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

February 2018

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. 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.	Iman	Female	SWD 004

1. Husbandry

1.1 Animal Management

The number of rainy days has been quite consistent in February 2018, after a short dry spell, with rain mostly occurring in the afternoon and evening.

This has great consequences on the roads in general and in the paddocks, making rhino trails more muddy and deep. Water puddles and deep trenches could be seen along roads to RIF. Semi hardened trails became muddy again and wallows becomes watery overnight.

The short 20-meter path to Iman's night stall were muddy and more difficult to climb up from her wallow. Keepers had to try and level the trenches before letting her out. However, every time it rained, the trail becomes unbearable and tough to maneuver through, risking her leiomyoma getting dislodge and bleed (Plate 1).

Plate 1. The muddy trail from the wallow that leads to the night stall above (arrow).

Kretam uses his old wallow situated up on a ridge near the Laran (*Neolamarkia cadamba*) tree. Although it's not the best wallow but with limited area, he does not have a choice. His hoof cracks were improving and almost resolved. However, treatment with antiseptics, Stockholm's coal tar and oral supplements is still continued. As with Iman, her hoof cracks, involving 90 percent of hooves, took more than six months to resolve.

Iman uses her man – made wallow, very frequently. Although on many occasions she would stand next to the fence bordering her old wallow which almost took her life on 18th December 2018.

Fortunately, the mud and the composition of the wallow is of high grade (no stones and sand, smooth yellow – orange clay). There were no roots underneath and the clay churns well in water. This wallow is classed as a Grade 1 (Plate 2).

Plate 2. Iman in her Grade 1 wallow, smooth and yellow – orange coloration

Food plants were still abundant and readily available. The same amount was fed to Kretam but less were given to Iman for fear of overloading her hind gut which can impact her uterus to cause bleeding. She gets about half her usual amount of foliage which will be increased gradually at a rate of one kilogram every 10 - 14 days.

1.2 Body Weight

The body weights were usually taken twice a month, using a TruTest® electronic weighing scale. Kream was weighed on the 14th and 28th February 2018. Several more weights were taken for Iman in February 2018 to monitor her condition with gradual increase in her feed intake.

Iman's body weight plunged to a very low 520 kg on 17th December 2017 after the severe hemorrhage from a dislodged uterine leiomyoma. As she recovers in January, 2018, her body weight slightly increased to 526 kg on 25th January 2018. In the same month she had a relapse of uterine hemorrhage and her weight plunged further to 516 kg (13 February 2016) and subsequently to 506 kg on 20th February 2018. Her feed intake was deliberately reduced by about half, to reduce the pressure on her uterus from the adjacent caecum and colon. The foliage was increased gradually to 7 kilograms, twice daily, every 10 – 14 days. Her weight on the 28th February increased slightly to 510 kilograms (Figure 1).

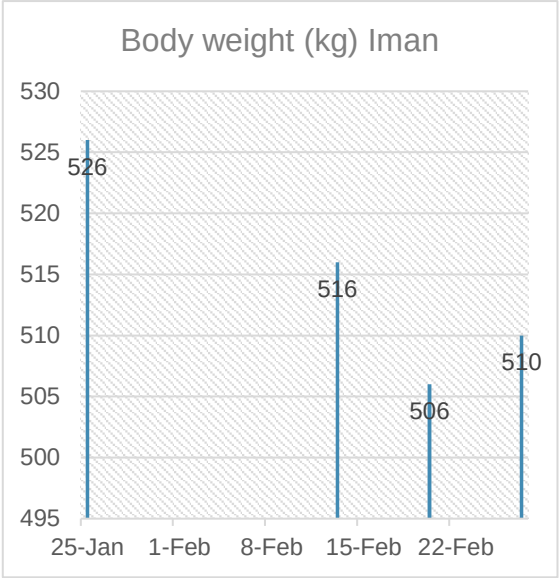

Figure 1. Iman's body weight (January – February 2018)

Kretam's body weight increased by 3 kilograms to 672 (SD: 11.31) kilograms (Figure 2).

