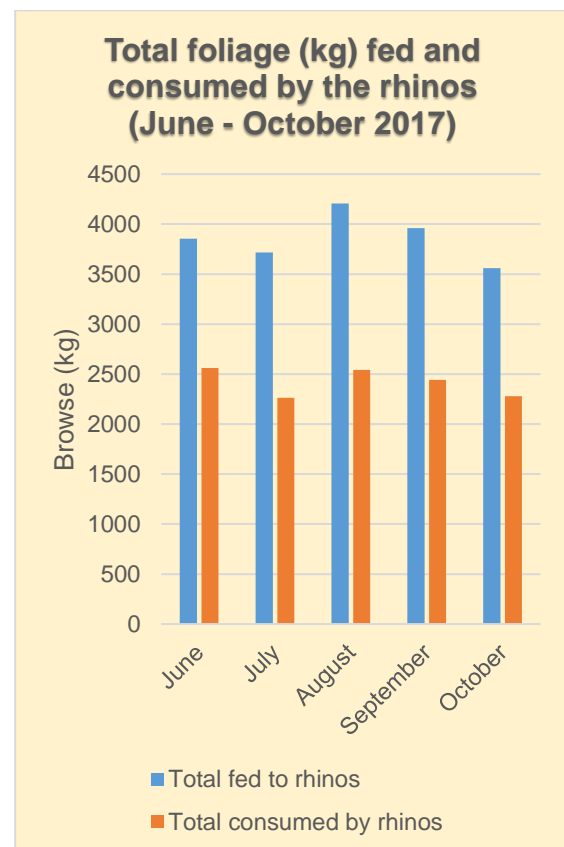


Figure 2. The total browse offered and consumed by the two rhinos (June – October 2017)

3.1 Voluntary Feed Intake (VFI)

The total foliage consumed by the rhinos varies depending on the frequencies of them returning for the morning and evening feedings. It was observed in October 2017, Kretam did not return for eight morning feedings (average 144 kg browse @ 18 kg per feeding not consumed). It was more likely the weather (gloomy or rain), disturbance by macaques and sometimes, whenever he mounts a log in his paddock (Plate 10).



Plate 10. Kretam mounting a log in his paddock, at least once a month

In contrast, Iman comes back for all of the feeding periods (morning and evening). However, there are periods when she comes in late for her feeding. This is due to weather or macaques' presence in or near her paddock.

The amount of browse that was hand fed to Kretam and Iman were 1495 and 1052 kg respectively. The amount consumed were 1081 (72.3 %) and 782 (74.3%) kg respectively. Similarly, the browse hung out for Kretam and Iman totaled 543 and 472 kg respectively. The total amount fed to the rhinos (hand fed and hung out) in October 2017 is 3560.5 kg. Of this, 71% consisted of those hand fed, with 29% constituting those that are hung out in the paddock (Kretam) or night stall (Iman) for night or early morning feeding (Figure 3).

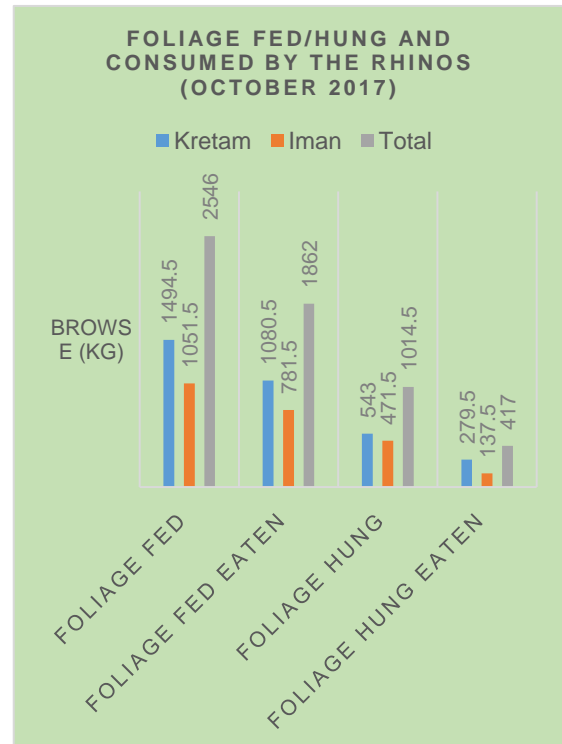


Figure 3. The amount of foliage hand – fed and hung out for the two rhinos in October 2017.

The amount of browse offered and eaten daily by Kretam and Iman ranged from 21 – 52 kg and 25 – 27 kg respectively. Of this, the daily average consumed by Kretam and Iman were 36 and 26 kg respectively. From the total of 3560.5 kg of foliage fed to the rhinos, 2279 kg (36.5%) were not consumed. These consisted mainly of coarse stems, soiled branches and those deemed unpalatable by the rhinos.

A total of 16 - 17 species were fed to the rhinos daily (morning and evening). The rhinos are also supplemented with horse pellets (Gold coin®). Kretam and Iman gets 500 and 400 grams respectively. This amount will be reduced to 200 gm for Iman, starting in November 2017 to bring down her body weight, which was constantly increasing.

