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

March 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 had ceased (15 days) but rainfall, occasionally remained heavy. Most of the rain occurred in the afternoon and early morning. A few sections of the road towards RIF became deep trenches that needed repair. There were also frequent floods along Tabin road and those inside KL – Kepong plantations. The worse was still the path from Iman's wallow to the night stall, despite the keepers' efforts to drain the compacted ground.

During the heavy rainfall, most of the rivers throughout the Tabin road and those towards the rhino enclosures were very flooded, even for large vehicles to pass through (Plate 1).

Plate 1. Flooding of rivers in KL – Kepong plantation (above) and one along Jalan Tabin

With Iman being released into the bigger part of her enclosure, the impact on the muddy path to the night stall is significantly much less.

Both the rhinos have problems with the hooves ranging from cracks to chipping at the edges. These were associated with the wet weather and muddy/soggy paddocks. Although with Kretam, they were also related to his increased body weight.

As anticipated, on the 28th March 2018, Kretam made a new wallow and a new "toilet" in the paddock. The old "laran" wallow was abandon, most likely as the mud content had depleted too much and more rocks and pebbles were surfacing. The new wallow is of good quality and lack rocks and situated below a ridge. The new "toilet" is situated along a water runway (Plate 2).

Plate 2. The new wallow with excellent mud (a) and Kretam's new toilet in a small stream (b)

Kretam's hooves issues (cracks) were improving and almost resolved except one which just started. The deep one-inch wide, crack was just below the coronary band of the left hind feet (Digit 1). Treatment with antiseptics, 2% formalin, Stockholm's coal tar and oral supplements is maintained. The amount of concentrates (Gold Coin® horse pellets) was reduced as his bodyweight increased significantly and this will have an effect on her hooves.

Iman still uses her man – made wallow despite being let out in the bigger enclosure on the March 2018. She is also being monitored by the keepers. The voltage on the inside of the fence was put at a low 2.9 kv as compared to 9 – 10 kv on the outside. The old "cave" wallow was covered with about 30 sandbags to prevent her from using it (Plate 3).

Plate 3. The keepers covering the wallow with sandbags before she was let out into the bigger paddock.

Iman was given more concentrates to try and increase her body weight to about 520 kilograms.

1.2 Body Weight

The body weights of Kretam were taken twice in March 2018, using a TruTest® electronic weighing scale. Kretam was weighed on the 15th and 31th March 2018. Iman on the other hand was weighed weekly to monitor her body condition after the severe bleeding and anemia in December 2017 – January 2018 (Figure 1).

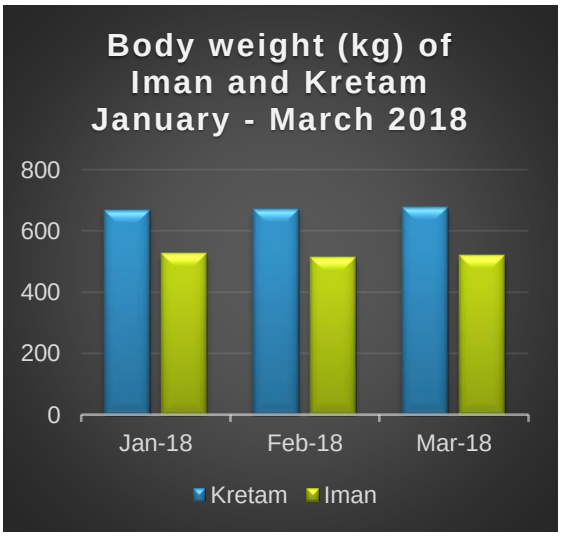

Figure 1. The bodyweights of rhinos

Both, Kretam and Iman increased in bodyweights in March 2018. This was probably due to the increased in concentrates and fruit supplements given daily.

The foliage given to Iman was reduced from 12 kg to 8 – 10 kilograms twice daily after noticing blood in her vaginal discharge. This was due to the pressure on her uterus from the food materials inside the adjacent caecum and colon.