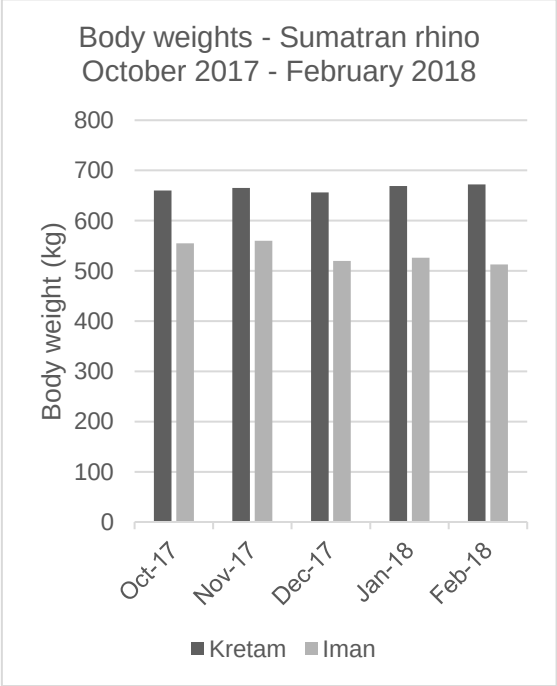

Figure 2. The body weights of Kretam and Iman (October 2017 – February 2018)

2. Animal Health

The body scores of Kretam was maintained at around 3.0 (Body Condition Scoring for Horses, Henneke et., al 1981). Kretam came back for feedings on all 28 days in February 2018. He was not observed to

mount the log or mud – mount in his paddock.

Iman's body score is 1.5 – < 2.0 but is improving with time. She was emaciated in December 2017 – January 2018 due to the excessive bleeding and pain, anemia and inappetence.

Her condition improved significantly in February 2018 and a decision was made on the 14th to increase her intake of forage from 6.5 kg to 10 kilograms. However, on the 15th she was observed to have bloody discharge (Category 3) but no signs of depression or pain. Her appetite was still very good. The discharge flowed down her vagina, after urination (Plate 3).

Plate 3. Bloody discharge seen on the concrete pillar and floor at the entrance of her night stall

Kretam's hooves' problem had improved quite significantly and in the final stages of treatment. Similarly, the horn matrix had grown quite well. His puncture wound on the left flank is scarring normally and treatment had ceased.

The routine monthly sampling for health checks were carried out for both rhinos on the 11th February 2018 (Sunday) and submitted to the Veterinary Diagnostic Laboratory and Public Health Laboratory in Kepayan, Kota Kinabalu on the 12th February 2018, before noon.

The soil sampling was done around the night stalls at RIF and RQF. These included areas inside the exercise yard (RIF) and paddock (RQF). Soil samples were also taken from the wallows. Floor swabs were taken randomly inside the night stalls, focusing in areas where water accumulates after washing or after a heavy rain. Blood, urine and fecal samples were collected from the rhinos. Water from all the water tanks were sampled for coliform counts, particularly *E.coli*. Water sample from the Lipad River was also examined for contamination with pathogenic bacteria.

2.1 *Kretam*

a. Deformity of posterior horn

The posterior horn problem was initially complicated with fungal infection. After treatment, the growth still remained slow and uneven. This is also related to him rubbing the horns against objects including wooden posts. Povidone (Septidine®) is applied on the inner part of the horn. The oral supplementation with Hoofmaker TRM® (50 grams) is given daily. The horn matrix, especially the sides have grown in height and thickness. However, a few small holes and depressions still existed anteriorly and at the back (Plate 4).

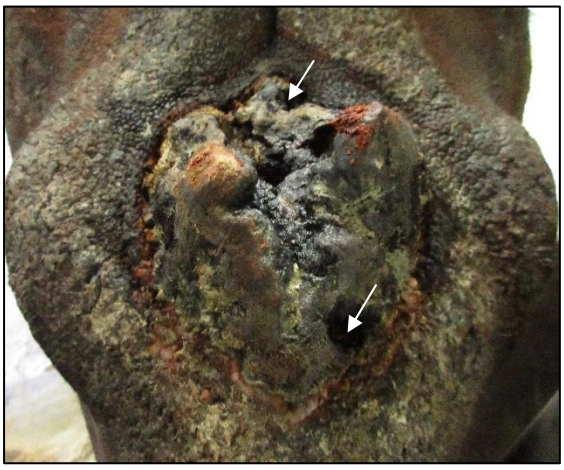

Plate 4. The posterior horn showing the increased thickness and depressions/holes (arrow)

b. Hoof cracks

The lateral cracks are slowly replaced or pushed ventrally by the new growth of the dermal layers, clearly demarcated by the light grey color of the hoof wall. All the cracks are away from the coronary band. The crack on digit 3 of the right hind feet is almost healed over with new hoof wall. The crack on digit 1, right hind feet, is still apparent but healing and being pushed ventrally. Digit 1 on the left hind feet has a crack on the medial surface. All these cracks are healing over time (Plate 5).