Ripe banana (155 kg each per month) were provided as part of their daily diet. Small amount of skinned pumpkins (500 – 1000 grams) and papaya were also provided as a supplement. Depending on fruit season, they will also be fed mangoes when in

season and tangkol fruits (*Ficus racemosa*) when it is fruiting.

4. Biosecurity/health monitoring

The biosecurity is maintained as a routine to control and prevent spread of any diseases in managing the rhinos. Apart from monitoring the feed and feed intake, other measures are in place to ensure there is no introduction of potential diseases from outside the center.

Various samples including water used for drinking and washings, soil samples and floor swabs were collected on the 22nd October 2017 (Sunday).

Blood was also collected from Kretam for a complete blood count. In addition, urine and fecal samples were also analysed for pathogens and endoparasites. These were submitted to the Veterinary Diagnostic Laboratory and the Veterinary Public Health Laboratory, in Kepayan, Kota Kinabalu the following morning.

The samples were mainly for isolation of pathogenic bacteria and general health checks of the rhinoceros. The water from 13 tanks were tested for total coliform counts as half of these tanks were for human consumption.

4.1 Hematology

Blood was only collected from Kretam in EDTA tube for a complete blood count. Iman's temperament and stress factors were reasons as to why blood was not collected from her for now.

The values for Kretam were compared with his previous hematological index in September 2017 and those from other Sumatran rhinoceros. The values were within normal range for the Sumatran rhinoceros (Table 1).

Table 1. Blood parameters for Kretam in September and October 2017

Parameters	Animal Kretam	
	17 Sept	22 Oct
Hemoparasites	Neg	neg
RBC (X10 ¹² /L)	5.61	5.98
WBC (1000/UL)	8.06	8.63
Hb (G/DL)	14.3	14.2
PCV (%)	42.6	44
Seg. Neutrophils (%)	62	63
Eosinophils (%)	20	15
Lymphocytes (%)	13	18
Monocytes (%)	4	3
Basophils (%)	1	1

4.2 Bacteriology

Of the 20 floor swabs from the night stalls, swabs 5 and 9 had moderate *Pantoea spp.* The rest had only few growths.

The 17 soil samples taken from various locations surrounding and inside the rhino enclosures were negative for *Bukholderia pseudomallei*. This were similar for the five samples from the wallows.

The two tyre baths contained few *Enterobacter cloacae* complex. Samples from the sumps had few *Aeromonas hydrophila*.

There were no pathogens isolated from the feces of the two rhinoceros.

The water samples taken from 13 tanks at the RIF, RQF and main storage tanks had a total bacterial count ranging from 0 – 4200 cfu/ml. Total coliform count only range from 0 – 2400 cfu/ml. The significant *E.coli* count was only seen in Tank 7 (1070 cfu/ml) and Tank 10 (100 cfu/ml).

Table 2. The total bacterial, coliform and *E.coli* counts in 13 water tanks (cfu/ml) for the month of October 2017

Tank	Total bacteria	Total coliform	<i>E.coli</i>
1	0	0	0
2	1400	100	0
3	390	50	0
4	1390	40	0
5	1450	40	0
6	150	0	0
7	4200	2400	1070
8	650	0	0
9	60	0	0
10	3280	510	100
11	640	20	10
12	230	40	0
13	300	10	0

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

The monthly fluctuations in bacterial and *E.coli* counts will always remain as long as the water supply comes from the Lipad river and its tributaries. This situation will worsen during heavy downpours and seasonal visits by the elephants. The only remedial action is the routine screening for pathogens, especially *Salmonella spp* and *E.coli*. Simultaneously, the contamination can also occur via contamination by rats and macaques, if and when the tanks are not closed properly.

4.3 Parasitology

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

4.4 Routine prophylaxis

Routine liming was carried out mostly around the rhino dung piles outside the enclosure and the sumps for water run – offs from the night stalls. Liming was also carried out when required around the staff quarters (Plate 11).



Plate 11. Wilson spreading lime into the sump at RIF

4. Reproductive assessments

The positive behavioral reaction towards the odor from Iman's feces indicated that the olfactory sensors does affects Kretam's libido. The lowered libido and depression after Puntung's death had badly impacted his behavior in July and August 2017. However, placement of the feces from Iman commenced in September 2017 as a students' Industrial Training project to study ethology of Sumatran rhinoceros in captivity.

Currently, the fresh feces from Iman was placed in Puntung's paddock each morning. The positive correlation observed also included Kretam mounting a horizontal log or earth mount inside his paddock (Plate 12).



Plate 12. Kretam mounting an earth mount in his paddock

5.1 Ultrasonography

5.1.1 Iman

Iman was only ultrasound on a few occasions to try and reduce stress on her and her pathologies. The last scanning was carried out on the 27th October 2017.

Ultrasonograph showed her left ovary being void of any follicle. There were several corpus luteum observed (Plate 13).



Plate 13. The sagittal section of the left ovary showing the corpus luteum

In contrast, the right ovary is more active with two follicles and one that is leutenizing. The follicles measured 0.65 and 1.3 cm in diameter. The shrinking leutenizing follicle is 0.8 cm in diameter (Plate 14).



Plate 14. The right ovary showing the 1.3 cm follicle (arrow) and the shrinking leutenizing follicle on the right

Iman is due to be vaccinated with Improvac® on the 9th November 2017.