Her bodyweight was 506 kg on 20th February 2018. Her supplement of horse pellets was increased from 400 grams to 500 grams daily. In March 2018, her bodyweight was observed to increase gradually from 508 kg on the 6th March to 522 kg on the 27th March (Figure 2).

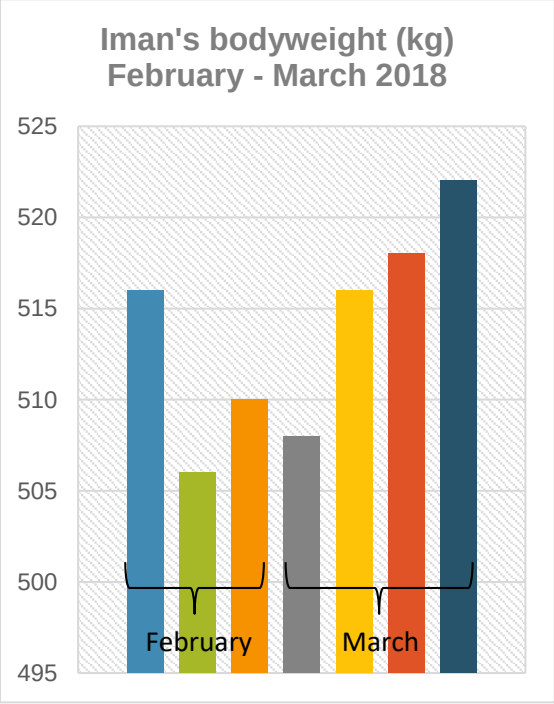

Figure 2. Iman's bodyweight showing the gradual increase in March 2018

Kretam's body weight increased by 4 kilograms to 676 kg, while Iman showed an increase of 14 kg. The plan is to reduce Kretam's bodyweight by 10 – 15 kilograms due to his hoof problems. Iman's bodyweight will be maintained between 520 to 530 kilograms.

2. Animal Health

The body scores of Kretam was maintained at around 3.0 (modified from Body Condition Scoring for Horses, Henneke et., al 1981). Kretam came back for his feedings on all 31 days in March 2018. He was observed to mount the log or mud – mount in his paddock on several occasions.

Iman's body score improved to 2.0 and is improving with time. She was emaciated in December 2017 – January 2018 due to the excessive bleeding and pain, anemia and inappetence. However, her body condition improved slightly in February and better in March 2018.

The hoof cracks observed in Kretam had healed almost completely. However, a new crack was observed in March 2018 and is being treated. Similarly, the horn matrix had grown quite well. His puncture wound on the left flank is has healed and a scar remained.

The routine monthly sampling for health checks were carried out for both rhinos on the 18th March 2018 (Sunday) and submitted to the Veterinary Diagnostic Laboratory and Public Health Laboratory in Kepayan, Kota Kinabalu on the 19th March 2018, before noon. Blood sampling was usually carried out in the evening.

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 active wallows. Floor swabs were taken at random locations inside the night stalls, focusing in areas where water accumulates after washing or after a heavy rain. Blood, urine and fecal samples were also collected from the rhinos for parasitic counts. Water from all the water tanks were sampled for coliform counts, particularly *E.coli*. Water sample from the Lipad River was also examined from time to time for contamination with pathogenic bacteria.

2.1 *Kretam*

a. Deformity of posterior horn

The healing of the posterior horn still remained slow and uneven. This is also related to him rubbing the horns against objects including wooden posts. Treatment consisted of Povidone (Septidine®), applied on the inner part of the horn. The oral supplementation with Hoofmaker TRM® (20 grams) is given daily. The powder is made into a paste by adding water. The rhinos will not take it as a powder. The horn matrix is more even and showed good progress. 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 less depressions/holes (above). Hoofmaker is made into a paste before putting it inside banana to feed Kretam

b. Hoof cracks

The lateral cracks are slowly healing, being replaced or pushed ventrally by the new growth of the dermal layers (light grey color). 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 (Plate 5).

Plate 5. Marikus treating the hoof of Kretam with Stockholm coal – tar

A new 1.5 cm crack was observed on the left hind feet, digit 1, about 2.0 cm below the coronary band. This as also treated in a similar manner (Plate 6).