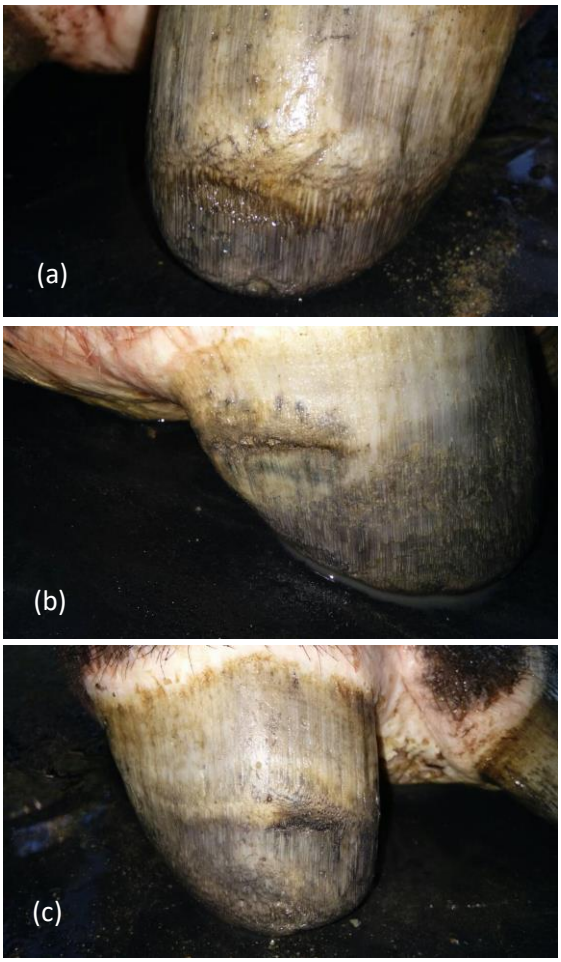

Plate 5. The cracks on digit 3, right hind feet (a), digit 1 on the left hind feet (b) and (c), digit 1 on the right hind feet

The daily treatment consisted of topicals (antiseptics, 2.5% formaldehyde and coal tar) twice daily and supplementation of biotin and methionine (20 grams Hoofmaker TRM®), once daily in the afternoon.

c. Puncture wound

The puncture wound on the left thorax on 16th January 2018 has healed completely, leaving a scar. Topical treatment administered included washing with antiseptics, followed by packing it with Negasunt powder® (Plate 6).

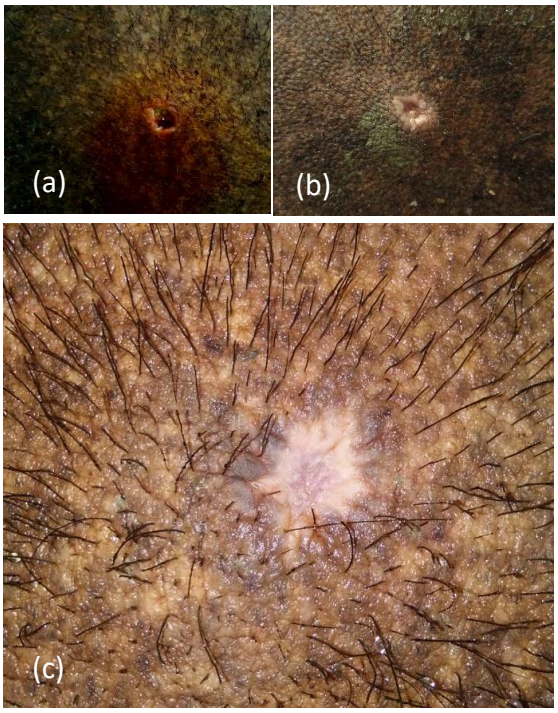

Plate 6. The healing process of a puncture wound (a) 16th January 2018, (b) 30th January 2018 and (c) 10th February 2018

2.2 *Iman*

a. Reproductive tract pathologies (bloody discharge, anemia, inappetence)

The reproductive pathologies and subsequent severe hemorrhage in December 2017, with a relapse in mid-January 2018 had resulted in a significant loss in condition.

She was emaciated, losing almost 50 kilograms since December 2017. Her body weight dropped to a low 506 kilograms on the 20th February 2018. Increasing her daily intake of forage from 13 kilograms to 20 kilograms caused bleeding from her uterus. This was observed on the 15th February 2018. She was immediately started on one-gram Tranexamic acid, twice daily. She

bled again on the 17th February 2018 before the problem was resolved (Plate 7).

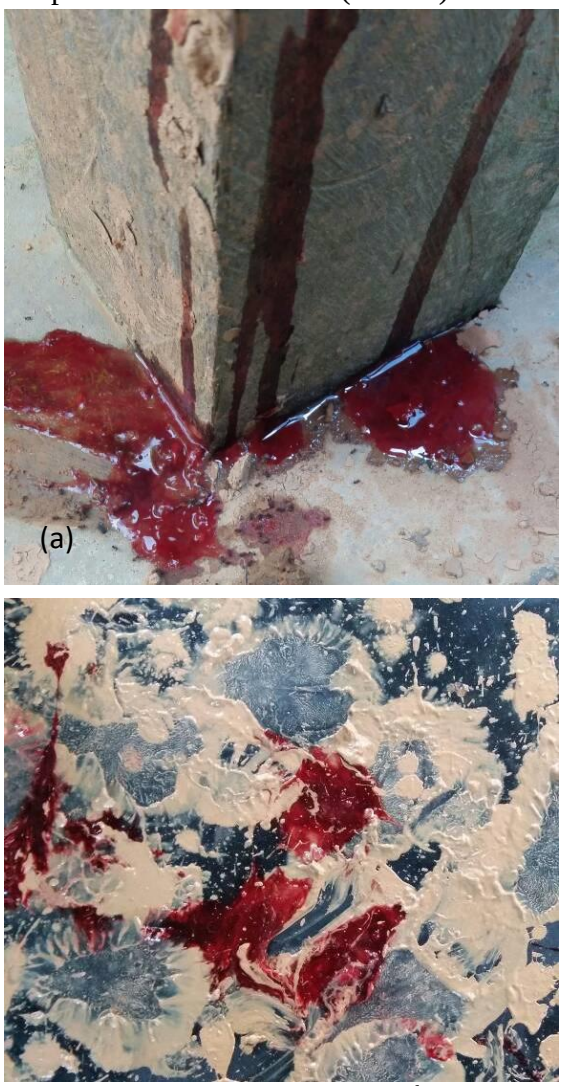

Plate 7. The bleeding on the 15th February, a day after her forage was increased by 3 kilograms (a) and (b) the bleeding on the 17th February 2018

Currently, the main factor that needed to be carefully maintained is her feeding regime. Too much forage will result in recurrent bleeding and too little, she does not gain weight. The bulk of forage that she gets in the morning (usual 15 kg) and evening (usual 15 kg) has to be spaced out and reduced to avoid the sudden impact on her uterus. Now, she gets 8 kg (from 7 kg) in the morning and 8 kg (from 7 kg) in the afternoon. Subsequently, after the afternoon feeding, she is allowed to browsed on the foliage hung inside the night stall, for about 30 minutes prior to letting her out into the paddock.

The amount of concentrates (Horse pellets, Gold Coin®) was increased to 400 grams from an initial 200 grams. Apart from the usual banana and papaya, more fruit varieties were also given to Iman including water melon, "cempedak" (*Artocarpus integer*) and mangoes.

With this new feeding regime, her bleeding has stopped completely. On and off, some clear – whitish mucoid discharge is seen on the ground (Plate 8).

Plate 8. The mucoid discharge observed on the ground inside Iman's paddock

Her condition is monitored daily and she is weighed once a week. Blood would be collected from her for serum iron levels and serum chemistry. She will also be scanned in late March or early April 2018.