Plate 6. The hoof crack on the hind feet is possibly related to the increase in body weight.

2.2 *Iman*

a. Hoof chippings

Similarly, the problem with hoof is also seen in Iman. Currently, two hooves had

chippings at the base, likely a traumatic injury (Plate 7).

Plate 7. The chipping as seen at the base of digit 1 on the right front feet

The routine daily treatment regime consisted of topicals (antiseptics, 2.5% formaldehyde and coal tar) administered in the morning and evening. The oral Hoofmaker TRM® will be given to expedite healing process.

b. Reproductive tract pathologies

The current pathology observed in Iman is the intermittent vaginal discharge, consisting of pale mucoid exudate. These discharges were sometimes seen after her urination or in her wallow. Occasionally, the whitish mucous was observed on the wall of her night – stall.

No treatment was given to Iman although, the problem might aggravate with the amount of physical exertion she had to endure, coming back to her night stall at least twice daily.

Scanning done in March showed the many leiomyomata, cysts and fluids inside the uterus (Plate 8).

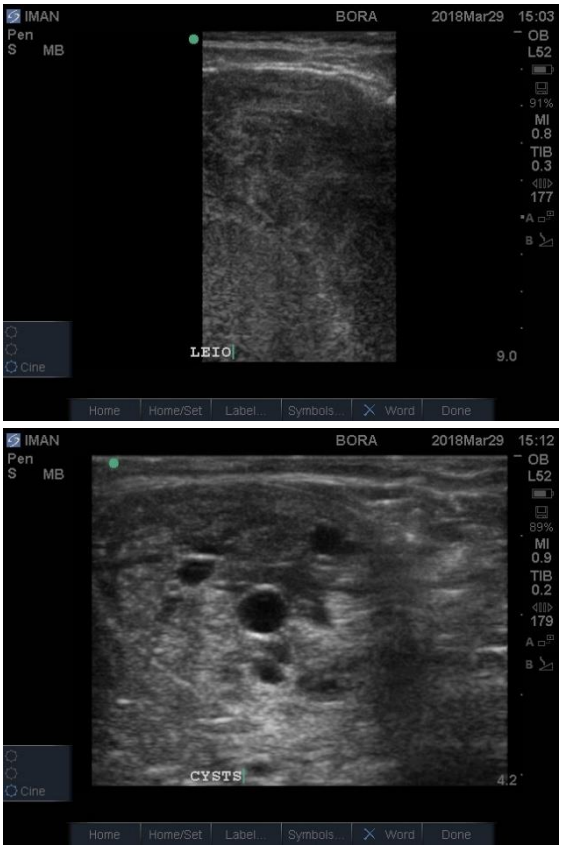

Plate 8. The leiomyoma (above) and the cysts with fluids inside the endometrium (below)

3. Feed and feeding

March is still a month of heavy downpours, causing flash floods inside and outside the rhino enclosures. The rain, although good for the rhino food source but hard for the keepers to gather them. The amount of browse is very adequate, especially with limited quantities fed to Iman. A lot of the browse were gathered from the oil palm plantation and the rhino food plantation (RFP). Most of the "*nangka"* (*Arthocarpus heterophillus*) leaves were obtained here and favoured by Iman. Some *Ficus spp* especially *F. francisi* were also collected from more than 100 of the trees planted in the RFP.

Clean drinking water is given ad libitum and supplemented with vitamins and minerals (Stressvitam ®). Apart from the water source, provided during her hand – feeding, water was also made available in a container inside her night stall (Plate 9).