3. Feed and feeding

Unfortunately, the amount of rain has not ceased and the weather was very warm – hot each morning, followed by rain in the afternoon or night. The amount of browse is sufficient. Most were gathered from the oil palm plantation followed by the rhino food plantation (RFP), mostly "*nangka"* (*Arthocarpus heterophillus*) and some *Ficus spp*. The "*nangka*" from RFP is favored over all other foliage hung inside the night – stall (Plate 9).

Plate 9. Iman having some "nangka" leaves before being let out to her paddock

Iman's appetite is excellent but is limited by her feeding regime. She came back for both her morning and afternoon feedings throughout February 2018. It was also observed that she started consuming her favorite foliage once more. In December 2017 – January 2018, she refused to eat her Grade 1 foliage but instead ate a larger variety and less bulky species especially Ara Mangga (Plate 10).

Plate 10. Ara manga is a Grade 1 species for Iman

Iman now consumes most of the species offered to her (minimum 10 species) in the morning and afternoon. Her total intake of forage (hand – fed and hung out) is limited to about 20 – 25 kg. This will be gradually increase to about 28 kilograms.

Kretam usually consumes most of the foliage offered to him inside the night – stall. However, on some days he would not consume even Grade 1 species. This is obvious he was accidently shocked by the electric fence.

Similarly, Kretam gets his fruits daily, consisting of banana, papaya, mango and *cempedak*. Half of these were fed in the morning and the remaining in the afternoon or evening.

3.1 Forages

The total amount of forage collected for the rhinos were 3164.5 kg, 63% of which was for Kretam and the rest for Iman. The total amount that was hung up for Iman inside her night – stall was 668 kilograms, 162 kilograms more than those hung out for Kretam. This is due to the reduced amount of foliage hand – fed to Iman every day. The favorite species that were hung for her include Putih Sebelah (*Leucosyke capitellata*), Nangka (*Artocarpus heterophylus*), Maitap (*Neonauclea spp*), Sadaman (*Macarangga spp*), Daun akar (*Merremia spp*), Binuang (*Octomeles sumatrana*) and Nangka Air (*Ficus spp*).

The other species hand fed included Nangka (*Artocarpus heterophylus*), Kemansi (*Artocarpus camansi*) Sadaman (*Macarangga spp*), Ludai (*Balakata baccatum*), Ara piring (*Ficus brunneoaurata*), Nangka Air (*Ficus spp*) and Kelawit (*Uncaria spp*), Gatal berbulu (*Ficus francisi*), Maitap (Neonauclea *spp*), Tarap (*Artocarpus spp*) and Earth ficus.

About 90% of the *nangka* fed to Iman and hung up in the night – stall came from the Rhino Food Plantation (Plate 11).

Plate 11. Ronald with the *nangka* foliage from the Rhino Food Plantation

Two new ficus plants were discovered in KL – Kepong plantation and added to the list of forage consumed by the rhinos. Some of the plants were also taken back to the RFP to be planted. These were readily consumed by Iman. Both of these ficus grew on belian (*Eusideroxylon zwageri*) stumps (Plate 12).

Plate 12. Four BORA staff bringing back a large piece of belian stump with the ficus plant

3.2 Voluntary Feed Intake (VFI)

The amount of hand – fed forage consumed by Kretam varies from 35 – 41 kilograms each day with an average of 37.26 kg. Prior to her uterine bleeding, Iman used to consume 30 kilograms of forage each day. She was inappetence in early December 2017 – late January 2018. Subsequently her appetite improved. She was initially fed a total of 13 kilograms daily but was increased to 21 kg to try and increase her body weight (Figure 2).

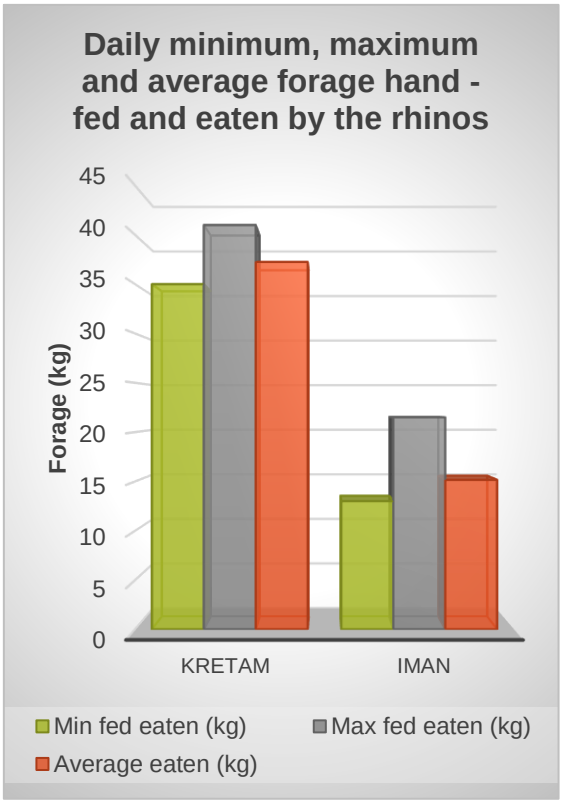

Figure 2. The amount of hand – fed forage consumed by Iman and Kretam in February 2018

However, two days after the increase, she was observed to bleed once more and the amount was reduced to 14 kilograms per day. This amount will be gradually increased by a kilogram, every 10 – 14 days.

The total amount of forage consumed by Kretam and Iman were 1269.5 and 675.5 kilograms respectively. Of this total, an average of 59% were hand – fed and 41%

were hung out for the rhinos to browse (Figure 3).

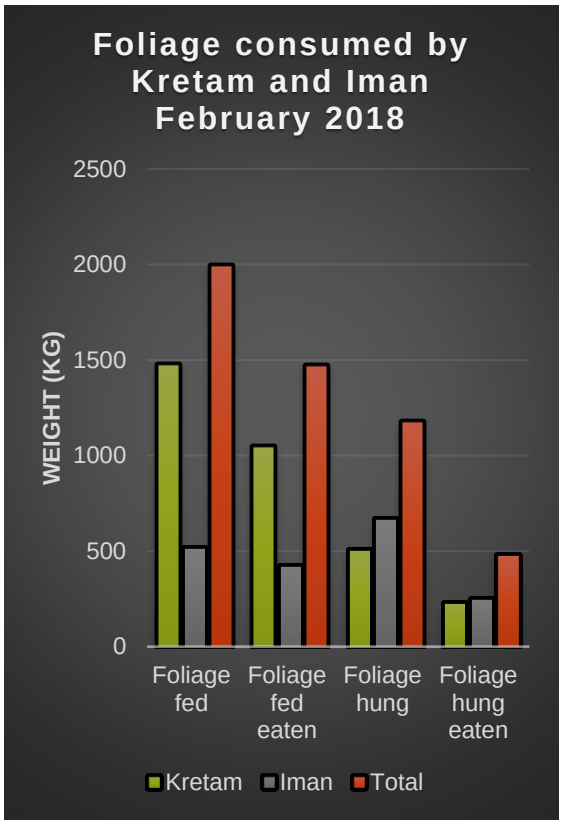

Figure 3. The total amount of foliage fed (hnd – fed and hung out) and eaten by Kretam and Iman in February 2018

The amount of browse that was hand fed to Kretam and Iman were 1476 and 514 kilograms respectively. The amount consumed were 1043.5 (70.7 %) and 424.5 (82.6%) kilograms respectively. Similarly, the browse hung out for Kretam and Iman totaled 506.5 and 668 kilograms respectively, of which 44.6 % is consumed by Kretam and 37.6 % by Iman. The total amount fed to the rhinos (hand fed and hung out) in February 2018 is 3164.5 kilograms. Of this, 64% were consumed by Kretam and 57.1 % constitute those eaten by Iman.

An average of 20 species of plants were fed to Kretam and 17 species to Iman each day (morning and evening). The rhinos were also supplemented with horse pellets (Gold coin®). Kretam gets 500 grams daily while Iman was fed 300 grams and gradually increased to 400 grams.

A total of 140 kilograms of bananas and 14 kilograms of pumpkins were eaten by each rhino in February 2018. In addition, the rhinos were fed with papaya, mango and *cempedak*, several days in a month. These additional fruits would be made a routine to increase the diversity of fruits eaten by the rhinos.