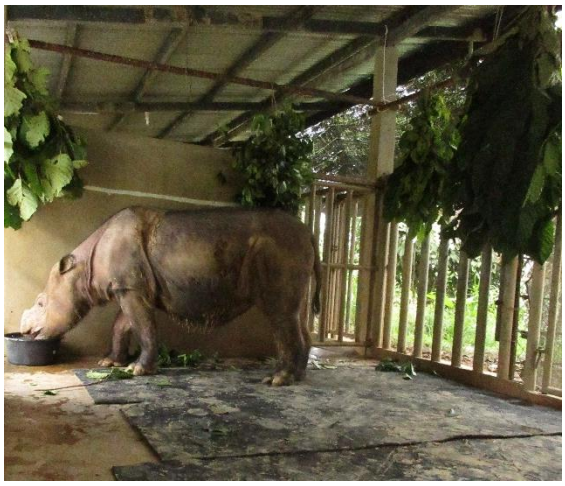

Plate 9. Iman drinking from the water bucket before leaving the night stall to go out into her paddock

3.1 Forages

The total amount of forage collected for the rhinos were 3472 kg, of which 56% were consumed by the two rhinos. About 65% of the foliage collected was reserved for Kretam and the rest for Iman.

A total of 594 kg of foliage was hung in the night stall for Iman as compared to 574 kg for Kretam. This is due to the reduced amount of foliage hand – fed to Iman. The favorite species that were hung for the rhinos 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*).

Plate 10. Justine hanging out the *L. capitellata* for Kretam

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. Similarly, all the *F. francisi* also were collected from the RFP (Plate 11).

Plate 11. Justine with a bundle of F. francisi from the RFP

3.2 Voluntary Feed Intake (VFI)

Iman's appetite is excellent but is limited by her feeding regime. She came back for both her morning and afternoon feedings throughout March 2018.

Iman now consumes most of the species offered to her (16 species daily) in the morning and afternoon. Her total intake of forage (hand – fed and hung out) is limited to an average of 22 kg. This will be gradually increase to about 28 kilograms.

Iman and Kretam gets 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.

In March 2018, the amount of hand – fed forage consumed by Kretam varies from 16.5 – 39.5 kilograms each day with an average of 35.8 kg. Iman consumed a minimum of 14.5 kilograms daily with a maximum of 20.5 kg with an average of 18 kg (Figure 3).

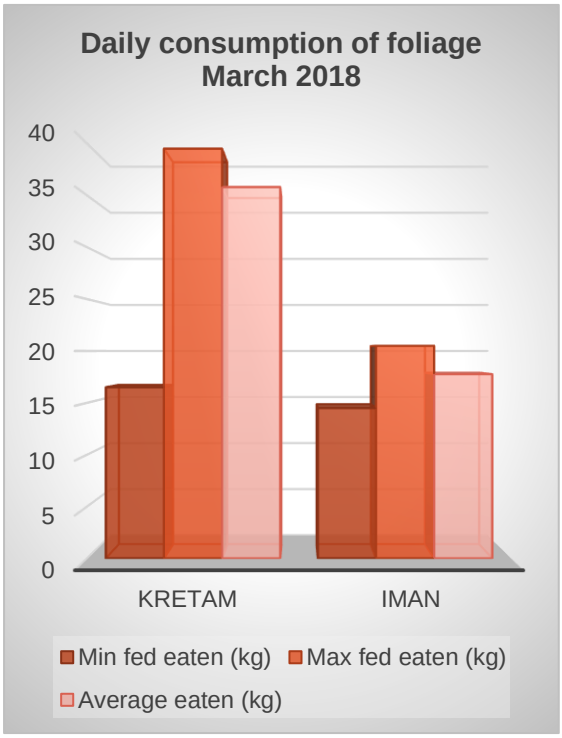

Figure 3. The amount of hand – fed forage consumed by Iman and Kretam in March 2018

The amount of browse that was hand fed to Kretam and Iman were 1682 and 623 kilograms respectively. The amount consumed were 1002.5 (59.6 %) and 497.5 (79.9%) kilograms respectively. Similarly, the browse hung out for Kretam and Iman totaled 573.5 and 594 kilograms respectively, of which 43 % is consumed by Kretam and 33.4 % by Iman. The total amount fed to the rhinos (hand fed and hung out) in March 2018 is 3472 kilograms. Of this, 55.4% were consumed by Kretam and 57.2 % constitute those eaten by Iman.

The total amount of forage consumed by Kretam and Iman were 1249 and 696 kilograms respectively. Of this total, an average of 56.3% were hand – fed to the rhinos (Figure 4).

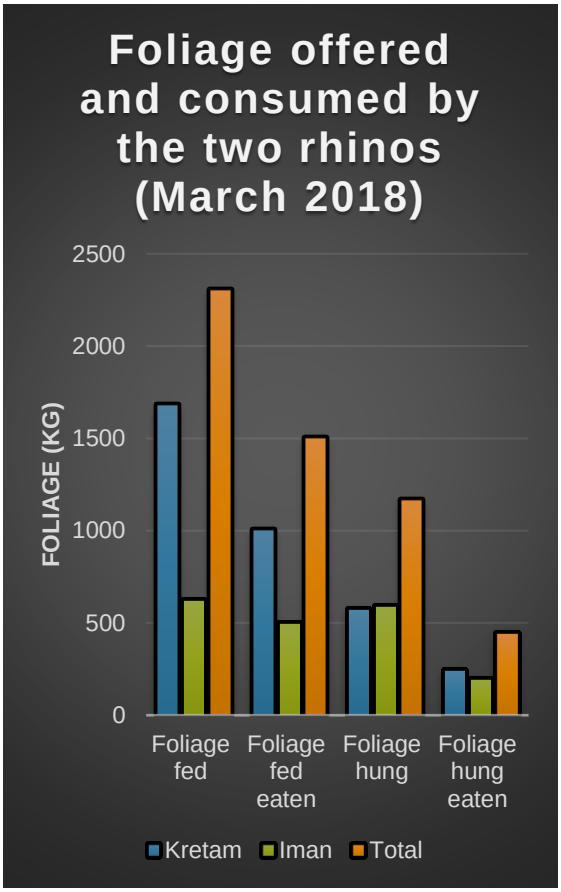

Figure 4. Foliage fed, hung and eaten by the two rhinos in Tabin

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's gets 500 grams daily but due to his hoof problem, the total was reduced to 300 grams daily. Iman was fed 400 grams of concentrates daily, and subsequently increased to 500 grams.

A total of 155 kilograms of bananas and 15.5 kilograms of pumpkins were eaten by each rhino in March 2018. In addition, the rhinos were fed with papaya, mango and *cempedak*, several days in a month.

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.

All foliage were washed and rinse after they were brought in and 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 also be collected in the coming months.

As of today, the blood values have not been received from the Veterinary Diagnostic Laboratory in Kepayan, Kota Kinabalu.

4.2 Bacteriology

Results for the floor swabs were not received from the Veterinary Diagnostic Laboratory in Kepayan, Kota Kinabalu.

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 water samples taken from 13 tanks at the RIF, RQF and main storage tanks had a total bacterial count ranging from 90 – 2500 cfu/ml. Total coliform count only ranged from 10 – 12900 cfu/ml. The *E.coli* count was variable ranging from 10 – 420 cfu/ml. Tanks 1 and 4 had a very high count and were treated (Table 1).

Table 1. The total bacterial, coliform and *E.coli* counts in 13 water tanks (cfu/ml) for the month of March 2018.

Tank	Total bacteria	Total coliform	*E.coli*
1	1200	950	230
2	170	100	10
3	514	110	50
4	1500	1290	420
5	528	30	20
6	250	230	40
7	210	200	10
8	90	60	10
9	234	10	0
10	480	10	0
11	350	150	30
12	150	50	20
13	240	50	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. In March 2018, the abnormally high bacterial counts is related to the heavy rainfall and flooding in Tabin.

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, wet and soggy ground and 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

The routine placement of Iman's feces in the morning was done each morning. This had resulted in Kretam being more sexually active and frequently mounting dead logs or soil mounts (Plate 11)

Plate 11. Marikus placing a bucket of feces from Iman in Puntung's paddock adjacent to Kretams.

Kretam was observed to mount the log and an earth mount in his paddock, twice in March 2018. These occurred in the evening. He would get erections while inside the chute (Plate 12).

Plate 12. Kretam on a soil mount (above) and having erections in the chute (below)

Iman was not vaccinated with Improvac® on the 9th March 2018 but will be carried out after the oocyte collection on the 28th April 2018.