The mineral and vitamin supplements (Stressvitam®) were added to the drinking water and the water to rinse some foliage prior to feeding the rhinos.

4. Biosecurity/health monitoring

The management of the rhinos focus on preventive measures to prevent a disease outbreak. This include preventing the introduction of disease from outside and ensuring the rhinos gets adequate nutrition and are not stressed. Apart from good hygiene, regular checks are necessary to ensure pathogens are absent in and around the rhinos. Tyre and foot bath are provided and maintained (disinfectant) at crucial locations (Plate 13).

Plate 13. The tyre bath at RQF with disinfectant added

In addition, the foliage were washed prior to feeding the rhinos. The drinking water were checked constantly and analyzed once a month for bacterial contamination. Soil samples, floor swabs, water samples from water tanks, urine and feces from the rhinos were also analyzed for pathogens. Staff were also reminded to practice good

hygiene. Samples were collected for isolation of pathogenic bacteria (particularly *E.coli*, *Bukholderia pseudomonas* and *Salmonella*) and general health checks were carried out on the rhinoceros routinely. The water from 13 tanks were tested for bacterial contamination, total coliform counts and *E.coli* as half of these tanks were for human consumption. Fruits were thoroughly washed. In addition, the scrubbing of floor inside the night stall is a compulsory daily routine.

4.1 Hematology

Blood was collected into EDTA tube from the digital plexus, for a complete blood count (CBC). Kretam's CBC was compared with his previous results. As her condition is better, Iman's blood would be collected in March 2018.The values for Kretam were compared with the previous hematological index in January 2018 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 January and February 2018

Parameters	Animal (Kretam)	
	25 Jan	14 Feb
Hemoparasites	Nil	Nil
RBC (X10^12/L)	4.97	6.66
WBC (1000/UL)	8.8	6.05
Hb (G/DL)	12.5	14.1
PCV (%)	37.4	40
Seg. Neutrophils (%)	NA	76
Eosinophils (%)	NA	17
Lymphocytes (%)	NA	5
Monocytes (%)	NA	2
Basophils (%)	NA	0
MCV (FL)	75.2	NA
Platelets (G/L)	129	NA
MPV (FL)	8.2	NA
MCH (PG)	25.2	NA
MCHC (G/L)	335	NA

NA: Not available

4.2 Bacteriology

Of the 20 floor swabs from the night stalls, swabs 1, 3, 6, 17 – 20 had few *E. coli.* Swabs 4, 5, 7 – 14 and 16 had few Bacillus *spp.* Swabs 2 had few *Staphylococcus lentus* while swab 15 had few *Kocuria varians*.

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

The two tyre baths contained moderate *Granulicatella elegans*. Samples from the sumps had scanty *Kocuria rosea.*

There was moderate *E. coli* isolated from the feces of the two rhinoceros. There was no bacterial growth from Kretam's urine.

The water samples taken from 13 tanks at the RIF, RQF and main storage tanks had a total bacterial count ranging from 20 – 443 cfu/ml. Total coliform count only ranged from 0 – 300 cfu/ml. The *E.coli* count was low with 20 – 30 cfu/ml in tanks 6 and 7 (Table 2).

Table 2. The total bacterial, coliform and *E.coli* counts in 13 water tanks (cfu/ml) for the month of February 2018.

Tank	Total bacteria	Total coliform	*E.coli*
1	80	0	0
2	102	0	0
3	248	100	0
4	418	0	0
5	20	0	0
6	340	140	10
7	210	240	40
8	120	110	0
9	80	0	0
10	145	0	0
11	390	30	0
12	443	0	0
13	310	300	0

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

The monthly fluctuations in bacterial and *E.coli* counts is related to the natural water source from the Lipad River and its tributaries.

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 outside the enclosure and the sumps. Liming was also carried out when required around the staff quarters and paddocks.

Disinfectant were added to the tyre bath at least once weekly, depending on the weather condition. During heavy rainfall, the addition of disinfectants was more regular.

5. Reproductive assessments

Kretam did not mount the “log” or mud hill inside his paddock for the month of February.

Iman is due to be vaccinated with Improvac® on the 9th March 2018 but will be delayed until after the oocyte collection at the end of April 2018